Request for Bid
For
Construction of New Iowa Department Of Transportation Maintenance Facility in Muscatine Iowa

Issued by:

IOWA DEPARTMENT OF TRANSPORTATION
Purchasing Section
Proposal No. **17841**

Letting Date: January 11, 2017

Must be submitted no later than 1:00 PM Central Time
Bid Responses received after this date will be rejected

For information about this notice, and during this procurement, interested persons shall contact only:

Jody McNaughton
800 Lincoln Way
Ames, Iowa 50010
Phone: 515-239- 1298
Fax: 515-239-1538
E-Mail: jody.mcnaughton@dot.iowa.gov

Issued addenda and all other correspondence will be posted to Iowa DOT's website:
http://**www.iowadot.gov/purchasing**

Procurement Timetable

The following dates are set forth for informational and planning purposes. The Iowa DOT reserves the right to revise the dates as needed. All times listed are Central Time.

Event/Dates	Section Reference	Date/Time
Issue RFB	cover	November 23, 2016
Number of Copies of Bid Responses Required		1
Bidders Conference (Pre-Bid) [X] *Box will be checked when* ***Attendance is mandatory for all General Contractors*** **Location: The McAvoy Center 1403 Park Ave, Muscatine IA 52761 Room101-102** **Time: 11:00a.m.**	2.28	December 5,2016
DOT Response from Bidder's Conference Questions	2.28	December 12, 2016
Bidder Questions, Requests for Clarification, & Changes *(no later than)*	2.2/2.5	December 19, 2016
DOT Response to Questions Issued *(no later than)*	2.2/2.5	December 30, 2016
Bid Opening/Proposal Due	2.8/2.9	January 11, 2017
Presentations & Demonstrations "Short list" (*by invitation only*)	2.22/ 5.3	N/A
Announce Successful Bidder Intent to Award* *see note below*	4.1	January 16, 2017
Completion of Contract Negotiations & Execution of the Contract	4.3	January 27, 2017
Contract Begin Date	See solicitation response page	February 1, 2017 **With work to begin no later than 4/1/2017**
Contract End Date	See solicitation response page	November 1, 2017 **See Section 3 for specific building completion dates.**

*Intent to Award - See Section 2.22

It is intended that Bid Responses will be evaluated and a notice of "intent to award" will be issued within thirty (30) days of the bid opening date. Bid Responses prices, terms and conditions must be held firm for a 180-day period from the date of the notice of "intent to award" the contract.

Solicitation Response

	Response Due Date	Time	Location
	January 11, 2017	1:00 P.M.	800 Lincoln Way, Ames, IA

Proposal Number	Description
17841	Construction of a New Iowa Department of Transportation Maintenance Facility in Muscatine IA

Contract Begin Date	Contract Completion Date	Bid Bond	Performance Bond (Y/N)	Liquidated Damages
2/1/2017	11/1/2017 (See Section 3 specified completion dates)	(5) % of submitted bid	Yes	See Section 3 for specifics

Purchasing Agent assigned	E-mail Address	Phone	Fax
Jody McNaughton	jody.mcnaughton@iowadot.us	515-239-1298	515-239-1538

RESPONDER INFORMATION

Company Name			Federal Tax ID
Street Address	City	State	Zip Code

Contact Name	E-mail Address	Phone	Fax

Responder agrees to sell goods/services or both at the same prices, terms and conditions to any other Iowa state agency, Regent or Political Subdivision upon request. Please check Yes or No.

☐ Yes ☐ No

Responder is an Iowa Targeted Small Business

☐ Yes ☐ No

GENERAL INFORMATION

This solicitation includes the Solicitation Response cover page, Schedule of Prices, Standard Terms and Conditions, Supplemental terms (if any), Specifications, Plans and Drawings, mailing label and all other information needed to prepare and submit a response to the solicitation. Information in the "Solicitation Response" above must be typed or completed in ink, signed, and returned in a flat style envelope along with any other information required in the solicitation prior to the response due date and time. Please use the furnished mailing label, or label the response as "Iowa Department of Transportation, proposal number and response due date on the outside of the return envelope. Responders may personally deliver, mail, or select a carrier that ensures timely delivery. **Faxed or e-mail responses will not be accepted.**

If required, each response must be accompanied by a bid bond in an accepted form, in the percent amount indicated above. Refer to the Standard Terms and Conditions for the accepted forms in which the bid bond requirement may be fulfilled. **Responses without a required bid bond will not be considered for award.** If the intended awarded responder fails to enter into a formal contract within fifteen (15) days after award is made for any reason on their part, the bid bond may be retained by the State.

The entire contents of this solicitation, Addendums, Schedule of Prices, Specifications, Plans and Drawings, Supplemental Terms and Conditions, Standard Terms and Conditions, shall become part of the contract.

We certify that we have not, either directly or indirectly, entered into any agreement or participated in any collusion or otherwise taken any action in restraint of free competition; that no attempt has been made to induce any other person or firm to submit or not to submit a response; that this response has been independently arrived at without collusion with any other responder, competitor, or potential competitor; and that this response has not been knowingly disclosed prior to the opening of responses to any other responder or competitor.

We certify that all materials, equipment goods and/or services proposed meet or exceed the specifications and will be supplied in accordance with the entire contents of this solicitation including delivery schedules. We promise to complete the contract within the contract period, or pay any liquidated damages, if stipulated, for each calendar day as set forth in the solicitation documents.

Signed _____ Date _____

Iowa Department of Transportation
Standard Terms and Conditions
For

Submission of Quotations, Bids or Proposals

-FORMAL-

Formal is the procurement process required by Iowa law when the estimated, aggregate amount of the purchase equals or exceeds $50,000.

The entire contents of this solicitation shall become a part of a contract or purchase order. In case of a discrepancy between the contents of the solicitation documents, the following items listed by descending order shall prevail:

- Addendums to the solicitation
- Solicitation
  - Schedule of Prices
  - Specifications
  - Plans and Drawings
- Supplemental Terms and Conditions
- Standard Terms and Conditions

(Example - if a statement in the specifications contradicts a statement in the Standard Terms and Conditions, the statement in the specifications shall apply)

Preparation of Solicitation or Bid Response: All responses must clearly address all aspects of the solicitation. Responses must be typed or completed in ink and submitted on the forms supplied by the Iowa DOT.

Responses must be signed and received prior to the opening date and time indicated on the Solicitation Response page or other specified areas throughout the solicitation document. The Responder's signed Response shall become the official Response to be considered for award.

No email, fax or web link bid Responses will be accepted. Responses must be signed, sealed and delivered in person or by a mail courier that ensures timely delivery.

A. Solicitation

1. **Opening:** The openings of responses are made public and conducted at the Iowa DOT, Ames complex unless otherwise specified. Responses received after the time of the opening will be returned unopened and considered non-compliant.
2. **Communications:** Questions concerning this solicitation should be directed to the purchasing agent listed on the Solicitation Response page. Inquiries can be written, phoned, or faxed. In all cases, written communication will take precedence over verbal communication.
3. **Bid Bond:** If required, the Solicitation Response page will indicate the fixed percent of the bid security based on the amount of the Bidder's bid. A Bid Bond can be supplied in one of the following ways: **(1)** Certified check or credit union certified share draft, cashier's check, or bank draft, drawn on a solvent bank or credit union. Certified checks and certified share drafts shall be drawn and endorsed in the amount indicated. Checks or drafts shall be made payable either to the Iowa Department of Transportation (Iowa DOT) or to the bidder. If payable to the bidder, the check or draft shall be endorsed without qualifications to the Iowa DOT by the bidder or an authorized agent. **(2)** An insurance or surety company may be retained to provide a bond in fulfillment of the Bid Bond requirement. A properly completed and signed copy of the Bid Bond *(Form 131084)* must accompany the bid. **The Iowa DOT's Bid Bond form must be used; no other forms or formats will be accepted.**

4. **Pricing and Discount:** Unit prices shown in the response shall be quoted as the price per unit (e.g., gal., case, each, etc.) as requested in the solicitation. If there is a discrepancy between the unit bid prices, extended price, or total amount of response, the unit prices shall prevail. Unless otherwise indicated, prices shall be firm for the duration of the contract or purchase order. Discounts for early payment are allowed, but not considered in award of the contract.
5. **Acceptance/Rejection:** The Iowa DOT reserves the right to accept or reject any or all responses and to waive irregularities or technicalities, provided such waiver does not substantially change the offer or provide a competitive advantage to any supplier(s) or provider. The Iowa DOT also reserves the right to accept that response which is deemed to be in the best interests of the state. Any unauthorized changes, additions, or conditional response including any ties to another response or any reservations about accepting an award or entering into a contract, may result in rejection of the response. Responses must remain available for award for thirty (30) days from opening date and time.
6. **Results & Disclosure:** Tabulation results will be posted on the Iowa DOT website at www.iowadot.gov/purchasing under the *Bid Award* link referencing the proposal number with an award recommendation indicated. At the conclusion of the selection process, the contents of all received responses will be placed in the public domain and be open to inspection by interested parties, according to state law. Trade secrets or proprietary information that are recognized as such and are protected by law may be withheld if clearly identified as such in the response.
7. **Quality of Goods:** All material shall be new and of first quality. Items which are used, demonstrators, refurbished, obsolete, seconds, or which have been discontinued are unacceptable without prior written approval by the Iowa DOT.
8. **Recycled Content:** The Iowa Code encourages purchase of products and materials with recycled content, including but not limited to paper products, oils, plastic products, compost materials, aggregate, solvents, and rubber products. Recycled items or alternatives must be noted in the Solicitation Response, if known.
9. **Shipping Terms:** Deliveries shall be F.O.B. Destination unless otherwise specified. All deliveries shall be accompanied by a packing slip indicating the Supplier, quantities shipped, and the purchase order number(s). All delivery charges shall be included in the response price and paid by the Supplier. No collect C.O.D. deliveries shall be accepted. When entering into a contract, the Supplier shall notify the freight company that all freight and delivery charges are to be prepaid by the Supplier. Goods delivered to the Iowa DOT Distribution Center at 800 Lincoln Way, Ames, IA shall be received between the hours of 7:00 a.m. and 3:00 p.m. on any day except Saturday, Sunday, or a holiday. For deliveries to other Iowa DOT locations, the Supplier may contact the destination location for available times to deliver as not all Iowa DOT locations have the same business hours. The Iowa DOT will not be liable for any freight claims or unpaid freight bills arising from contract or purchase order issues.

B. Award

The binding agreement (award) may be issued in the form a purchase order or contract or both depending on the requirements and complexity of the agreement.

1. **Method of Award:** Award shall be made to the responsible, responsive Responder whose Quotation, Bid or Proposal meets the requirements of the solicitation and is the most advantageous to the Iowa DOT. An Iowa company or individual will be given preference over an out-of-state company or individual when responses are equal in all aspects and are tied in price. By virtue of statutory authority preference will be given to products and provisions grown and coal produced within the State of Iowa.
2. **Award Protests:** Protests of award recommendations are to be addressed to the Director of Purchasing, and shall be made in accordance with paragraph 761--20.4(6)"e" of the Iowa Administrative Code.
3. **Contracts:** Successful Contractor(s) may be sent either a formal Contract, Notification of Award or Purchase Order as confirmation of acceptance and award. Any of these binding agreements shall be for the term stated in the solicitation or on a purchase order and may be renewed for additional period(s) under the same terms and conditions upon mutual agreement as defined. The successful Contractor may not assign a contract to another party without written authorization from the Iowa DOT Purchasing Section. The Iowa DOT may offer a contract extension to the Contractor when a scheduled target date cannot be met.

4. **Consumer Price Index (CPI-U):** A CPI may be allowed as specified in the terms of the solicitation and at the discretion of the Iowa DOT based on currently posted CPI-U, US City Average, All Items – non seasonally adjusted unless otherwise specified. This applies each of any subsequent renewals, extensions, amendments issued under the contract for the duration of the contract.
5. **Payment Terms:** The Iowa DOT typically pays properly submitted invoices within thirty (30) days of receipt, providing goods and/or services have been successfully delivered, installed or inspected (if required), and accepted. Invoices presented for payment must be only for quantities received by the Iowa DOT and must reference the purchase order number or contract number to be submitted for processing.
6. **Default (Supplier):** Failure of the Supplier to adhere to specified delivery schedules or to promptly replace rejected materials shall render the Supplier liable for all costs in excess of the bid price when alternate procurement is necessary. This shall not be the exclusive remedy and the Iowa DOT reserves the right to pursue other remedies available to it by law or under the terms of the binding agreement.
7. **Default (Contractor):** Failure of a Contractor other than a Supplier to meet any specified project completion deadline shall render the Contractor liable for all costs incurred by the Iowa DOT that were: a) necessary to meet said deadline; or b) necessary to complete said project after said deadline. This shall not be the exclusive remedy and the Iowa DOT reserves the right to pursue other remedies available to it by law or under the terms of the agreement.

C. General

1. **Administrative Rules:** For additional details on the rules governing the actions of the Iowa DOT Purchasing Section, refer to 761 IAC, Chapter 20, Iowa Administrative Code, entitled "Procurement of Equipment, Materials, Supplies and Services".
2. **Affirmative Action:** The Contractor (and also subcontractor, vendor, service provider or supplier) is prohibited from engaging in discriminatory employment practices forbidden by federal and state law, executive orders and rules of the Iowa Department of Management, pertaining to equal employment opportunity and affirmative action. Contractor may be required to have on file a copy of their affirmative action program, containing goal and time specifications. Contractors doing business with Iowa in excess of $5,000 annually and employing 50 or more full time employees may be required to file with the Iowa Department of Management a copy of their affirmative action plan. Failure to fulfill these non-discrimination requirements may cause the contract to be canceled and the contractor declared ineligible for future state contracts or subject to other sanctions as provided by law or rule.
3. **Applicable Law:** The contract shall be governed under the laws of the State of Iowa. The contractor shall at all times comply with and observe all federal and state laws, local laws, ordinances, and regulations which are in effect during the period of a contract and which in any manner affect the work or its conduct. Any legal action relating to a contract shall only be commenced in the Story County, Iowa, District Court or the United States District Court for the Southern District of Iowa.
4. **Conflict of Interest:** No state or county official or employee, elective or appointive shall be directly or indirectly interested in any contract issued by the Iowa DOT, see Code of Iowa 314.2.
5. **Debarment and Vendor Suspension:** By submitting a response, the contractor is certifying that it and its principals and/or subcontractors are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by the State of Iowa or any Federal department or agency.
6. **Equal Opportunity:** Responders to the solicitation must be an "Equal Opportunity Employer" as defined in the Civil Rights Act of 1964 and in Iowa Executive Order Number Thirty-four.
7. **Indemnification-Goods:** To the extent the goods are not manufactured in accordance with Iowa DOT's designs, Supplier shall defend, indemnify and hold harmless Iowa DOT, its assignees, and other users of the goods from and against any claim of infringement of any letters patent, trade names, trademarks, copyright or trade secrets by reason of sale or use of any articles purchased. Iowa DOT shall promptly notify Supplier of any such claim.
8. **Infringement:** Goods shall be delivered free of the rightful claim of any third party by way of infringement. Contractor shall indemnify and save harmless the State of Iowa and the Iowa DOT against all claims for infringement of, and/or royalties claimed under, patents or copyrights on materials and equipment furnished under this bid.

9. **Iowa Open Records Law**: All Solicitation Responses are subject to terms and provisions of Iowa Code Chapter 22 Examination of Public Records (Open Records), specifically 22.7- Confidential Records.
10. **Records Audit:** The contractor agrees that the Auditor of the State of Iowa or any authorized representative of the state, and where federal funds are involved, the Comptroller General of the U.S. Government, shall have access to and the right to examine, audit, excerpt, and transcribe any directly pertinent books, documents, papers, and records of the contractor relating to orders, invoices, or payments of a contract or purchase order.
11. **Targeted Small Businesses:** The Iowa DOT seeks to provide opportunities for women and/or minority small business enterprises. To apply for certification as an Iowa Targeted Small Business, contact the Iowa Department of Inspection and Appeals (515-281-5796). Contractors shall take documented steps to encourage participation from Targeted Small Businesses for the purpose of subcontracting and supplying of goods or services or both.
12. **Taxes:** Prices quoted shall not include state or federal taxes from which the state is exempt. Exemption certificates will be furnished upon request.
13. **Termination:**
    - **Termination Due to Lack of Funds or Change in Law**

      The Iowa DOT shall have the right to terminate this Contract without penalty by giving thirty (30) days written notice to the vendor as a result of any of the following:

      • Adequate funds are not appropriated or granted to allow the Iowa DOT to operate as required and to fulfill its obligations under contract.

      • Funds are de-appropriated or not allocated or if funds needed by the Iowa DOT, at the Iowa DOT's sole discretion, are insufficient for any reason.

      • The Iowa DOT's authorization to operate is withdrawn or there is a material alteration in the programs administered by the Iowa DOT.

      • The Iowa DOT's duties are substantially modified.

    Following a 30 day written notice, the Iowa DOT may terminate a binding agreement in whole or in part without the payment of any penalty or incurring any further obligation to the Responder. Following termination upon notice, the Responder shall be entitled to compensation upon submission of invoices and proper proof of claim for goods and services under contract up to and including the date of termination.

Schedule of Prices

Project Description: Construction of new Muscatine Maintenance Facility the project consisting of: 19,200 sq. ft. 16-stall maintenance garage plus offices building, 10-stall cold storage building, drive-through Brine/Reclaim building, salt storage hoop building, and general site construction including drives, parking, fuel depot, detention pond, utility upgrades (DOES NOT included: sanitary sewer connection, asphalt drives, or any landscaping) All lines are tied.

Item No.	Description	Quantity	Unit/Price	Total Bid Amount
1	**Phase 1** Construction of 3500 ton hoop building as per plans and specifications. **Completion date is September 1, 2017**	1	job	$_____
2	**Phase 2** Construction of a 10 Stall Cold Storage pole building as per plans and specifications. **Completion date is September 15, 2017**	1	job	$_____
3	**Phase 3** Construction of a drive through Brine/Reclamation building as per plans and specifications. **Completion date is September 30, 2017**	1	job	$_____
4	**Phase 4** Construction of new Muscatine Maintenance Facility construction project consisting of: 19,200 sf ft., 16-stall maintenance garage plus offices building, and general site construction including drives (Does not include the asphalt drives, only the drive prep and asphalt inside the hoop structure), parking, fuel depot, detention pond, utility upgrades. **Completion date is November 1, 2017**	1	job	$_____
5	**Alt 1** 3 bay heated addition to the pole building see 17841 plans pole building set **Completion date is November 1, 2017**	1	job	$_____

Fabricated or Custom Built Products (Reference section 2.33.1)
List all and the lead times for each

_____

_____

_____

_____

_____

_____

I hereby certify that this Bid Response meets or exceeds the minimum requirements including specifications and addendums.

Authorized Signature: _____

Contact Person:

Company: _____

_____
(Print Name)

Address: _____

_____
(City) (State) (Zip Code)

Contractors Registration No (If applicable).:_____

Phone No: _____

Email:_____

Fax No.: _____

I acknowledge receipt of addendums:_____

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Section 1 Introduction

1.1 Purpose & Overview of the RFB Process

The purpose of this Request for Bid (RFB) is to solicit Bid Responses from responsible, responsive Bidders to provide the goods and/or services identified on the RFB cover page and described further in Section 3 of this RFB. The Iowa DOT intends to award a contract(s) beginning and ending on the dates listed on the Procurement Timetable. The Iowa DOT may renew the contract(s) for up to the number of annual extensions identified on the Procurement Timetable at the sole discretion of the Iowa DOT. Any contract(s) resulting from the RFB shall not be an exclusive contract.

Bidders will be required to submit Bid Responses according to the Procurement Timetable. The Iowa DOT will evaluate all responsible Bidders that submit timely responsive Bid Responses to be considered for award.

Overview The Iowa Department of Transportation is seeking a General Contractor to construct a New Iowa Department of Transportation Maintenance Facility located in Muscatine Iowa. The construction project consisting of a 19,200 sq. ft. pre-cast concrete maintenance garage with a 16-stall maintenance garage plus offices building, 10-stall cold storage building, drive-through brine/reclaim building, salt storage hoop building, and general site construction including drives, parking, fuel depot, detention pond, utility upgrades (This does not included: sanitary sewer connection or landscaping in this project) There are separate completion dates for various buildings in this project which are identified in the Section 3 of the Scope of Work for completion specific completion dates and liquidated damages as identified building.

1.2 Definitions

The terms used in individual sections of this document are intended to be consistent with those commonly used in the application field in question. When responding, use the terms and acronyms used in this document, and define any terms or conditions that require further clarification.

1.2.1 "Bid Response" means the bid document submitted by the bidder in response to the RFB.

1.2.2 "Contract" or "Resulting Contract" means the contract(s) entered into with the successful Bidder(s) as described in section 4.

1.2.3 "Bidder" means individual, company or entity submitting a response in response to the RFB.

1.2.4 "Iowa DOT" means the Iowa Department of Transportation.

1.2.5 "Participating Agency" or "Participating Agencies" means the all state boards, and commissions, and any political subdivisions as identified on the RFB cover sheet as Participating Agencies and any other agency that decides to utilize the executed contract.

1.2.6 "Procurement Timetable" *(on the page immediately following the RFB cover)* provide timeline, event and date information.

1.2.7 "Purchase Order" means the documentation issued by the State to the Contractor for a purchase of goods and/or services in accordance with the terms and conditions of the Contract. It may include an identification of the items to be purchased, the delivery date and location, the address where the supplier should submit the invoices, and any other requirements deemed necessary by the State. Any preprinted contract terms and conditions included on Bidder's forms or invoices shall be null and void.

1.2.8 "Responsible Bidder" means a bidder that has the capability in all respects to perform the requirements of the Bid Proposal specifications. In determining whether a Bidder is a responsible, responsive Bidder, the Iowa DOT may consider various factors including, but not limited to, the Bidder's competence and qualifications to provide the goods or services requested, the Bidder's integrity and reliability, the past performance of the Bidder relative to the quality of the goods or services offered by the Bidder, the proposed terms of delivery, and the best interest of the Iowa DOT and Participating Agencies.

1.2.9 "RFB" means Request for Bid and any attachments, exhibits, schedules or addenda hereto. A written response by a Bidder shall be considered a bid and referred to as a Bid Response.

1.2.10 "State" means the Iowa DOT, State of Iowa, and Participating Agencies identified on the title page and all state agencies, boards, and commissions, and any political subdivisions making purchases off of the resulting Contract as permitted by this RFB.

1.2.11 "Subcontractor" Includes every person furnishing material, equipment or performing labor as a sublet of any part of contract.

1.3 General

1.3.1 Owner:

The Owner of these projects is the Iowa Department of Transportation, 800 Lincoln Way, Ames, Iowa 50010.

Project Location: 3001 Grandview Ave. Muscatine IA 52761

1.4 Bidding Documents

1.4.1 Addenda

- Addenda, if issued, will be posted to the Iowa DOT"s website. All addendums must be acknowledged by bidders and included in the Bid Response.
- All addenda so issued shall become part of the contract documents.

1.4.2 Withdrawal Period

Prime Contractors, subcontractors and material suppliers on these projects agree to guarantee their proposal costs and work to be performed for a period of thirty (30) days after the date of receipt of bids.

Section 2 Administrative Information

2.1 Issuing Agent

The Issuing Agent, identified on the cover page is the sole point of contact regarding the RFB from the date of issuance until the notice of intent to award is issued (selection of the successful contractor).

2.2 Restriction on Communication

From the issue date of this RFB until the notice of intent to award is issued (announcement of the successful bidder), bidders may contact only the Issuing Agent.

The Issuing Agent will respond only to questions regarding the procurement process. Questions related to the interpretation of this RFB must be submitted in writing to the Issuing Officer by the deadline found in the Procurement Timetable listed immediately after the cover sheet**.** Verbal questions related to the interpretation of this RFB will not be accepted. Questions related to the interpretation of this RFB must be submitted as provided in section 2.5. Contractors may be disqualified if they contact any state employee other than the Issuing Agent. *Exception: Contractors may contact the State Targeted Small Business Office on issues related to the preference for Targeted Small Businesses.*

In NO CASE shall verbal communication override written communications. Only written communications are binding on the State.

The Iowa DOT assumes no responsibility for representations concerning conditions made by its officers or employees prior to the execution of a contract, unless such representations are specifically incorporated into this RFB. Verbal discussions pertaining to modifications or clarifications of this RFB shall not be considered part of the RFB unless confirmed in writing. All such requests for clarification shall be submitted in writing. Any information provided by the Contractor verbally shall not be considered part of that Contractor's proposal. Only written communications from the Contractor and received by the Department shall be accepted.

With the exception of the written Bid Response which must be submitted by Contractors in accordance with Section 2 herein, communications between the Issuing Agent and Contractors may be conducted by regular prepaid US mail, courier service, e-mail or facsimile transmission.

2.3 Downloading the RFB from the Internet

All correspondence for this Bid Proposal will be posted on the Iowa DOT's website at **www.iowadot.gov/purchasing/lettingschedule.** **Bidders are required** to visit the Iowa DOT's home page periodically for any and all addendums or other pertinent information regarding this bid opportunity.

2.4 Procurement Timetable

The dates listed in the Procurement Timetable (on the page immediately following the RFB cover) are set forth for informational and planning purposes; however, the Iowa DOT reserves the right to change the dates. If a change is made to any of the deadlines for Contractor submission, the Iowa DOT will issue an addendum to the RFB. All times listed are Central Times.

2.5 Questions, Requests for Clarification, and Suggested Changes

Contractors are invited to submit written questions and requests for clarifications regarding the RFB during the time indicated in the Procurement Timetable. Contractors may also submit suggestions for changes to the requirements of this RFB. The questions, requests for clarifications or suggestions must be in writing and received by the Issuing Agent on or before the deadline stated in the Procurement Timetable. Oral questions will not be permitted. If the questions, requests for clarifications, or suggestions pertain to a specific section of the RFB must be referenced.

Written responses to questions, requests for clarifications or suggestions will be posted on or before the deadline stated in the Procurement Timetable and posted on the Iowa DOT's website (see Section 2.3) If the Iowa DOT decides to adopt a suggestion, the Iowa DOT will issue an addendum to the RFB.

The Iowa DOT assumes no responsibility for verbal representations made by its officers or employees unless such representations are confirmed in writing and incorporated into the RFB.

Each bidder must inform themselves fully of the conditions relating to the proposal. Failure to do so will not relieve a successful bidder of their obligation to furnish all services required to carry out the provisions of his contract. Insofar, as possible, the Contractor, in carrying out the work, must employ such methods or means as will not cause any interruption of, or interference with the work of any other contractor.

If a bidder discovers any significant ambiguity, error, conflict, discrepancy, omission, or other deficiency in this RFB, the bidder should immediately notify the Issuing Agent in writing of such error and request modification or clarification of the RFB document.

2.6 Revisions to Contractor Bid Response

Contractors who submit Bid Proposals in advance of the bid opening date may withdraw, modify, and resubmit Bid Proposals at any time until the bid opening date and time. Contractors must notify the Issuing Agent in writing if they wish to withdraw their Bid Response. A Contractor shall not withdraw its Bid Response or its prices prior to the end of the one hundred and eighty (180) day period immediately following the notice of intent to award a contract.

2.7 Submission of Bid Responses

The Iowa DOT must receive Bid Responses addressed to the Department of Transportation, Purchasing Section, 800 Lincoln Way, Ames, Iowa 50010 before the deadline stated in the Procurement Timetable. **This is a mandatory requirement and will not be waived by the Iowa DOT**. Any Bid Response received after this deadline will be rejected and returned unopened to the contractor.

Contractors mailing Bid Responses must allow ample mail delivery time to ensure receipt by the Iowa DOT on or before the due date. Postmarking by the due date will not substitute for actual receipt of the Bid Response.

Electronic mail and faxed Bid Responses will not be accepted.

Contractors must furnish all information necessary to evaluate the Bid Response. Bid Responses that fail to meet the mandatory requirements of the RFB will be disqualified. Verbal information provided by the Contractor shall not be considered part of the Contractor's Bid Response.

2.8 Bid Response Opening

The Iowa DOT will open Bid Responses on the date and time stated in the Procurement Timetable. Bid Responses will remain confidential until a bid tabulation has been posted on the Iowa DOT's website for all bidders to view the results in the form of "Intent to Award". (See Iowa Code Section 72.3.)

The names of the Contractors who submit compliant Bid Responses within the time frame permitted will be available for public review after the contract has been awarded.

2.9 Costs of Preparing the Bid Response

The costs of preparation and delivery of a Bid Response are solely the responsibility of the Contractor.

No payments shall be made by the State to cover costs incurred by any Contractor in the preparation of or the submission of this RFB or any other associated costs.

2.10 Reasonable Accommodations

Upon request, the Iowa DOT will provide reasonable accommodations, including the provision of informational material in an alternative format, for individuals with disabilities. If accommodations are required at time of a bid opening, contact the Issuing Agent designated on the cover page.

2.11 Rejection of Bid Responses

The Iowa DOT reserves the right to reject any or all Bid Responses, in whole or in part, received in response to this RFB at any time prior to the execution of a written contract. Issuance of this RFB in no way constitutes a commitment by the Iowa DOT to award a contract. This RFB is designed to provide Contractors with the information necessary to prepare a competitive Bid Response. This RFB process is for the Iowa DOT benefit and is intended to provide the Iowa DOT with competitive information to assist in the selection of a Contractor to provide services.

It is not intended to be comprehensive and each Contractor is responsible for determining all factors necessary for submission of a comprehensive Bid Response.

The Iowa DOT reserves the right to negotiate the terms of the contract, including the award amount, with the awarded Contractor prior to entering into a contract. If contract negotiations cannot be concluded successfully, the Iowa DOT reserves the right to negotiate a contract with the next lowest Bidder.

2.12 Disqualification

The Iowa DOT may reject outright and shall not evaluate proposals for any one of the following reasons:

2.12.1 The Contractor states that a requirement of the RFB cannot be met.

2.12.2 The Contractor's Bid Response materially changes a requirement of the RFB or the Bid Response is not compliant with the requirements of the RFB.

2.12.3 The Contractor's response limits the rights of the Iowa DOT.

2.12.4 The Contractor fails to include a *Bid Bond*, also or bid security, *if required*. See Bid Response cover page and **Section 2.31.**

2.12.5 The Contractor fails to include any signature, certification, authorization, stipulation, disclosure or guarantee (if required).

2.12.6 The Contractor presents the information requested by this RFB in a format inconsistent with the instructions of the RFB or otherwise fails to comply with the requirements of this RFB.

2.12.7 The Contractor initiates unauthorized contact regarding the RFB with state employees.

2.12.8 The Contractor provides misleading or inaccurate responses.

2.12.9 The Contractor fails to attend the mandatory Contractors Conference or Pre-Bid meeting.

2.12.10 The Contractor's Bid Response is materially unbalanced.

2.12.11 There is insufficient evidence (including evidence submitted by the Contractor and evidence obtained by the Iowa DOT from other sources) to satisfy the Iowa DOT that the Contractor is a "Responsible Contractor".

2.12.12 The Contractor alters the Bid Proposal language in any way.

2.13 Nonmaterial and Material Variances

The Iowa DOT reserves the right to waive or permit cure of nonmaterial variances in the Bidder's Bid Response if, in the judgment of the Iowa DOT, it is in the Iowa DOT best interest to do so. Nonmaterial variances include minor informalities that do not affect responsiveness; that are merely a matter of form or format; that do not change the relative standing or otherwise prejudice other Contractors; that do not change the meaning or scope of the RFB; or that do not reflect a material change in the services. In the event the Iowa DOT waives or permits cure of nonmaterial variances, such waiver or cure will not modify the RFB requirements or excuse the Contractor from full compliance with RFB specifications or other contract requirements if the Contractor is awarded the contract. The determination of materiality is in the sole discretion of the Iowa DOT.

2.14 Reference Checks

The Iowa DOT reserves the right to contact any reference to assist in the evaluation of the Bid Response, to verify information contained in the Bid Response and to discuss the Contractor's qualifications and the qualifications of any subcontractor identified in the bidders Bid Response.

2.15 Information From Other Sources

The Iowa DOT reserves the right to obtain and consider information from other sources concerning a Contractor, such as the Contractor's capability and performance under other contracts, the qualifications of any subcontractor identified in the Contractor's Bid Response, specifically, the Contractor's financial stability, past or pending litigation, and publicly available information.

2.16 Verification of Bid Response Contents

The content of a Bid Response submitted by a Contractor is subject to verification. Misleading or inaccurate responses shall result in disqualification and rejection of the Bid Response.

2.17 Criminal History and Background Investigation

The Contractor hereby explicitly authorizes the Iowa DOT to conduct criminal history and/or other background investigation(s) of the Contractor, its officers, directors, shareholders, partners and managerial and supervisory personnel retained by the Contractor for the performance of the contract.

2.18 Bid Response Clarification Process The Iowa DOT reserves the right to contact a Contractor after the submission of Bid Response for the purpose of clarification to ensure mutual understanding.

This contact may include written questions, interviews, site visits, a review of past performance if the Contractor has provided goods or services to the Iowa DOT or any other political subdivision wherever located, or requests for corrective pages in the Contractor's Bid Response. The Iowa DOT will not consider information received if the information materially alters the content of this Bid Proposal or alters the type of goods and services the Contractor is offering to the Iowa DOT. An individual authorized to legally bind the Contractor shall sign responses to any request for clarification. Responses shall be submitted to the Iowa DOT within the time specified in the Iowa DOT request. Failure to comply with requests for additional information may result in rejection of the Bid Response as non-compliant.

2.19 Disposition of Bid Responses

At the conclusion of the selection process, the contents of all Bid Responses will be in the public domain and be open to inspection by interested parties except for information for which Contractor properly requests confidential treatment or is subject to exceptions provided in Iowa Code Chapter 22 or other applicable law.

2.20 Public Records and Requests for Confidential Treatment

The Iowa DOT may treat all information submitted by a Contractor as public information following the conclusion of the Intent to Award. Iowa DOT release of information is governed by Iowa Code chapter 22. Contractors are encouraged to familiarize themselves with chapter 22 before submitting a Bid Response. The Iowa DOT will copy and produce public records as required to comply with the public records laws.

2.21 Release of Claims

By submitting a Bid Response, the Contractor agrees that it will not bring any claim or cause of action against the Iowa DOT based on any misunderstanding concerning the information provided herein or concerning the Iowa DOT failure, negligent or otherwise, to provide the Contractor with pertinent information as intended by this RFB.

2.22 Award Notice and Acceptance Period

Notice of intent to award will be posted on the Iowa DOT's website at www.iowadot.gov/purchasing/bidaward. Final negotiation and execution of the contract(s) shall be completed no later than thirty (30) days from the date of the Notice of Intent to Award or such other time as designated by the Iowa DOT.

If the successful Contractor fails to negotiate and deliver an executed contract by that date, the Iowa DOT in its sole discretion may cancel the award and redirect the contract to the next lowest bidder meeting the specifications.

2.23 No Contract Rights until Execution

The full execution of a written contract shall constitute the making of a contract for services and no Contractor shall acquire any legal or equitable rights relative to the contract services until the contract has been fully executed by the successful Contractor and the Iowa DOT.

2.24 Restrictions on Gifts and Activities

Iowa Code Chapter 68B restricts gifts which may be given or received by state employees and requires certain individuals to disclose information concerning their activities with state government. Contractors are responsible to determine the applicability of this Chapter to their activities and to comply with the requirements. In addition, pursuant to Iowa Code section 722.1, it is a felony offense to bribe or attempt to bribe a public official.

The laws of Iowa provide that it is a felony to offer, promise, or give anything of value or benefit to a state employee with the intent to influence that employee's acts, opinion, judgment or exercise of discretion with respect to that employee's duties. Evidence of violations of this statute will be submitted to the proper prosecuting attorney.

2.25 No Minimum Guaranteed

The Iowa DOT anticipates that the selected Contractor will provide services as requested by the Iowa DOT. The Iowa DOT will not guarantee any minimum compensation will be paid to the Contractor or any minimum usage of the Contractor's services.

2.26 Conflicts Between Terms

The Iowa DOT reserves the right to accept or reject any exception taken by the Contractor to the terms and conditions contained in this RFB. Should the Contractor take exception to the terms and conditions required by the Iowa DOT, the Contractor's exceptions may be rejected and the entire proposal declared nonresponsive. The Iowa DOT may elect to negotiate with the Contractor regarding contract terms that do not materially alter the substantive requirements of the request for proposals or the contents of the Contractor's Bid Response.

2.27 News Releases

No news releases or other materials pertaining to this procurement, or any part of this proposal, will be made available to the media or the public, the Contractor's clients or potential clients without the prior written approval of the Iowa DOT.

2.28 Pre-Bid Conference

If the Procurement Timetable indicates a Contractor's Pre-Bid Conference will be held in conjunction with this RFB, it will be held at the date, time, and location listed on the Procurement Timetable immediately following the cover page. If Attendance at the Contractor's Pre-Bid Conference is a mandatory requirement to submit a Bid Response, it will be indicated on the Procurement Timetable. The purpose of the Pre-Bid conference is to discuss with prospective Contractors the work to be performed and allow prospective Contractors an opportunity to ask questions regarding the RFB. Verbal discussions at the Pre-Bid conference shall not be considered part of the RFB unless confirmed in writing by the Iowa DOT and incorporated into this RFB. The conference may be recorded. Questions asked at the conference that cannot be adequately answered during the conference may be deferred.

A copy of the questions and answers will be posted on the DOT website for viewing.

In an effort to seek competitive bids the DOT reserves the right to schedule a second pre-bid meeting in the event only one or no vendors are in attendance at the scheduled mandatory pre-bid. The Potential bidder in attendance at the scheduled pre-bid will not be required, but is welcome to attend the second pre-bid if they choose.

2.29 Contractors Responsibilities

2.29.1 Codes, Laws and Regulations

The laws of the State of Iowa in relation to and pertaining to public improvements shall apply to these projects. All construction, materials and methods shall comply with the State and Local Building Codes and with Local Ordinances, except where plans and specifications establish a higher standard.

2.29.2 Licenses, Permits and Inspections

The Bidders shall comply with all codes, laws, ordinances, rules and regulations of any public authority having jurisdiction that bears on the performance of its work. Bidders shall pay for all licenses, permits and inspection fees required for its work. Bidders must furnish copies of all approved inspection certificates and approvals from authorities having jurisdiction in a timely fashion upon completion of the work.

2.30 Consideration of Bids

2.30.1 Rejection of Bids

The Iowa DOT reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Iowa DOT that such bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.
Conditional bids will not be accepted.

2.30.2 Qualification of Bidder

The Iowa DOT may make such investigations as they deem necessary to determine the ability of the Bidder to perform the required work, and the bidder shall furnish to the Iowa DOT all such information and data for this purpose as the Iowa DOT may request.

2.31 Bonds

2.31.1 Bid Bond

Bid Bond's must be submitted on **Iowa DOT Form No. 131084 (Appendix A) or the bid will be rejected.**

The Bid Bond from the qualified responsive Bidder
will be retained until an executed contract is in place and the required bonds and Insurance Certificates are in the possession of the Iowa DOT after which the bid security will promptly be returned.

2.31.2 Performance and Payment Bond (is required of the awarded vendor)

The Solicitation Response page will indicate the <u>fixed percent of the bid security required based on the amount of the Bidder's bid.</u> *See also Standard Terms and Conditions Section A-3.*

It is the responsibility of the Contractor to notify the surety company of the required amount of the performance bond. The performance bond is based on the percentage of the contractors total bid response.

If the contracted amount is $25,000 or more, the successful Bidder shall furnish a performance bond covering the faithful performance of 100% of the Contract and the payment of all obligations arising thereunder.

One copy of the bond shall be submitted on Iowa Department of Transportation **Form 131070**. All items must be properly filled in, including Bidder's signature.

A Resident Commission Agent or attorney-in-fact must file a copy of the power of attorney.

2.31.3 Power of Attorney

Attorney-in-fact who signs the Bid Bond and/or Performance Bond must file with each bond a certified and effectively dated copy of the Power of Attorney.

2.32 Labor Regulations

All Bidders, before entering into a contract with the Department, must be registered with the Division of Labor in the Iowa Department of Workforce Development (515-281-3606) according to chapter 91C, Code of Iowa 2015. This pertains to contractor's who engage in the business of construction.

2.33 Fabricated or Custom Built Materials Lead time

2.33.1 All Bidders shall provide a lead time on any fabricated or custom built product or products that will impact the project timeline. Lead times are to be listed for each fabricated product, including estimated product delivery on the Schedule of Prices.

If no critical fabricated or custom built products are needed for the project, bidders shall simply indicated "Not applicable or N/A in the Schedule of Prices. This indicated no known additional time for readily available materials and products needed for the project.

Section 3 General Requirements

3.1 Scope of Work

Successful Bidder shall be required to provide all materials, labor and equipment necessary for the construction of the New Iowa Department of Transportation Maintenance Facility in Muscatine Iowa.
The Project consists of constructing a 19,200 sq. ft. 16 stall pre-cast concrete maintenance garage plus offices building, 10-stall cold storage
building, drive-through brine/reclaim building, salt storage hoop building, and general site construction including drives, parking, fuel depot, detention pond, utility upgrades (This does not included: sanitary sewer connection, asphalt drives, or landscaping)

We are seeking a licensed General Contractor for this project. The awarded contractor must have a contractor number at the time of the award refer to section 2.32

Onsite training of all mechanical and electrical systems is required.

The schedule of prices will break down the various buildings into phases with specific targeted completion dates and separate liquidated damages as per building. The phases will not determine when a building begins as that will be determined during the pre-construction meeting and construction timelines as specified in the additional specifications after section 4.7

Phase1-Construction of 3500 ton hoop building with a completion date of **September 1, 2017.** Liquidated damages for this building is **$50.00** per calendar day.

Phase 2-10 stall cold storage pole building with a completion date of **September 15, 2017**. Liquidated damages for this building is **$60.00** per calendar day.

Phase 3-Drive through Brine/ Reclamation Building with a completion date **September 30, 2017.** Liquidated damages for this building is **$100.00** per calendar day.

Phase 4- Maintenance Garage Building, is a 19,200 sf ft.16-stall maintenance garage plus offices building, and general site construction including drives, parking, fuel depot, detention pond, utility upgrades. Completion date **November 1, 2017**. Liquidated damages of **$500.00** per calendar day.

Additional mandatory specifications are included after section 4.7

3.2 Adoption of General Conditions

3.2.1 The General Requirements of this Contract shall include the "General Conditions", "Plans and Specifications" and any and all requirements of this RFB, as herein stated.

3.2.2 "THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION", A.I.A. FORM #A-201, LATEST EDITION AND A.I.A. DOCUMENT, "INSTRUCTIONS TO BIDDERS", FORM #A-701, LATEST EDITION, SHALL BE INCLUDED, AS MODIFIED IN THE "SUPPLEMENTARY INSTRUCTIONS TO BIDDERS" AND "SUPPLEMENTARY GENERAL CONDITIONS", AND BOUND WITH THE STANDARD FORM OF AGREEMENT BETWEEN THE CONTRACTOR AND OWNER", A.I.A. FORM #101, CHANGES IN WORK A.I.A. FORM # G701, PAY APPLICATION A.I.A. FORM # G702 & G703. LATEST EDITION, AS A PART OF THIS CONTRACT SPECIFICATION.

3.2.3 All bidder information and conditions, bid check lists and similar documents included in the specifications issued by the Iowa DOT, Ames, Iowa are hereby made a part of the General Conditions.

3.3 Contractor Response

3.3.1 Guidelines

- Contractors shall comply with Iowa Occupational Safety and Health Standards as found in 29 CFR Parts 1910 and 1926. Of particular importance are those standards referring to the use of personal protective equipment (PPE), fall protection and ventilation.
- Contractor may be required to make available to the Iowa DOT all Safety Data Sheets (SDS) for all products provided at time the apparent low bidder has been determined. SDS shall be sent to the Issuing Agent (when applicable) prior to issuance of the contract.

3.3.2 Guarantee

The Contractor shall guarantee all work executed under this contract, both as the workmanship and materials, for a period of twelve (12) months after the substantial completion date. Neither the final payment nor any provision of the contract documents shall relieve the Contractor of responsibility for faulty materials or workmanship. The Contractor shall remedy any defect thereto and pay for any damage to other work resulting therefrom, which shall appear within a period of one (1) year from the date of the final acceptance. With one month remaining in the guarantee period, the Contractor shall notify the Iowa DOT and set up a complete walk-through inspection.

- All materials, items of equipment, and workmanship furnished under this division of the specifications shall carry the standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, or workmanship which may develop, shall be made good, forthwith.
- The Guarantee shall include, but not be limited to the following elements and services:

a. Repair or replace defective materials, equipment, workmanship and installation that develops within the guarantee period, promptly and to Iowa DOT's satisfaction and correct damage caused in making necessary repairs and replacements, including all other damage done to areas, materials, and other systems resulting from the failure or defect, under guarantee by and at the expense of the Contractor.

b. Replace material or equipment that requires excessive service during guarantee period, as defined and as directed by the Iowa DOT.

c. Make all service calls, replacements, repairs and adjustments during the guarantee period without cost to the Iowa DOT.

3.3.3 Use of Premises

- All Contractors shall confine all apparatus, storage of materials and construction to areas as directed by the Iowa DOT and shall not encumber the premises with materials.
- Notwithstanding any approvals or instructions which must be obtained by the Contractors from the Iowa DOT in connection with use of premises, the responsibility for the safe working conditions at the site shall remain that of the Contractors.

3.3.4 Verifying Work of Other Contractors

- When a Contractor's work depends on proper execution of work by other contractors, such Contractor shall promptly report to the Iowa DOT project lead any defects in such work and/or discrepancies between executed work plans, drawings or specifications.
- Contractors shall employ such methods and means in carrying out work as will not cause interruption or interference with any other Contractor. General Contractors shall give other Contractors sufficient notice to permit installation of sleeves, piping, conduit, and other items, prior to placing concrete or laying masonry. Any Contractor failing to comply with above shall be responsible for expense caused by such failure.

3.4 Sub-Contractors

- Specific attention shall be given by the Contractor to Article 5 of the A.I.A. Document A-201, "The General Conditions of the Contract for Construction".
- The Successful Bidder for the project shall furnish the Iowa DOT with a complete list of subcontractors, schedule of values, and major material suppliers at the pre-construction meeting.

- The Iowa DOT shall approve and maintain the list of subcontractors and major suppliers and issue a general approval of same after official award of the contract, subject to the specific requirements of the Plans, Specifications and the "General Conditions of the Contract, and of these supplementary Conditions," " Special Provisions," and elsewhere with contract documents, as applicable. Deviations from the list of subcontractors and material suppliers shall be made only with the specific approval of, or at the request of the Iowa DOT.

3.5 Protection of Persons and Property

3.5.1 Safety and Health Regulations

The Contractor, serving in the role of the employer for the project, shall exercise at all times the protection of all persons and property. Contractor shall comply with all requirements of the Occupational Safety and Health Act of 1970, Iowa Bureau of Labor and all applicable state and municipal laws, as well as building and construction codes. It is the Contractor's responsibility to enforce all regulations that apply to these projects.

3.5.2 Protection of Site

The Contractor shall furnish all permanent and temporary guards, signs, fencing, shoring, and underpinning and other protection necessary in the performance of the contract and for the necessary protection of all public and private property and shall be responsible for any damage caused by failure to comply with this requirement.

- After building operations are completed, the Contractor shall replace or satisfactorily repair all damaged walks or pavements which shall have become damaged due to operations of these projects.
- The Contractor shall take care of all underground pipes, conduits, etc., encountered in the excavations, and protect same from damage until such time as they can be permanently disposed of.
- The Contractor shall continuously maintain adequate protection of all work from damage and shall protect the Owner's property and adjacent property from damage arising in connection with this contract.

3.6 Miscellaneous Provisions

3.6.1 Iowa State Building Code

- All construction under this section shall conform to the requirements of the Iowa State Building Code. The provisions of the Iowa State Building Code will be strictly adhered to, and will take precedence over any local Governmental Body Regulations. Work not regulated by the Iowa State Building Code shall be performed in accordance with local Governmental Body Regulations.

3.6.2 Discriminatory Practices

- All Contractors or subcontractors working under the terms of these projects are prohibited from engaging in discriminatory employment practices as forbidden by the Iowa Civil Rights Act of 1965. These provisions shall be fully enforced, as directed through Executive Order Number 34 dated July 22, 1988. Any breach of the provisions contained in the Iowa Civil Rights Acts of 1965 shall be regarded as a material breach of contract.

- Bidder agrees that if awarded a contract to construct and/or remodel any portion of the project described in these Specifications, neither the Contractor nor any subcontractors will engage in any discriminatory employment practices based on race, color, creed, religion of natural origin and that they will in all contracts comply with all statutes of the State of Iowa against discrimination. Failure to do so could be deemed a material breach of contract.

3.7 Contractor Responsibilities

3.7.1 Pre- bid / Site Visit

[X] Mandatory Pre-bid for all General Contractors is required. Prospective bidders interested in participating in this bid proposal must be in attendance.

Pre-bid Date: December 5, 2016 Time: 11:00a.m.
Location: The McAvoy Center 1403 Park Ave Muscatine IA 52761
Room 101-102

- No considerations or revision in the contract price or scope of the project will be considered by the Iowa DOT for any item which could have been revealed by a thorough on-site inspection and examination or pre- bid meeting.

3.7.2 Conditions of Work

Bidders must inform themselves fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve successful bidders of their obligation to furnish all material and labor necessary to carry out the provisions of this contract. Insofar as possible, the Contractor, in carrying out the work, must employ such methods or means as will not cause any interruption of, or interference with the work of any other Contractor.

3.7.3 Obligation

At the time of the bid opening, each bidder will be presumed to have read and become thoroughly familiar with the drawings, specifications, and other contract documents, including all addenda.

Bidders are responsible for the proper submission of bids. Omissions by a bidder to examine a form, instrument, or document shall in no way relieve that bidder from any obligations in respect to their bid.

3.8 Bid Proposal Documents

3.8.1 Plans and Specifications

Electronic Plans and specifications are available on the Iowa DOT's website, www.iowadot.gov/purchasing. The Bidder is responsible for all copies of plans and specifications necessary for the execution of the work.

In the event of a conflict between the specifications and the drawings, the specifications shall take precedence.

3.8.2 Alternates or Exceptions

3.8.2.1 Alternates or exceptions must be evaluated prior to the letting date listed in this proposal.

3.8.2.2 Substitutions will be reviewed up to 7 days before bid letting date.

Section 4 Contract Terms & Conditions

4.1 Contract Award

It is the intent of the Iowa DOT to award the contract to the responsible bidder whose submitted quotation is the most advantageous to the Iowa DOT, cost and other factors considered. Other factors include, but are not limited to: meeting or exceeding mandatory requirements, proposed staffing, and meeting required time schedule.

Bid price will include all requirements listed in Section 3 to complete this proposed project. The Prime Contractor shall be responsible for taking all sub-bids and for all coordination between trades.

A "Prime" contract shall be awarded for each project for all work shown on the Drawings and described in the Specifications including Site work, General construction, Demolition, Plumbing, Mechanical, Energy management and control and Electrical work. The Prime Contractor shall be responsible for taking all sub-bids and for all coordination between trades.

Protests of award recommendations shall be made in accordance with Paragraph 761--20.4(6)"e", Iowa Administrative Code.

4.2 Contract Period

See Bid Proposal timeline for dates. The date of completion shall be stated in calendar days on the Bidder's Bid Response, and if necessary, adjusted by mutual agreement between the Iowa DOT and successful bidder prior to executing the contract documents.

The Iowa DOT realizes that deliveries and site conditions have a definite bearing on the completion date. The Iowa DOT will demand diligence in the prosecution of the work, but with good cause and satisfactory past performance by the Contractor, the Iowa DOT may revise the completion date to another mutually-acceptable date, when requested in writing and in good faith by the Contractor.

4.3 Liquidated Damages

Time is an essential component of the contract, and it is important that the work be completed on the or before the dates listed on the Procurement Timetable.
For each calendar day that any work shall remain uncompleted beyond the <u>substantial completion date</u> and beyond the <u>final completion date</u> or any extension granted under Extension of Contract Period, the amount per calendar day specified in the Bid Response cover page will be assessed, not as a penalty but as predetermined and agreed upon liquidated damages.

If work remains uncompleted on more than one portion for which calendar days and liquidated damages have been specified, the liquidated damages assessed will be the total of the damages per day listed for each uncompleted portion. The Iowa DOT shall prepare and forward to the Contractor an invoice or credit change order for such liquidated damages. The final payment shall be withheld until payment of the invoice has been made or the credit change order has been agreed upon.

Assessment of liquidated damages will be based only on the number of calendar days required to complete the contract beyond the contract completion date, plus authorized extensions.

The provision for the assessment of liquidated damages for failure to complete work within the contract period does not constitute a waiver of the Iowa DOT's right to collect any additional damages other than time delays, which the Iowa DOT may sustain by the failure of the Contractor to carry out the terms of the contract.

4.4 Immunity of Iowa Department of Transportation

The Contractor shall defend, indemnify and hold harmless the Iowa DOT and its officials and employees from liability arising out of or resulting from the Contractor's activities at the designated work site, its performance or attempted performance of the contract, as well as the Contractor's activities with Sub-Contractors and all other third parties.

4.5 Payments and Completion of Contract

4.5.1 Payments on contract will be made monthly by means of state warrants to the extent of ninety-five percent (95%) of the value of work performed, including acceptable material stored at the building site, as determined by the Contractor as governed by the Iowa DOT.

4.5.2 At the Pre-Construction Conference, the contractor shall submit a schedule of values of the various parts of the work, aggregating the total sum of the contract, made out in such form as the Iowa DOT may direct and, if required, supported by evidence as to its correctness. This schedule, when approved by the Iowa DOT, shall be used as a basis for requests for payment.

4.5.3 Final payment shall be authorized not later than thirty (30) days following the completion and final acceptance of the contract, provided that the provisions herein and all other contract requirements have been fulfilled, accepted and approved, where no claims have been filed or following adjudication or release of claims as provided in Chapter 573 of the Code of Iowa.

4.5.4 No notification of payment being processed, no payment made to the Contractor, no partial payment, nor shall the entire use or occupancy of the work by the Iowa DOT be held to constitute an acceptance, in whole or in part, by the Iowa DOT prior to making the final payment and acceptance in full completion of the contract.

4.6 Contractor(s) Insurance Requirements

The resulting Contract will require the successful Contractor to maintain insurance coverage(s) of the type and in the amounts set forth below.

• It shall be the Contractor's responsibility to have liability insurance covering all of the project operations incident to contract completion and the Contractor(s) must have on file with the Contracting Authority a current "Certificate of Insurance" prior to award of contract. The certificate shall identify the insurance company firm name and address, contractor firm name, policy period, type of policy, limits of coverage, and scope of work covered (single contract or statewide). This requirement shall apply with equal force, whether the work is performed by persons employed directly by the Contractor(s) including a subcontractor, persons employed by a subcontractor(s), or by an independent contractor(s).

• In addition to the above, the Contracting Authority shall be included as an insured party, or a separate owner's protective policy shall be filed showing the Contracting Authority as an insured party.

• The liability insurance shall be written by an insurance company (or companies) qualified to do business in Iowa. For independent contractors engaged solely in the transportation of materials, the minimum coverage provided by such insurance shall be not less than that required by Chapter 325A, Code of Iowa, for such truck operators or contract carriers as defined therein. For all other contractors, subcontractors, independent contractors, and the Contracting Authority, the minimum coverage by such insurance shall be as follows:

• Commercial General Liability including Contractual Liability;
• Contingent Liability;
• Damage; Occurrence Basis Bodily Injury: Broad Form Personal Injury; Broad Form Property Damage.

Bodily Injury

The contractor will purchase and maintain throughout the term of this contract the following minimum limits and coverage:

• Each person	$750,000
• Each accident/occurrence	$750,000
• Workers Compensation	$750,000
• Statutory Limits	$750,000
• Employer's liability	$750,000
• Occupation Disease	$750,000

Operations

• Property Damage	$250,000 each occurrence

The Contractor(s) shall require all subcontractor(s) meet the above insurance requirements.

The Certificate of Insurance must include the following;

• Iowa Department of Transportation must be listed as an additional insured

Builders Risk Insurance *(if applicable)*

- Each Contractor holding a valid contract with the Iowa DOT shall furnish and pay for builder's risk insurance, providing coverage for at least the following losses: fire, extended coverage, vandalism and malicious damage to materials incorporated in the project, and materials purchased to be incorporated in the project, either stored on or off the permanent job site. If this insurance coverage is not provided, the Contractor shall assume all responsibility for the perils outlined above which may occur prior to project completion and acceptance.
- Failure on the part of the Contractor(s) to comply with the requirements of this Article will be considered sufficient cause to suspend the work, withhold estimates, and to deny the Contractor(s) any further contract awards, as provided in Article 1103.01.
- The Contractor(s) shall require all subcontractor(s) meet the above insurance requirements.

4.7 Public Contract Termination

The provisions of Iowa law as contained in Chapter 573A of the Code of Iowa, an Act to provide for termination of contracts for the construction of public improvements when construction or work thereon is stopped because of national emergency, shall apply to and be a part of this Contract, and shall be binding upon all parties hereto, including sub-contractors and sureties upon any bond given or filed in connection herewith.

SECTION 00 0101
PROJECT TITLE PAGE

FOR
MUSCATINE MAINTENANCE FACILITY

PROJECT NUMBER: BG-2M31(000)--80-70

3001 GRANDVIEW AVENUE
MUSCATINE, IOWA 52761

PROJECT MANUAL
BUILDING SPECIFICATIONS FOR: MUSCATINE MAINTENANCE FACILITY
DATE: 10/31/2016

END OF SECTION

SECTION 00 0105

CERTIFICATIONS PAGE

ARCHITECT:

I HEREBY CERTIFY THAT THE PORTION OF THIS TECHNICAL SUBMISSION DESCRIBED BELOW WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND RESPONSIBLE CHARGE. I AM A DULY REGISTERED ARCHITECT UNDER THE LAWS OF THE STATE OF IOWA.

LICENSE RENEWAL DATE:__6-30-2018_____

PRINTED OR TYPED NAME:__Jerry L. Burnes_____

SIGNATURE

PAGES OR SHEETS COVERED BY THIS SEAL: 00 0101, 00 0105, 00 0110, 00 0115, DIVISIONS 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 31, 32, 33

END OF SECTION

IOWA DEPARTMENT OF TRANSPORTATION
MUSCATINE MAINTENANCE FACILITY
3001 GRANDVIEW AVENUE
MUSCATINE, IOWA 52761
IOWA DOT PROJECT NO: BG-2M31(000)-80-70

BBSAE Project Number 16016

	I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. _____, 20_____ Susan R. Oltrogge, P.E. License number: 13008 My license renewal date is December 31, 2017 Discipline Mechanical Engineering Specification Divisions covered: Divisions 21-23, 33 Date issued October 31, 2016

	I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. _____, 20_____ Robert A. Hedgepeth, P.E License number: 14212 My license renewal date is December 31, 2017 Discipline Electrical Engineering Specification Divisions covered: Divisions 26, 27, and 28 Date issued October 31, 2016

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BROOKS BORG SKILES
ARCHITECTURE ENGINEERING LLP
317 6th Avenue, Suite 400
Des Moines, IA 50309-4108

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PRE-BID SUBSTITUTIONS

PART 1 GENERAL

1.01 DOCUMENT INCLUDES

A. Pre-Bid Substitutions

B. Sample Form: Request For Substitution
   1. Contractor shall make copies as needed.
   2. Use one form for each Specified Item.

1.02 BIDDER'S OPTIONS

A. For products specified by reference standard only, select product meeting that standard, by any manufacturer.

B. For products specified by naming several products or manufacturers, select one of the products and manufacturers named which complies with the technical Specifications. No substitutions will be allowed.

C. For products specified by naming several products or manufacturers and stating “or equivalent”, or “equal”, or “Architect approved equivalent”, or similar wording, submit a Request For Substitution for any product or manufacturer which is not specifically named. Architect and/or Engineer will review and consider for approval. If not approved prior to bidding, product is not allowed for use in the project.

D. For products specified by naming only one product/manufacturer, there is no option and no substitution will be allowed.

1.03 SUBSTITUTIONS

A. Prepare Base Bid in accordance with requirements of the Bidding Documents.
   1. Substitutions for products may be made during the bidding period by submitting completed Request For Substitution form and providing substantiating product information. Request For Substitution form must be received by the Office of Purchasing a minimum of seven (7) calendar days prior to the Bid Date.
   2. The Iowa DOT will consider substitution requests for approval provided they meet the submittal requirements and product information is complete and accurate.
   3. The Office of Purchasing will notify Bidders of approved product substitutions in an addendum.

B. Submit separate request for each item. Provide the following with each request:
   1. Complete data substantiating compliance of proposed substitution with requirements stated in Bidding Documents:
      a. Product identification, including manufacturers name and address.
      b. Manufacturer's literature, identifying:
         1) Product description and model number.
         2) Reference standards.
         3) Performance and test data.
         4) Samples, as applicable.
      c. Name and address of projects on which product has been used and date of each installation.
   2. Itemized comparison of the proposed substitution with product specified, listing significant variations.
   3. Advise of any change in construction schedule resulting from use of proposed substitution.
   4. All effects of substitution on separate contracts.
   5. List of changes required in other work or products.
   6. Designation of responsibility for cost of required license fees or royalties.
      a. Description of availability of maintenance services and sources of replacement materials and parts.

C. Substitutions will not be considered for acceptance when:
   1. Acceptance will require substantial revision of Contract Documents.
   2. In the judgment of the Iowa DOT, the submittal does not include adequate information for a comprehensive evaluation.

1.04 BIDDER'S REPRESENTATION

A. In making formal request for substitution the bidder represents that:
   1. The bidder has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.
   2. The bidder will provide the same warranties or bonds for substitution as for the product specified.
   3. The bidder will coordinate installation of the accepted substitution into the Work, and will make such changes as may be required for the Work to be completed in all respects.
   4. The bidder waives claims for additional costs caused by substitution which may subsequently become apparent.

1.05 ARCHITECT'S ACTION

A. Review requests for substitution. Substitution requests that are either approved or not approved will not be returned to person submitting request.

B. Issue an addendum to identify accepted substitutions.

C. Only those substitutions noted as approved in an addendum may be included in the Bid.

1.06 SUBSTITUTION REQUEST FORM

A. See Request for Substitution form at the end of this RFP.

B. Substitutions will be considered only when the Request for Substitution form is completed and submitted with product information requested.

END OF SECTION

SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contract description.

B. Owner supplied products.

C. Contractor's use of site and premises.

D. Owner occupancy.

E. Specification Conventions.

1.02 PROJECT

A. Project Name: Muscatine Maintenance Facility

B. Iowa Department of Transportation's Name: Iowa Department of Transportation.

C. The Project consists of the construction of site grading, on site utilities, and construction of Muscatine Maintenance Garage, Brine Building, Pole Building, and Hoop Building.

1.03 CONTRACT DESCRIPTION

A. Contract Type: Stipulated Price as described inStandard form of Agreement Between the Contractor and Owner, AIA Form A101, latest Edition.

1.04 OWNER SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner-reviewed Shop Drawings, Product Data, and Samples, to Contractor.
   2. Arrange and pay for delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner-reviewed Shop Drawings, Product Data, and Samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

C. Products furnished to site and installed by Owner:
   1. Fuel tank, fuel pump, light, fuel monitoring panel, emergency push-button stop switch, circuit breaker, and wiring for fuel island. Electrical conduits to fuel island location are in this contract.
   2. Mechanic Bays Benches
   3. Welder (s)
   4. Brine maker
   5. Brine pumps, tanks, and brine piping
   6. Site mulching and seeding by owner - finish grading, rock removal, and erosion-control devices are in this contract
   7. Asphalt provided and installed by Owner except in the Hoop Building. Asphalt inside Hoop Building is in contract.
   8. GPS Antenna and Bracket. Conduit for wiring included in contract.
   9. Radio Antenna adn bracket. Conduit for wiring included in contract
   10. Telephone outlet covers and wiring - conduits are in this contract
   11. Radios, speakers, and related conductors, conduits are in this contract
   12. Radio panel - telephone wiring back board is in this contract

13. Communications rack
14. Refrigerator (local district option)
15. Flags (local district)

D. Items furnished by Owner for installation by Contractor:
1. Building Signs for monument location - concrete structure by Contractor, Contractor shall install placard signage provided by Owner.
2. ADA parking signage - sign only, installed by Contractor.
3. Pressure Washer - piping extensions for two pressure outlets and remote, through-the-wall controls are in this contract
a. Complete installation, venting, electrical and plumbing connections.
b. Furnish and install VTR, vent hood, double wall pipe, and bracing.
c. At the wash bays the contractor is responsible for installing the high pressure piping with a hose connection fitting as shown on the plans.
d. The DOT will provide the high pressure hose.
4. Fuel Tank and Fuel Pumps to be provided by Owner.
a. Contractor to provide explosion proof conduits as noted on drawings
b. Contractor to floor concrete slabs, approaches, and bollards as shown on drawings.

1.05 OWNER OCCUPANCY

A. Construction, including punch list items, must be completed no later than the following date:by the date stated in the Agreement as the contract completion date.
1. Extension requests must be in writing and must be accompanied by appropriate documentation supporting the reason for the extension request.
2. No extensions or additional payments will be allowed for cold weather construction.

B. Iowa Department of Transportation intends to occupy the Hoop Building and Reclamation Building prior to the project completion date for to store materials.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Arrange use of site and premises to allow:
1. Work by Others.

B. Time Restrictions:
1. Contractor may perform construction operations any day of the week and at any time of the day, but must have a representative present during any Sub-Contractor work.

1.07 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

B. The following terms are used throughout the specifications and defined as follows:
1. Contractor: General Contractor or contractor responsible for Work of specified section
2. Owner: Representative of building occupants.
3. Architect/Engineer: Representative of Facilities Support.

1.08 SPECIFICATION SECTIONS APPLICABLE TO ALL CONTRACTS

A. Unless otherwise noted, all provisions of the sections listed below apply to all contracts. Specific items of work listed under individual contract descriptions constitute exceptions.

B. Section 01 2000 - Price and Payment Procedures.

C. Section 01 2100 - Allowances.

D. Section 01 2300 - Alternates.

E. Section 01 3000 - Administrative Requirements.

F. Section 01 3216 - Construction Progress Schedule.

G. Section 01 4000 - Quality Requirements.

H. Section 01 5000 - Temporary Facilities and Controls.

I. Section 01 5100 - Temporary Utilities.
J. Section 01 5213 - Field Offices and Sheds.
K. Section 01 5713 - Temporary Erosion and Sediment Control.
L. Section 01 5721 - Indoor Air Quality Controls.
M. Section 01 6000 - Product Requirements.
N. Section 01 7000 - Execution and Closeout Requirements.
O. Section 01 7419 - Construction Waste Management and Disposal.
P. Section 01 7800 - Closeout Submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Price and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Payment procedures relating to allowances.

1.03 SCHEDULE OF VALUES

A. Form to be used: AIA G703.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization, bonds and insurance, and General Requirements as separate line items for each structure.

E. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Form to be used: AIA G702 and G703.

C. Forms filled out by hand will not be accepted.

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. Submit three original copies of each Application for Payment.

H. Include the following with the application:
   1. Construction progress schedule, revised and current as specified in Section 01 3000.
   2. Updated Submittal Log.
   3. Updated NPDES Inspection Report Logs.
   4. Progress meeting minutes.

I. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue an AIA Document G701 change order document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
   2. Promptly execute the change.
   3. Contractor will not begin work prior to signature and approval of Change Order by Architect, IDOT and Contractor. If work is done prior to approval of Change Order by all parties, the contractor will not receive remuneration and may be required to change the project back per the original plans at the behest of the Architect.

C. For changes for which advance pricing is desired, Architect will issue an AIA Document G709 work change proposal request that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   2. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Overhead and profit.
         1) Profit and overhead not to exceed 15 percent total between General Contractor and Sub Contractor.
   2. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.
   2. All punch list items have been completed.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inspecting and testing allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 INSPECTING AND TESTING ALLOWANCES

A. Costs Included in Inspecting and Testing Allowances: Cost of engaging an inspecting or testing agency; execution of inspecting and tests; and reporting results.

B. Costs Not Included in the Inspecting and Testing Allowances:
   1. Costs of incidental labor and facilities required to assist inspecting or testing agency.
   2. Costs of testing services used by Contractor separate from Contract Document requirements.
   3. Costs of retesting upon failure of previous tests as determined by Architect.

C. Payment Procedures:
   1. Submit 3 copies of the inspecting or testing firm's invoice with next application for payment.
   2. Pay invoice on approval by Architect.

D. Differences in cost will be adjusted by Change Order.

1.04 ALLOWANCES SCHEDULE

A. Soils Testing Allowance: Include the sum of $15,000 for testing compacted soils specified in Section 31 2200.

B. Concrete Testing Allowance: Include the sum of $5,000 for testing concrete specified in Section 03 3000.

C. HVAC Testing, Adjusting, and Balancing Allowance: Include the sum of $10,000 for testing, adjusting, and balancing mechanical systems as specified in Section 23 0583.

D. Commissioning of HVAC system upon completion of Testing, Adjusting, and Balancing signed and scaled by ME Engineer. Allowance for Commissioning: $10,000.00

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Alternative submission procedures.

B. Documentation of changes to Contract Sum and Contract Time.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Iowa Department of Transportation's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - 3 Stall heated storage additon to 10 stall pole building.

1. Refer to Pole Building Drawing Set: Drawing number: PSP-1 through E103A.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Site mobilization meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Coordination drawings.

F. Submittals for review and for information.

G. Number of copies of submittals.

H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

B. Section 01 7800 - Closeout Submittals: Project record documents, construction progress schedules, closeout submittals.

1.03 PROJECT COORDINATION

A. Project Coordinator: Project Manager.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for vehicular access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:
   1. Requests for interpretation.
   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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

B. Project Coordinator will schedule a meeting after Notice of Award.

C. Attendance Required:
   1. Owner.

2. Architect/Engineer.
3. General Contractor.
4. All major Sub-Contractors.

D. Agenda:
1. Review Owner-Contractor Agreement and contract conditions.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Review list of Subcontractors, list of Products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties to Contract, Owner and Architect.
6. Review procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Coordinate commencement of construction.
8. Use of premises by Owner and Contractor.
9. Temporary utilities provided by Contractor.
10. Security and housekeeping procedures.
11. Procedures for testing.
12. Procedures for maintaining record documents.
13. Requirements for start-up of equipment.
14. Inspection and acceptance of equipment put into service during construction period.
15. Scheduling.
16. Scheduling activities of a Geotechnical Engineer.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Iowa Department of Transportation, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

A. Iowa Department of Transportation will schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
1. Contractor.
2. Iowa Department of Transportation.
3. Architect.
4. Contractor's Superintendent.
5. Major Subcontractors.

C. Agenda:
1. Use of premises by Iowa Department of Transportation and Contractor.
2. Iowa Department of Transportation's requirements and occupancy prior to completion.
3. Construction facilities and controls provided by Iowa Department of Transportation.
4. Temporary utilities provided by Iowa Department of Transportation.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Requirements for start-up of equipment.
8. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Iowa Department of Transportation, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-weekly intervals.

B. General Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems 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. Status of Proposal Requests, Change Orders, Architect's Supplemental Instructions and Requests For Information. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to Work.

E. General Contractor will record minutes and distribute copies to participants and those affected by decisions made within (5) five days of progress meeting. The distribution will be made electronically unless requested otherwise.

3.04 CONSTRUCTION PROGRESS SCHEDULE

A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

B. 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.

C. Within 10 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

3.05 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

3.06 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 Architect 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 only 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 7800 - Closeout Submittals.

3.07 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. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Iowa Department of Transportation. No action will be taken.

3.08 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. Documents for Information: Submit one copy electronically.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
   2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

B. Transmit each submittal with AIA Form G810.

C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

E. 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.

F. Deliver submittals to Owner in electronic format only.
   1. Only physical samples to be submitted to Owner's address.

G. Schedule submittals to expedite the Project, and coordinate submission of related items.

H. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

J. Provide space for Contractor and Architect review stamps.

K. When revised for resubmission, identify all changes made since previous submission.

L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

M. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 RELATED SECTIONS

A. Section 01 1000 - Summary: Work sequence.

1.03 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; O'Brien; 2006.

1.04 SUBMITTALS

A. Within 10 days after date established in Notice to Proceed, 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.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit progress schedules electronically.

G. Submit under transmittal letter form specified in Section 01 3000 - Administrative Requirements.

1.05 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with 1 years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.06 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 11x17 inches or width required.

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide legend for symbols and abbreviations used.

3.03 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Iowa Department of Transportation and to Iowa Department of Transportation's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Iowa Department of Transportation, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Submittals.

C. References and standards.

D. Mock-ups.

E. Control of installation.

F. Tolerances.

G. Testing and inspection agencies and services.

H. Control of installation.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Allowance for payment of testing services.

B. Section 01 3000 - Administrative Requirements: Submittal procedures.

C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.

D. 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.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

C. Design Data: Submit for Architect'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 Iowa Department of Transportation's information.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect 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 Architect, provide interpretation of results.
2. Test report submittals are for Architect'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 Iowa Department of Transportation's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate that 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 Architect.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Iowa Department of Transportation's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Iowa Department of Transportation.
1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Iowa Department of Transportation.
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Iowa Department of Transportation.

1.05 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.

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. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Contractor shall employ and pay for services of a third party or independent testing agency to perform specified concrete cylinder break and asphalt testing and commissioning for equipment and materials provided and installed by the contractor and vendors .

B. Iowa Department of Transportation will perform or pay for third party testing and commissioning of equipment provided by the IDOT and installed by the contractor or vendors.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
   4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

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 Architect 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. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 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 Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

A. Contractor to Notify the following agencies for required inspections of work to be outlined in the Pre-Construction Meeting and provide reports, certifications, and permits as applicable:
   1. Iowa Department of Transportation, Office of Support Services, 800 Lincoln Way, Ames, Iowa 50010
      a. Footings/Foundations

b. Underslab Plumbing and utilities
c. Electrical and Plumbing Rough-in
d. Mechanical Rough-in
e. Roof and wall insulation
f. Final Inspection

2. Iowa Department of Public Safety, State Fire Marshall Division, 215 E. 7th Street, Des Moines, Iowa 50319 Phone: 515-725-6145
   a. Footings/Foundations
   b. Underslab Plumbing and Utilities
   c. Plumbing wall rough-in
   d. Fire Sprinkler Inspection
   e. Final Inspection
3. Iowa Work Force Development, Division of Labor- Boilers, 1000 East Grand Avenue, Des Moines, Iowa 50319-0209, Phone: 515-281-6533 Fax: 515-242-5076 E-mail: www.iowaworkforce.org
   a. Boiler Inspection (Notify 10 days before boiler installation)
   b. Final Inspection
4. State Fire Marshall Division, Electrical Examining Board, 215 E. 7th Street, Des Moines, Iowa 50319 Phone: 515-725-6147 or Steve Nisser at 515-210-7294
   a. Electrical Rough-in
   b. Electrical Service Inspection
   c. Final Electrical Inspection
5. Kinder Morgan Pipeline; Randy Stonebraker, E-mail: Randy_Stonebraker@kindermorgan.com. Phone: Office, 641-635-2431 Ext. 226
   a. Contact prior to performing any site work over the pipeline easements.
   b. Work within the Pipeline easements must be done per the Kinder Morgan, "Guidelines for Design and Construction near Kinder Morgan Operated Facilities". See attached form.

B. See individual specification sections for testing required.

C. Testing Agency Duties:
1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.

D. 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.

E. 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 and to manufacturers' facilities.
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 Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Iowa Department of Transportation's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

G. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
1. Observer subject to approval of Iowa Department of Transportation.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

Guidelines for Design and Construction near Kinder Morgan Operated Facilities

Name of Company: _____

The list of design, construction and contractor requirements, including but not limited to the following, for the design and installation of foreign utilities or improvements on KM right-of-way (ROW) are not intended nor do they waive or modify any rights KM may have under existing easements or ROW agreements. Reference existing easements and amendments for additional requirements. This list of requirements is applicable for KM facilities on easements only. Encroachments on fee property should be referred to the Land and Right-of-Way Department.

Design

- KM shall be provided sufficient prior notice of planned activities involving excavation, blasting, or any type of construction on KM's ROW to determine and resolve any location, grade or encroachment problems and provide protection of our facilities and the public **before** the actual work is to take place.

- Encroaching entity shall provide KM with a set of drawings for review and a set of final construction drawings showing all aspects of the proposed facilities in the vicinity of KM's ROW. The encroaching entity shall also provide a set of as-built drawings showing the proposed facilities in the vicinity of KM's ROW.

- Only facilities shown on drawings reviewed by (Company) will be approved for installation on KM's ROW. All drawing revisions that effect facilities proposed to be placed on KM's ROW must be approved by KM in writing.

- KM shall approve the design of all permanent road crossings.

- Encroaching entity shall, at the discretion of the Kinder Morgan, Inc., incorporate Heath ATI "sniffer" Gas Detection Units in the design of paved areas or "Green Belt" areas of KM ROW. The units shall be installed per KM Standard **TYP-V-0100-B010**.

- Any repair to surface facilities following future pipeline maintenance or repair work by KM will be at the expense of the developer or landowner.

- The depth of cover over the KM pipelines shall not be reduced nor drainage altered without KM's written approval.

- Construction of any permanent structure, building(s) or obstructions within KM pipeline easement is **not** permitted.

- Planting of shrubs and trees is not permitted on KM pipeline easement.

- Irrigation equipment i.e. backflow prevent devices, meters, valves, valve boxes, etc. shall not be located on KM easement.

- Foreign line, gas, water, electric and sewer lines, etc., may cross perpendicular to KM's pipeline within the ROW, provided that a minimum of two (2) feet of vertical clearance is maintained between KM pipeline(s) and the foreign pipeline. Constant line elevations must be maintained across KM's entire ROW width, gravity drain lines are the only exception. Foreign line crossings below the KM pipeline must be evaluated by KM to ensure that a significant length of the KM line is not exposed and unsupported during construction. When installing underground utilities, the last line should be placed beneath all existing lines unless it is impractical or unreasonable to do so. Foreign line crossings above the KM pipeline with less than 2 feet of clearance must be evaluated by KM to ensure that additional support is not necessary to prevent settling on top of the KM natural gas pipeline.

- A foreign pipeline shall cross KM facilities at as near a ninety-degree angle as possible. A foreign pipeline shall not run parallel to KM pipeline within KM easement without written permission of KM.

- The foreign utility should be advised that KM maintains cathodic protection on their pipelines. The foreign utility must coordinate their cathodic protection system with KM's. At the request of KM, foreign utilities shall install (or allow to be installed) cathodic protection test leads at all crossings for the purposes of monitoring cathodic protection. The KM Cathodic Protection (CP) technician and the foreign utility CP technician shall perform post construction CP interference testing. Interference issues shall be resolved by mutual agreement between foreign utility and KM. All costs associated with the correction of cathodic protection problems on KM pipeline as a result of the foreign utility crossing shall be borne by the foreign utility for a period of one year from date the foreign utility is put in service.

- The metallic foreign line shall be coated with a suitable pipe coating for a distance of at least 10 feet on either side of the crossing unless otherwise requested by the KM CP Technician.

- AC Electrical lines must be installed in conduit and properly insulated.

- DOT approved pipeline markers shall be installed so as to indicate the route of the foreign pipeline across the KM ROW.

- No power poles, light standards, etc. shall be installed on KM easement.

Construction

- Contractors shall be advised of KM's requirements and be contractually obligated to comply.

- The continued integrity of KM's pipelines and the safety of all individuals in the area of proposed work near KM's facilities are of the utmost importance. Therefore, contractor must meet with KM representatives prior to construction to provide and receive notification listings for appropriate area operations and emergency personnel. **KM's on-site representative will require discontinuation of any work that, in his opinion, endangers the operations or safety of personnel, pipelines or facilities.**

- The Contractor must expose all KM transmission and distribution lines prior to crossing to determine the exact alignment and depth of the lines. A KM representative must be present. In the event of parallel lines, only one pipeline can be exposed at a time.

- KM will not allow pipelines to remain exposed overnight without consent of KM designated representative. Contractor may be required to backfill pipelines at the end of each day.

- A KM representative shall do all line locating. A KM representative shall be present for hydraulic excavation. The use of probing rods for pipeline locating shall be performed by KM representatives only, to prevent unnecessary damage to the pipeline coating.

- Notification shall be given to KM at least 72 hours before start of construction. A schedule of activities for the duration of the project must be made available at that time to facilitate the scheduling of Kinder Morgan, Inc.'s work site representative. Any Contractor schedule changes shall be provided to Kinder Morgan, Inc. immediately.

- Heavy equipment will not be allowed to operate directly over KM pipelines or in KM ROW unless written approval is obtained from (Company). Heavy equipment shall only be allowed to cross KM pipelines at locations designated by Kinder Morgan, Inc. Contractor shall comply with all precautionary measures required by KM to protect its pipelines. When inclement weather exists, provisions must be made to compensate for soil displacement due to subsidence of tires.

- Excavating or grading which might result in erosion or which could render the KM ROW inaccessible shall not be permitted unless the contractor/developer/owner agrees to restore the area to its original condition and provide protection to KM's facility.

- A KM representative shall be on-site to monitor any construction activities within twenty-five (25) feet of a KM pipeline or aboveground appurtenance. The contractor **shall not** work within this distance without a KM representative being on site. Only hand excavation shall be permitted within a minimum of 18 inches (refer to state specific rules/regulations regarding any additional clearance requirements) of KM pipelines, valves and fittings. However, proceed with extreme caution when within three (3) feet of the pipe.

- Ripping is only allowed when the position of the pipe is known and not within ten (10) feet of KM facility unless company representative is present. .

- Temporary support of any exposed KM pipeline by Contractor may be necessary if required by KM's on-site representative. Backfill below the exposed lines and 12" above the lines shall be replaced with sand or other selected material as approved by KM's on-site representative and thoroughly compacted in 12" lifts to 95% of standard proctor dry density minimum or as approved by KM's on-site representative. This is to adequately protect against stresses that may be caused by the settling of the pipeline.

- No blasting shall be allowed within 1000 feet of KM's facilities unless blasting notification is given to KM including complete Blasting Plan Data. A pre-blast meeting shall be conducted by the organization responsible for blasting.

KM shall be indemnified and held harmless from any loss, cost of liability for personal injuries received, death caused or property damage suffered or sustained by any person resulting from any blasting operations undertaken within 500 feet of its facilities. The organization responsible for blasting shall be liable for any and all damages caused to KM's facilities as a result of their activities whether or not KM representatives are present. KM shall have a signed and executed Blasting Indemnification Agreement before authorized permission to blast can be given.

No blasting shall be allowed within 300 feet of KM's facilities unless blasting notification is given to KM a minimum of one week before blasting. *(note: covered above)*KM shall review and analyze the blasting methods. A written blasting plan shall be provided by the organization responsible for blasting and agreed to in writing by KM in addition to meeting requirements for 500' and 1000' being met above. A written emergency plan shall be provided by the organization responsible for blasting. *(note: covered above)*

- **Any** contact with any KM facility, pipeline, valve set, etc. shall be reported immediately to KM. If repairs to the pipe are necessary, they will be made and inspected before the section is re-coated and the line is back-filled.

- KM personnel shall install all test leads on KM facilities.

- Burning of trash, brush, etc. is not permitted within the KM ROW.

Insurance Requirements

- All contractors, and their subcontractors, working on Company easements shall maintain the following types of insurance policies and minimum limits of coverage. All insurance certificates carried by Contractor and Grantee shall include the following statement: "Kinder Morgan and its affiliated or subsidiary companies are named as additional insured on all above policies (except Worker's Compensation) and waiver of subrogation in favor of Kinder Morgan and its affiliated or subsidiary companies, their respective directors, officers, agents and employees applies as required by written contract." **Contractor shall furnish Certificates of Insurance evidencing insurance coverage prior to commencement of work and shall provide thirty (30) days notice prior to the termination or cancellation of any policy.**

1. Statutory Coverage Workers' Compensation Insurance in accordance with the laws of the states where the work is to be performed. If Contractor performs work on the adjacent on navigable waterways Contractor shall furnish a certificate of insurance showing compliance with the provisions of the Federal Longshoreman's and Harbor Workers' Compensation Law.
2. Employer's Liability Insurance, with limits of not less than **$1,000,000** per occurrence and **$1,000,000** disease each employee.
3. Commercial General Liability Insurance with a combined single limit of not less than **$2,000,000** per occurrence and in the aggregate. All policies shall include coverage for blanket contractual liability assumed.
4. Comprehensive Automobile Liability Insurance with a combined single limit of not less than **$1,000,000.** If necessary, the policy shall be endorsed to provide contractual liability coverage.
5. If necessary Comprehensive Aircraft Liability Insurance with combined bodily injury, including passengers, and property damage liability single limits of not less than **$5,000,000** each occurrence.
6. Contractor's Pollution Liability Insurance this coverage shall be maintained in force for the full period of this agreement with available limits of not less then **$2,000,000** per occurrence.
7. Pollution Legal Liability Insurance this coverage must be maintained in a minimum amount of **$5,000,000** per occurrence.

SECTION 01 4100

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project are the following:

B. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice; current edition.

C. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

D. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

E. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.

F. State of Iowa amendments tosome or all of the following.

G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

H. ICC (IFC) - International Fire Code; 2012.

I. ICC (IBC) - International Building Code; 2015.

J. ICC (IPC) - International Plumbing Code; 2012.

K. ICC (IMC) - International Mechanical Code; 2012.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. ICC (IECC) - International Energy Conservation Code; 2012.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.
   5. Traffic regulation.

C. Temporary Controls:
   1. Water control.
   2. Dust control.
   3. Noise control.
   4. Pest control.
   5. Pollution control.
   6. Rodent control.

D. Temporary telecommunications services.

E. Temporary sanitary facilities.

F. Temporary Controls: Barriers, enclosures, and fencing.

G. Vehicular access and parking.

H. Waste removal facilities and services.

I. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 5100 - Temporary Utilities.

1.03 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Existing facilities may not be used.

C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Existing facilities may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

D. At end of construction, return facilities to same or better condition as originally found.

1.06 BARRIERS

A. 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.
   1. Provide 4'-0" high minumum vinyl construction fencing unless otherwise noted on drawings.

B. Provide barricades or fencing around any excavated holes or trenches as per OSHA requirements until they are backfilled..

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Iowa Department of Transportation.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.08 WASTE REMOVAL

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

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.

1.09 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 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.10 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. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. 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 5100
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls:
   1. Temporary telecommunications services for administrative purposes.
   2. Temporary sanitary facilities required by law.

1.03 TEMPORARY ELECTRICITY

A. Cost: By Contractor.

B. Provide temporary electric feeder from existing building electrical service at location as directed.

C. Power Service Characteristics: 120 volt, 200 ampere, three phase, 3 wire.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

E. Provide main service disconnect and over-current protection at convenient location and meter.

F. Permanent convenience receptacles may not be utilized during construction.

G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft .

B. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may not be utilized during construction.

1.05 TEMPORARY HEATING

A. Cost of Energy: By Contractor.

B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F unless indicated otherwise in specifications.

D. Permanent facilities utilities and equipment shall not be used.

1.06 TEMPORARY COOLING

A. Cost of Energy: By Contractor.

B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

C. Maintain maximum ambient temperature of 80 degrees F unless indicated otherwise in specifications.

D. Permanent facilities utilities and equipment shall not be used.

1.07 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Contractor.

B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

C. Extend branch piping with outlets located so water is available by hoses with threaded connections.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field offices for use of Contractor.

B. Maintenance and removal.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: use of premises and responsibility for providing field offices.

B. Section 01 5000 - Temporary Facilities and Controls:
   1. Temporary telecommunications services for administrative purposes.
   2. Temporary sanitary facilities required by law.

C. Section 01 5000: Parking and access to field offices.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.

B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.

C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.

D. Exterior Materials: Weather resistant, finished in one color.

E. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.

F. Lighting for Offices: 50 fc at desk top height, exterior lighting at entrance doors.

G. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONTRACTOR OFFICE AND FACILITIES

A. Size: For Contractor's needs and to provide space for project meetings.

B. Telephone: Landline or cellular device required.

C. Internet: Internet access required.

D. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.

E. Other Furnishings: Contractor's option.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

B. Employee Residential Occupancy: Not allowed on Iowa Department of Transportation's property.

3.03 MAINTENANCE AND CLEANING

A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 01 5713

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 Iowa Department of Transportation for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Temporary and permanent grade changes for erosion control.

B. Section 32 1123 - Aggregate & Aggregate Base Course: Temporary and permanent roadways.

C. Section 03 3000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

1.03 REFERENCE STANDARDS

A. Iowa Department of Transportation: Standard Specifications for Highway and Bridge Construction - Series 2001

B. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.

C. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).

D. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2011.

E. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.

F. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.

G. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
   1. Include:
      a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
      b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
      c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
      d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
      e. Other information required by law.
      f. Format required by law is acceptable, provided any additional information specified is also included.
   2. Obtain the approval of the Plan by authorities having jurisdiction.
   3. Obtain the approval of the Plan by Iowa Department of Transportation.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:
   1. Wood waste, chips, or bark.
   2. 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. 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, 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 lb-f, minimum, in cross-machine direction; 124 lb-f, 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 lb-f, minimum, when tested in accordance with ASTM D4533.
   7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

D. Silt Fence Posts: One of the following, minimum 5 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
   2. Softwood, 4 by 4 inches in cross section.
   3. Hardwood, 2 by 2 inches in cross section.

E. Gravel: See Section 32 1123 for aggregate.

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, minimum.
   2. Length: 50 feet, minimum.
   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.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 100 feet..
      b. Slope Between 2 and 5 Percent: 75 feet.
      c. Slope Between 5 and 10 Percent: 50 feet.
      d. Slope Between 10 and 20 Percent: 25 feet.

e. Slope Over 20 Percent: 15 feet.

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 thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches 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.
   2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
   3. Place and compact at least 6 inches of 1.5 to 3.5 inch 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 high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
   3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
   4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches 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, with extra post.
   7. Fasten fabric to wood posts using one of the following:
      a. Four nails per post with 3/4 inch diameter flat or button head, 1 inch long, and 14 gage, 0.083 inch shank diameter.
      b. Five staples per post with at least 17 gage, 0.0453 inch wire, 3/4 inch crown width and 1/2 inch 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 high with post spacing not more than 4 feet.

C. 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.

4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch 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 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. 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 Architect.

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 5721
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   3. Establish condition of existing ducts and equipment prior to start of alterations.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

C. Ventilation: HVAC system has been designed to achieve the minimum requirements for ventilation specified in ASHRAE 62.1.

1.03 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Testing and inspection services.

B. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC: Testing HVAC systems for proper air flow rates, adjustment of dampers and registers, and settings for equipment.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 62.1 - Laboratory Method of Testing to Determine the Sound Power in a Duct; 2013.

B. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.05 DEFINITIONS

A. Absorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Identify potential sources of odor and dust.
   2. Identify construction activities likely to produce odor or dust.
   3. Identify areas of project potentially affected, especially occupied areas.
   4. Evaluate potential problems by severity and describe methods of control.
   5. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
   6. Describe cleaning and dust control procedures.
   7. Describe coordination with commissioning procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

1.07 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

E. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
   1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
   2. Exhaust directly to outside.
   3. Seal HVAC air inlets and outlets immediately after duct installation.

F. Do not store construction materials or waste in mechanical or electrical rooms.

G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Procedures for Iowa Department of Transportation-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Document 00 2113 - Instructions to Bidders: Product options and substitution procedures prior to bid date.

B. Section 01 1000 - Summary: Lists of products to be removed from existing building.

C. Section 01 4000 - Quality Requirements: Product quality monitoring.

D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

E. Section 22 0513 - Common Motor Requirements for Plumbing Equipment: Motors for plumbing equipment.

F. Section 23 0513 - Common Motor Requirements for HVAC Equipment: Motors for HVAC equipment.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.

B. NEMA MG 1 - Motors and Generators; 2014.

C. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.; 2000.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. DO NOT USE products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.
   4. Are made of vegetable materials that are rapidly renewable.

D. Adhesives and Joint Sealants:
   1. Definition: This provision applies to gunnable, trowelable, and liquid-applied adhesives, sealants, and sealant primers used anywhere on the interior of the building inside the weather barrier, including duct sealers.
   2. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
      a. Require each installer to certify compliance and submit product data showing product content.
   3. Specific Product Categories: Comply with limitations specified elsewhere.

E. Aerosol Adhesives:
   1. Provide only products having lower volatile organic compound (VOC) content than required by GreenSeal GS-36.
   2. Specific Product Categories: Comply with limitations specified elsewhere.

F. Provide interchangeable components of the same manufacture for components being replaced.

G. Motors: Refer to Section 22 0513 - Common Motor Requirements for Plumbing Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

H. Motors: Refer to Section 23 0513 - Common Motor Requirements for HVAC Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

I. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

J. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. 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.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period and the documents required. Comply with requirements specified in Section 00 2113.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure (after contract award):
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 1000 - Summary for identification of Iowa Department of Transportation-supplied products.

B. Iowa Department of Transportation's Responsibilities:
   1. Arrange for and deliver Iowa Department of Transportation reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Iowa Department of Transportation reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Iowa Department of Transportation.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 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.

3.04 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. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

L. Prevent contact with material that may cause corrosion, discoloration, or staining.

M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

N. 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 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Iowa Department of Transportation personnel.

H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

G. Section 01 5713 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.

H. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

I. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

J. Section 02 4100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

K. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.

3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Iowa Department of Transportation or separate Contractor.
6. Include in request:
   a. Identification of Project.
   b. Location and description of affected work.
   c. Necessity for cutting or alteration.
   d. Description of proposed work and products to be used.
   e. Effect on work of Iowa Department of Transportation or separate Contractor.
   f. Written permission of affected separate Contractor.
   g. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Des Moines, Iowa.

1.06 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. 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 Iowa Department of Transportation.

E. 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.

F. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

G. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

H. 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.

1.07 COORDINATION

A. 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.

B. Notify affected utility companies and comply with their requirements.

C. 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.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and

conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Iowa Department of Transportation occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Iowa Department of Transportation's activities.

PART 2 PRODUCTS - NOT USED

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 Architect 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 Architect, Iowa Department of Transportation, 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 Architect of any discrepancies discovered.

C. Iowa Department of Transportation will locate and protect survey control and reference points.

D. Control datum for survey is that established by Iowa Department of Transportation provided survey.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect 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 Architect.

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.

L. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. 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.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. 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.

C. 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.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. 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. Match color, texture, and appearance.
   3. 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.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing 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.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. 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.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. 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.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Iowa Department of Transportation's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Iowa Department of Transportation's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

3.12 FINAL CLEANING

A. Contractor will provide comprehensive cleaning after final acceptance.

B. Use cleaning materials that are nonhazardous.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

E. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Iowa Department of Transportation.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect'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 in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Iowa Department of Transportation-occupied areas.

G. Accompany Project Coordinator on Contractor's preliminary final inspection.

H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

J. Provide Commissioning Documents for HVAC system with Engineers seal and signature

3.14 MAINTENANCE

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

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than 1 year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Furnish service and maintenance of components indicated in specification sections during the warranty period.

D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Iowa Department of Transportation.

G. 11 Month Inspection of Buildings and Property shall be done by Contractor and IDOT Representative. Any items that are covered by the one year warranty that are damaged or need replacement will need to be documented and provided to Contractor to be corrected as part of the builders warranty at no cost to IDOT.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood: May be used as blocking or furring.
   5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
   6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   7. Gypsum drywall and plaster.
   8. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
   9. Paint.
   10. Fluorescent lamps (light bulbs).

E. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

F. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.
   5. Incineration, either on- or off-site.

G. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Waste Management Plan: Include the following information:
   1. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   2. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   3. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 6000 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

B. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.

C. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

D. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

E. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

F. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

G. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Iowa Department of Transportation, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Iowa Department of Transportation'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.

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 Iowa Department of Transportation.

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 depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

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. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. 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.

C. 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.

D. Additional information as specified in individual product specification sections.

E. 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.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

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. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. 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.

F. 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.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

Q. Provide Commissioning Documents per 2012 IECC requirements signed and sealed by Engineer or Commissioning Agent.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Iowa Department of Transportation'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 tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

1. The operation and maintenance Data documents can be submitted in a CD or Flash Drive but must be separated on the electronic drive as follows:
   a. Data in PDF Format and named by Specification Number of Product or equipment.
   b. Data included in Folders by Specification Division Number

F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

H. 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.

I. 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.

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.

N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Iowa Department of Transportation's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. 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.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

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

Geotechnical Engineering Report

Proposed Muscatine Maintenance Facility

Highway 61

Muscatine, Iowa

March 28, 2016

Terracon Project No. 07165036

Prepared for:

Iowa Department of Transportation
Ames, Iowa

Prepared by:

Terracon Consultants, Inc.
Bettendorf, Iowa

Terracon

March 28, 2016

Iowa Department of Transportation
Office of Support Services
800 Lincoln Way
Ames, Iowa 50010

Attention: Mr. Jerry Burnes

Re: Geotechnical Engineering Report
Proposed Muscatine Maintenance Facility
Muscatine, Iowa
Terracon Project No. 07165036

Dear Mr. Burnes:

Terracon Consultants, Inc. has completed the subsurface exploration for the proposed Maintenance Facility to be located in Muscatine, Iowa. These services were performed in general accordance with our Master Services Agreement Task Order with the Iowa Department of Transportation (IDOT), and our proposal (Terracon Proposal No. P07150295) dated September 29, 2015. This report presents the findings of the subsurface exploration, and provides geotechnical recommendations regarding earthwork including site preparation, the design and construction of shallow foundations, floor slab subgrade preparation, and subsurface information for the proposed geothermal wells.

We appreciate the opportunity to be of service to you on this project and look forward to providing the recommended testing and observation services during construction. If you have any questions concerning this report, or if we can be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

W. Ken Beck, P.E.
Iowa No. 10684

for: Greg J. Klein, P.E.
Iowa No. 20705

WKB/GJK/N:\Projects\2016\07165036\Project Documents\07165036 Report.docx

Attachments

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APPENDIX A – FIELD EXPLORATION

Exhibit A-1	Field Exploration Description
Exhibit A-2	Boring Location Plan
Exhibits A-3 to A-12	Boring Logs

APPENDIX B – LABORATORY TESTING

Exhibit B-1	Laboratory Testing
Exhibits B-2 to B-7	USCS Grain Size Distribution

APPENDIX C – SUPPORTING DOCUMENTS

Exhibit C-1	General Notes
Exhibit C-2	Unified Soil Classification System

EXECUTIVE SUMMARY

Information, professional opinions, and geotechnical engineering recommendations presented in this report are summarized below:

- Based on the estimated building loads and the subsurface conditions observed at the boring locations, the proposed structures can be supported using shallow foundations; however, loose sand soils were present at some boring locations at the expected foundation bearing depth. Densifying loose sand soils and removing low strength clays within the zone of influence beneath foundations is recommended to improve foundation support of these structures. Please refer to the **Geotechnical Overview** and **Shallow Foundations** sections of this report for recommendations regard the design and construction of shallow foundations.

- With the exception of a 3 to 3½ foot sandy lean clay layer at the surface, poorly graded sand was present at the geothermal borings (GT-1 and GT-2) to depths of about 133 and 138 feet. These borings terminated on apparent bedrock; based on Iowa Department of Natural Resources records, water wells in the immediately surrounding area terminated in rock at similar depths. In our experience, geothermal wells have been successfully installed in similar conditions. For further information, please refer to the logs for Borings GT-1 and GT-2 in Appendix A and the grain size distribution results in Appendix B.

- Clayey sand was present to a depth of about 7 feet at Boring 8 performed in the detention pond area. Based on the USDA classification system and correlations to infiltration rates, the clayey sand soils are expected to have infiltration rates of about 0.04 to 0.5 inches/hour, while the infiltration rate of the underlying sand is expected to be on the order 3.6 inches/hour. Infiltration testing is recommended prior to final design if more specific infiltration rates are needed. If the pond will extend into the sand soils, the use of a clay liner would be required if retaining water in the detention basin is desired. Please refer to the **Geotechnical Overview** and **Estimates of Infiltration Rates** sections of this report for further information.

The professional opinions and recommendations presented in this report are based on an evaluation of the data developed by testing and observation of discrete samples obtained from the borings. Site subsurface conditions have been inferred from available data, but actual subsurface conditions will only be revealed during construction. So that variations in subsurface conditions can be addressed as they are encountered, we recommend that Terracon provide testing and observation services during construction.

This summary is part of the entire report. The report presents information and additional recommendations not included in the **EXECUTIVE SUMMARY**. The **GENERAL COMMENTS** describe the report limitations.

GEOTECHNICAL ENGINEERING REPORT
PROPOSED MUSCATINE MAINTENANCE FACILITY
HIGHWAY 61
MUSCATINE, IOWA

Terracon Project No. 07165038
March 28, 2016

INTRODUCTION

Terracon Consultants, Inc. has completed the subsurface exploration for the proposed Maintenance Facility to be located in Muscatine, Iowa. These services were performed in general accordance with our Master Services Agreement Task Order with the Iowa Department of Transportation (IDOT), and our proposal (Terracon Proposal No. P07150295) dated September 29, 2015. Ten (10) borings extending to depths ranging from about 20½ to 138 feet below existing grades were performed for this exploration, and their approximate locations are shown on the Boring Location Plan (Exhibit A-2) in Appendix A. Logs for the borings (Exhibits A-3 through A-12) are provided in Appendix A. The purposes of this report are to describe the subsurface conditions encountered at the boring locations, present the test data, and provide recommendations for the following:

- the design and construction of shallow foundations
- earthwork including site preparation
- floor slab subgrade preparation
- estimated infiltration rates

PROJECT INFORMATION

Terracon's understanding of the project, based on information provided by IDOT, is summarized in the following tables. Please contact Terracon if any of the following information is not consistent with the current project plans.

Project Description

Item	Description
Site layout	The IDOT is currently planning a new maintenance facility on an approximately 26 acre site on the southwest side of Muscatine, Iowa. It is understood that 6 to 8 acres will be left undeveloped, the buildings will be constructed on about 10 acres, and a 2 to 3-acre storm detention pond is planned in the back part of the site; the remainder of the site (5 to 8 acres) will be covered with crushed limestone for outdoor equipment storage.
Structures	■ maintenance garage with 18 stalls, about 18,250 square feet ■ 10-stall pole building ■ 3,000 ton hoop salt storage building ■ brine making building with brine storage tanks

Item	Description
Building construction	the maintenance building will be precast concrete with insulated panels, a 6-inch thick concrete floor slab is planned, the eave height will be 29 feet wood frame construction with metal siding is expected for the pole and brine buildings steel frame with a fabric roof is expected for the hoop building reinforced concrete foundations are expected for all structures except the pole building
Finished floor elevation	not provided, but expected to be within 2 to 3 feet above existing grade
Maximum loads	the following maximum wall and floor slab loads were provided by the IDOT for the Maintenance Building: walls:……..……3 kips per linear foot (klf) slab:……200 pounds per square (psf) the maximum loads for the remaining structures were not provided, but the following values were used in our analysis: columns:……..50 kips walls:……..……2 klf slab:……200 psf hoop building slab……1,000 psf
Grading	grade will reportedly be raised about 2 to 3 feet in the maintenance building area
Below grade areas	none planned

Site Location and Description

Item	Description
Location	26 acre site along Highway 61, north of 33rd Street South, Muscatine, Iowa,
Existing improvements	none
Current ground cover	grass/weeds
Existing topography	based on a topographic map of the site provided by IDOT, the site slopes downward from the south to the north with about 10 feet of elevation difference across the site

SUBSURFACE CONDITIONS

Typical Profile

Subsurface conditions at each boring location are described on the individual boring logs (Exhibits A-3 through A-12) in Appendix A. The stratification boundaries shown on the boring logs represent the approximate depths where changes in soil types occur. In-situ, the transition between soils is usually gradual. Based on the conditions observed at the boring locations, the stratigraphy can generally be described as follows. Please refer to the boring logs in Appendix A for further information.

Strata	Approximate Depth to Bottom of Stratum	Material Description	Comments
surface	4 to 8 inches	topsoil	all borings
1[1]	not determined	poorly graded sand with varying amounts of gravel, clayey sand (SP, SC)	loose to dense

1. extended to the bottom of the borings at depths ranging from about 20½ to 138 feet; refusal was encountered at the bottom of Borings GT-1 and GT-2 on apparent bedrock

Water Level Observations

The borings were observed during and after the completion of drilling for the presence and level of water. The subsurface water levels observed are indicated on the boring logs (Exhibits A-3 through A-12) in Appendix A and are summarized in the following table. Subsurface water was not observed at most of the boring locations; however, the absence of water at a boring location does not necessarily mean the boring terminated above the groundwater table. Longer term observations in cased holes or piezometers would be necessary to better evaluate subsurface water levels at the site.

Boring Number	Observed Water Depth (feet) [1]	
	While Drilling	After Drilling
1, 2, 3, 4, 5, 6, 7	none observed	none observed
8	18	18
GT-1	24½	NA[2]
GT-2	24	NA[2]

1. below existing grade
2. a wash boring method was used to advance the borings GT-1 and GT-2 below depths of about 39 and 49 feet, respectively; this method introduces water into the borehole during drilling, which can affect the reliability of the after drilling water level reading, and for this reason, was not recorded

Water levels may fluctuate due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. Subsurface water levels during construction or at other times in the future may be different from the levels indicated on the boring logs. Trapped or "perched" water could occur above lower permeability soil layers. Water level fluctuations and perched water should be considered when developing design and construction plans and specifications for the project.

RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

GEOTECHNICAL OVERVIEW

Based on the proposed building loads and the subsurface conditions observed at the boring locations, the proposed structures can be supported using shallow foundations; however, loose

sand was present at Borings 1 and 5, and low strength native clays were present at Boring 2 at the expected foundation bearing depth. These soils could also be present at other areas not explored. In our opinion, footings should not be supported on loose sand soils. Terracon recommends that any loose sand soils be densified to a depth of at least ½ the footing width below the foundation bearing elevation. If the soils cannot be adequately densified in place to the degree of compaction recommended, then the sand should be removed and placed as engineered fill compacted as recommended in this report. Footings should also extend through medium stiff clays and bear on the underlying medium dense sands. Please refer to the **Shallow Foundations** and Earthwork sections of this report for further recommendations.

With the exception of a 3 to 3½ foot sandy lean clay layer at the surface, poorly graded sand was present at the geothermal boring locations (GT-1 and GT-2) to depths of about 133 and 138 feet; the borings terminated on apparent bedrock. For further information, please refer to the logs (Exhibits A-11 and A-12) for Borings GT-1 and GT-2 in Appendix A, and the grain size distribution results in Appendix B.

Clayey sands were present to a depth of about 7 feet at Boring 8 performed in the detention pond area. Based on the USDA classifications and correlations to infiltration rates, the clayey sand soils are expected to have infiltration rates of about 0.4 to 0.5 inches/hour, while the infiltration rate of the underlying sand is expected to be on the order 3.6 inches/hour. Infiltration testing is recommended prior to final design if more specific infiltration rates are needed. If the pond will extend into the sand soils, the use of a clay liner would be required if retaining water in the detention basin is desired. Please refer to the **Estimates of Infiltration Rates** section of this report for further information.

EARTHWORK

The following presents recommendations for site preparation, excavation, and placement of engineered fill for the project.

Site Preparation

Surface materials and/or otherwise unsuitable materials should be removed from the proposed building areas. Based on the information at the boring locations, excavation depths on the order of about 4 to 8 inches should be expected to remove the surface materials; however, surface materials could extend to greater depths in areas not explored. These materials should not be used for engineered fill beneath the buildings.

After removing the surface materials, and any unsuitable materials as recommended in this report, but before placing engineered fill, the exposed soils should be observed and tested by Terracon. Relatively clean sand present at subgrade elevation should be densified using a large, steel-drum, vibratory roller. Where clay and clayey sand soils are present, they should be scarified and compacted as recommended in this report. Scarification/compaction, and/or densification of subgrade soils will help provide a firmer base for the compaction of new fill sections and help delineate loose or disturbed materials that may exist at shallow depths below grade. If unsuitable

materials are observed that cannot be satisfactorily compacted in place, they should be removed and replaced with engineered fill as discussed in the **Earthwork Construction Considerations** section of this report. Care must be taken to avoid disturbance of soils supporting existing structures and improvements.

Engineered Fill Materials Requirements

Engineered fill for the project should meet the following material property requirements:

Fill Type [1, 2]	USCS Classification	Acceptable Location for Placement
Cohesive	CL, CL/ML[3], ML[3] (LL ≤ 45 and PI ≤ 20)	all locations
Granular	GW, GP, GM, GC, SW, SP, SM, SC	all locations
Unsuitable	CL/CH[4], CH[4], MH[4], OL, OH[4], PT	non-structural locations

1. Engineered fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to Terracon for evaluation prior to use on this site.
2. Any organic materials, rock fragments larger than 3 inches, and other unsuitable materials should be removed prior to use as engineered fill.
3. Highly susceptible to frost; unstable when wet; should not be used within the frost zone beneath exterior slabs.
4. High plasticity. Not recommended beneath movement sensitive features such as foundations, and floor slabs.

Fill Placement and Compaction Requirements

Item	Description
Fill lift thickness	9 inches or less in loose thickness; thinner lifts will be required when using hand equipment (e.g., jumping jack, vibratory plate compactor, etc.)
Compaction of granular material and cohesive soil [1, 2]	at least 95% of the material's standard Proctor maximum dry density (ASTM D 698) fill placed beneath foundations, and within 12 inches of final grade for floors slab supporting vehicles, salt, etc. should be compacted to at least 98% of the material's maximum standard Proctor dry density, this level of compaction should extend at least 8 inches beyond each foundation edge for every foot of fill placed beneath the footing
Moisture content of granular material [3]	workable moisture levels
Moisture content of cohesive soil	within 2% below to 3% above the material's standard Proctor optimum moisture content at the time of placement and compaction

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. If the granular material is a coarse sand, crushed limestone, or gravel, is of a uniform size, or has a low fines content, compaction comparison to relative density (ASTM D 4253 and D 4254) may be

more appropriate. In this case, granular materials should be compacted to at least 65% of the material's maximum relative density.

3. Specifically, moisture levels should be maintained to achieved compaction without bulking during placement or pumping when proofrolled.

Earthwork Construction Considerations

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during foundation construction, earthwork, and backfilling of excavations.

The water contents of some on-site soils may be outside the recommended range for compaction in accordance with the standard Proctor test method. For this reason, adjustments to the on-site soils' water contents should be expected to obtain the degree of compaction recommended in this report.

Care should be taken to avoid disturbance of prepared subgrades. New engineered fill can become disturbed under construction equipment. Construction traffic should not operate directly on saturated or low strength soils. If the subgrade becomes saturated, desiccated, or disturbed, the affected materials should either be scarified and compacted, densified in place, or be removed and replaced as previously discussed. Subgrades should be observed and tested by Terracon prior to construction. Placing a layer of crushed limestone on the sand should help reduce disturbance of the sand and improve support for rubber-tired vehicles.

The contractor is responsible for employing appropriate dewatering methods to control seepage and facilitate construction. In our experience, a greater dewatering effort should be expected for excavations extending below the subsurface water levels observed at the boring locations. The subsurface water level should be maintained at least 2 feet below the excavation bottom.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes, and in accordance with any applicable local, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced, and if they are not followed, the IDOT, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties. Under no circumstances should the information provided in this report be interpreted to mean that Terracon is responsible for construction site safety or the contractor's activities. Construction site safety is the sole responsibility of the contractor who shall also be solely responsible for the means, methods, and sequencing of the construction operations.

Grading and Drainage

During construction, grades should be developed to direct surface water flow away from or around the site. Exposed subgrades should be sloped to provide positive drainage so saturation of subgrades is avoided. Surface water should not be permitted to accumulate on the site.

Final grades should slope away from the building areas to promote rapid surface drainage and to prevent accumulation of water. Accumulation of water adjacent to the construction areas could contribute to significant moisture increases in the subgrade soils and subsequent softening/settlement. Roof drains should discharge into a storm sewer or at least 10 feet away from the buildings.

SHALLOW FOUNDATIONS

In our opinion, the proposed structures can be supported using conventional footing foundations, provided the foundations bear on medium dense/densified native soils, or newly placed engineered fill that extends to medium dense sand. At some locations, the excavations may need to extend through medium stiff clays to reach medium dense sand. Soils supporting foundations should be prepared as recommended in the following sections of this report.

Shallow Foundation Design Recommendations

Shallow footing foundations supported on densified native soils or engineered fill can be designed using the following:

Description	Value
Maximum net allowable bearing pressure[1]	3,000 psf
Minimum embedment below finished grade for frost protection[2]	3½ feet
Approximate total settlement[3, 4]	1 inch
Approximate differential settlement[3, 4]	1/2 to 2/3 of the total settlement
Minimum footing widths	isolated footings: 30 inches continuous footings: 16 inches

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation; the bearing pressure can be increased by ½ for temporary loading conditions. This pressure is based on the loose sand within the zone of influence being compacted as recommended in this report, or it will be removed and replaced with new engineered fill placed and compacted as recommended in this report. Foundations should step through any medium stiff clays to bear on medium dense sand.
2. For perimeter footings beneath heated areas; it should be noted that the maximum frost penetration can extend to depths on the order of 4½ feet below grade; if it is desired to reduce the potential for frost heave, footings below unheated areas or that will be exposed to freezing conditions during construction should extend to at least this depth.
3. Settlements will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of engineered fill, the density of the sands, footing construction and floor slab loading. Frequent control joints should be provided for walls. Greater settlement is possible for heavily loaded areas such as the brine storage tanks and salt hoop building. We are available to evaluate settlements of heavily loaded areas once the loads are available. Filling of the tanks prior to completing pipe connections should be considered to help reduce long-term differential movement between connecting piping and the tank.

4. Based on removal and replacement of any loose sand or clay soils within the zone of influence being compacted as recommended in this report, or it will be removed and replaced with new engineered fill placed and compacted as recommended in this report.

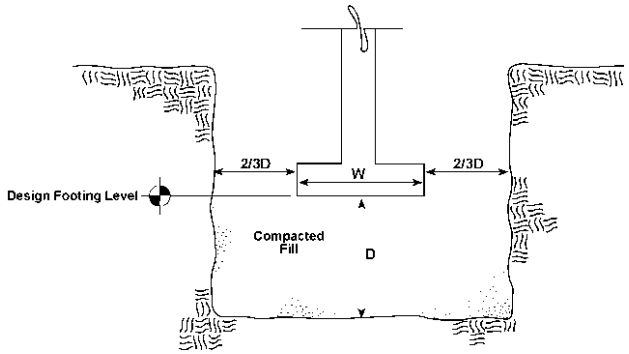
Footing foundations supporting the hoop building, and possibly other structures should be embedded sufficiently to resist uplift and lateral loads. Uplift loads may be resisted by the weight of the footing in addition to the weight of the soil directly above the footing. A total unit weight of 110 pounds per cubic foot (pcf) may be used for engineered fill placed above foundations. Horizontal loads acting on earth-formed foundations or foundations backfilled with engineered fill may be resisted by a combination of passive pressure on the sides of the footing and sliding friction at the base of the footing. An ultimate coefficient of sliding friction of 0.40 may be assigned to the base of the footings founded on approved native sands, or new engineered fill. If uplift loads will accompany horizontal loads, the contribution of sliding friction to the horizontal load capacity should be neglected. Passive resistance for foundations backfilled with granular engineered fill may be calculated using an equivalent fluid unit weight of 360 pounds per cubic foot (pcf). Regardless of depth, the passive pressure should not exceed 3,000 pounds per square foot. Passive pressure should be ignored within 4½ feet of the ground surface due to potential frost disturbance. Appropriate safety factors should be applied to the ultimate friction and equivalent fluid unit weight values provided.

Shallow Foundation Construction Considerations

The soils at the base of each footing excavation should be observed and tested by Terracon. The excavation should be probed or otherwise sampled at each isolated spread footing and at regular intervals along continuous footings.

Loose sand and medium stiff clays were present at Borings 1, 2 and 5, and could be present at other areas of the site within the zone of influence below bearing depth. To help reduce total and differential settlement, Terracon recommends that the loose sand soils be densified to a depth of at least ½ the footing width below the foundation bearing depth. The sands should be densified to at least 98% of Standard Proctor density or 65% of the materials relative density (ASTM D 4253/4254) as appropriate. The soils beneath footings should be tested by Terracon during and after the densification process.

If the sands cannot be improved in-place as recommended, or medium stiff clays are present, they should be removed and replaced with engineered fill to the required depth. For placement of engineered fill beneath the footings, the foundation excavation should extend laterally at least 8 inches beyond the edges of each footing for each foot of overexcavation depth below the foundation base elevation. The overexcavated depth should then be backfilled up to the foundation base elevation with sand or crushed limestone placed in lifts and compacted to at least 98% of the material's standard Proctor maximum dry density or at least 65% of the material's maximum relative density (ASTM D 4253/4254). Each lift of new engineered fill should be observed and tested by Terracon. The overexcavation and backfill procedure is illustrated in the following figure.



Note: Side walls are shown vertical for ease of dimensioning. In the field, side walls should be sloped or braced as required by OSHA.

The base of footing excavations should be free of water and loose soil prior to placement of concrete or reinforcing steel. The native soils encountered at the site and engineered fill comprised of similar materials can be disturbed by construction activity and water seepage. Care should be taken during footing construction to avoid disturbance of the bearing soils. Should bearing soils become disturbed, the affected soil should be removed and replaced with engineered fill. A crushed limestone or lean concrete working mat may be needed to reduce disturbance of the bearing soils in some areas. Only minimal foot traffic should be permitted on the bearing soils.

FLOOR SLAB

Heavily loaded slabs, such as the salt hoop building, may experience larger elastic settlements. Uniform subgrades should help to reduce settlements. Special subgrade preparation may be required to densify loose sand soils, and/or removal of other unsuitable soils present at final grade. Floor slab subgrade soils should be prepared as discussed in the **Earthwork** section of this report.

Floor Slab Subgrade Design Recommendations

Item	Description
Floor slab support[1, 2, 4]	native soils or engineered fill prepared, placed and compacted in accordance with **Earthwork** section of this report
Granular leveling course[3]	6 inches of well-graded granular material
Modulus of subgrade reaction[5]	150 pci

1. floor slab subgrade soils should be prepared using engineered fill as discussed in the **Earthwork** section of this report
2. floor slabs and foundations are expected to settle at different rates; differential movement between foundations and grade-supported floors should be considered by the structural engineer
3. the floor slab should be placed on a leveling course comprised of well-graded granular material compacted to at least 95% of the material's standard Proctor maximum dry density (ASTM D 698); the level of compaction should be increased to 98% for floor slabs subjected to vehicle loads, salt storage, etc.
4. joints should be constructed at regular intervals as recommended by the American Concrete Institute (ACI) to help control the location of cracking
5. for point loads; based on use of the recommended 6-inch thick crushed limestone leveling course

If moisture vapor transmission through the concrete slab is a concern, a vapor retarder should be used. The need for, and placement of, the vapor retarder should be determined by the architect or the slab designer based on the proposed floor covering treatment, building function, concrete properties, placement techniques, and construction schedule. For further guidance concerning the use of a vapor retarder system, refer to Sections 302 and 360 of the American Concrete Institute (ACI) Manual of Concrete Practice.

Floor Slab Subgrade Construction Considerations

The floor slab subgrade should be prepared in accordance with the recommendations presented in the **Earthwork** section of this report.

On most project sites, site grading is generally accomplished early in the construction phase. As construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, corrective action may be required prior to placement of the granular leveling course and concrete.

Terracon should review the condition of the floor slab subgrade immediately prior to slab construction. Particular attention should be given to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by scarification/compaction or by removing the affected material and replacing it with engineered fill.

ESTIMATED INFILTRATION RATES

Using the information obtained from the grain size analyses performed (Exhibits B-2 through B-7) in Appendix B, the soils tested were classified in accordance with the USCS system (Exhibit C-2) as shown on the logs. These classification systems differ slightly based on the particle size range for sand, silt and clay, and how the gravel size and other over-sized particles are incorporated in the sample. Based on the USDA textural classification, the approximate design infiltration rates can be obtained from the Iowa Stormwater Management Manual (ISMM), Section 2E-7 Soils Testing Requirements for Infiltration Practices. The clayey sands likely classify as loamy sand, sandy loam, sandy clay loam or sandy clay, while the poorly graded sand classify as sand. The estimated design infiltration rates provided in the ISMM are as follows:

Soil Textural Classification	Design Infiltration rate (inches/hour)[1, 2]
Coarse sand or coarser	3.6
Loamy coarse sand	3.6
Sand	3.6
Loamy sand	1.63
Sandy loam	0.5
Loam	0.24
Silt loam	0.13
Sandy clay loam	0.11
Clay loam	0.09

Soil Textural Classification	Design Infiltration rate (inches/hour)[1, 2]
Silty clay loam	0.06[2]
Sandy clay	0.05
Silty clay	0.04
Clay	0.02

1. Infiltration rates represent the lowest value for each textural class presented in Table 2 of Rawls[3]
2. Infiltration rate is an average based on Rawls[4], 1982
3. Rawls, W.J., D. Gimenez, and R. Grossman. Use of Soil Texture, Bulk Density, and Slope of Water Retention Curve to Predict Saturated Hydraulic Conductivity. 1998. Transactions of the ASAE. Vol. 41(4):983-988
4. Rawls, W.J., D.L Brakensiek, and K.E. Saxton, K. E. Estimation of Water Properties.1982, Transactions of ASAE. Vol 25 (5):1316-1320 &1328

GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If IDOT is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of IDOT for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that 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 Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

LICENSED PROFESSIONAL ENGINEER WILLIAM K. BECK 10684 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. W. Kim Beck 3/28/16 William K. Beck, P.E. Date My license renewal date is December 31, 2016.

APPENDIX A

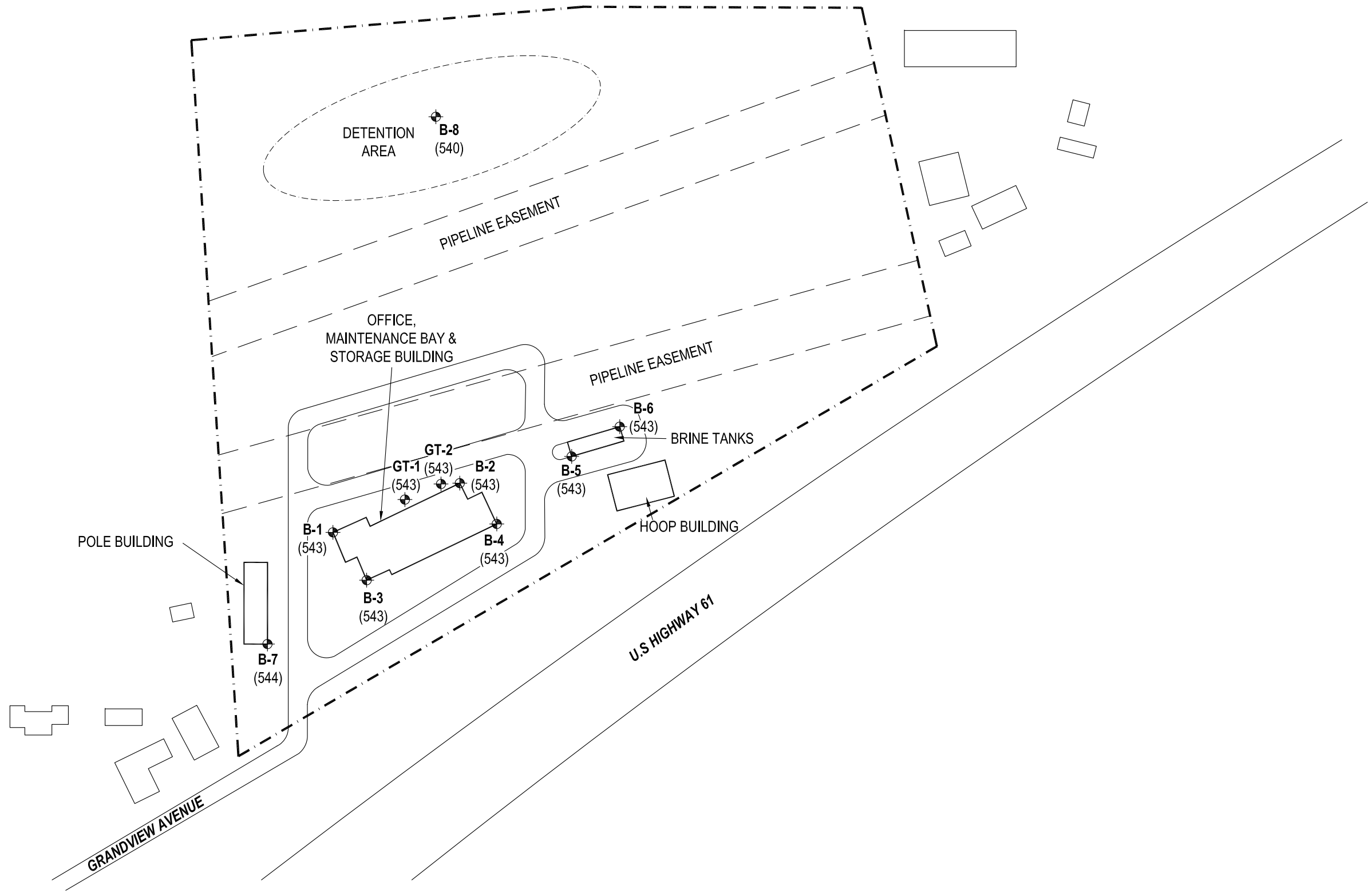
FIELD EXPLORATION

FIELD EXPLORATION DESCRIPTION

The borings were performed at the approximate locations requested by IDOT, and as shown on the attached Boring Location Plan (Exhibit A-2). Terracon's drill crew laid out the borings by measuring horizontal distances with a cloth tape and estimating right angles. Surface elevations at the boring locations (rounded to the nearest half foot) were obtained from superimposing the boring locations on the topographic plan of the site provided by the IDOT. Actual surface elevations could differ due to interpolation, and other differences could occur from superposing approximate boring locations on the topographic plan. The boring locations and elevations should be considered accurate only to the degree implied by the means and methods used for these measurements.

The borings were performed with a track-mounted, rotary drill rig using continuous flight, solid stem augers to advance Borings 1 through 8. Hollow-stem augers were used to advance Borings GT-1 and GT-2 to a depth of about 39 and 49 feet, respectively, below which a wash boring method was used. Soil samples were obtained using a split-barrel sampling procedure, in which a standard 2-inch (outside diameter) split-barrel sampling spoon is driven into the ground with a 140-pound Central Mine Equipment (CME) automatic SPT hammer falling a distance of 30 inches. Greater energy efficiency is typically obtained using an automatic SPT hammer as compared to a safety hammer operated with a cathead and rope. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value and are provided on the boring logs at their depths of occurrence. The blow counts, also referred to as SPT N-values are used to help estimate the relative density of granular soils and consistency of cohesive soils. The borings were backfilled with auger cuttings after the completion of drilling.

The drill crew prepared a field log of each boring to record data, including visual classifications of the materials encountered during drilling and the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent the engineer's interpretation of the subsurface conditions at each boring based on field and laboratory data and observations of the samples.



N

NOT TO SCALE

LEGEND

⌖	APPROXIMATE BORING LOCATION
(X)	APPROXIMATE SURFACE ELEVATION (FEET)

THIS DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr:	WKB
Drawn By:	TLY
Checked By:	WKB/MRF
Approved By:	WKB
Project No.	07165036
Scale:	AS SHOWN
File No.	GEO07165036-2
Date:	MARCH 2016

Terracon
Consulting Engineers and Scientists
870 40th Avenue Bettendorf, Iowa 52722
(563) 355-0702 (563) 355-4789

BORING LOCATION PLAN

PROPOSED IDOT MAINTENANCE GARAGE
HIGHWAY 61
MUSCATINE, IA

EXHIBIT

A-2

BORING LOG NO. B-1

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
0.4	542.5	**5" Topsoil**								
		POORLY GRADED SAND (SP), with gravel, brown, loose, fine to coarse			X	10	3-4-5 N=9	1		9
		with clay at Sample 1								
			5		X	11	4-4-4 N=8	2		3
					X	10	4-4-5 N=9	3		3
		medium dense at Samples 4 and 5	10		X	14	6-7-7 N=14	4		2
			15		X	9	5-6-5 N=11	5		2
		medium dense to dense at Sample 6	20		X	16	6-14-16 N=30	6		3
20.5	522.5	***Boring Terminated at 20.5 Feet***								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None observed while drilling and sampling

None observed 6 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. B-2

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
0.6	542.5						
8" Topsoil							
SANDY LEAN CLAY (CL), red brown, medium stiff			9	2-3-3 N=6	1	2000 (HP)	19
4.5	538.5						
POORLY GRADED SAND (SP), with gravel, brown, medium dense, fine to coarse		5	13	4-7-8 N=15	2		16 5
			7	4-5-5 N=10	3		4
loose at Samples 4 and 5		10	8	4-4-4 N=8	4		2
		15	11	3-5-4 N=9	5		3
20.5	522.5	20	14	5-5-5 N=10	6		3
Boring Terminated at 20.5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None observed while drilling and sampling

None observed 6 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. B-3

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
0.3	542.5	**4" Topsoil**								
		POORLY GRADED SAND (SP), with gravel, brown, medium dense, fine to coarse			X	7	4-5-6 N=11	1		3
			5		X	13	5-5-6 N=11	2		2
		loose at Samples 3, 4 and 5			X	14	3-4-5 N=9	3		2
			10		X	15	4-5-4 N=9	4		4
			15		X	16	5-4-5 N=9	5		3
20.5	522.5		20		X	14	4-5-5 N=10	6		2
		Boring Terminated at 20.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None observed while drilling and sampling

None observed 6 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. B-4

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)
0.3	542.5	**4" Topsoil**					
3.0	540	**CLAYEY SAND (SC)**, red brown, loose		12	2-3-2 N=5	1	14
		POORLY GRADED SAND (SP), with gravel, brown, medium dense, fine to coarse	5	10	5-6-6 N=12	2	4
				9	4-5-5 N=10	3	4
			10	13	5-5-5 N=10	4	3
			15	13	4-5-5 N=10	5	2
		loose at Sample 9	20	10	4-5-4 N=9	6	2
20.5	522.5	***Boring Terminated at 20.5 Feet***					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None observed while drilling and sampling

None observed 7 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. B-5

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)
0.4	542.5	**5" Topsoil**					
		POORLY GRADED SAND (SP), brown, loose, fine to coarse					
		with clay at Samples 1 and 2		11	2-2-2 N=4	1	10
		with gravel, medium dense below 4 feet	5	14	4-6-5 N=11	2	3
				16	4-6-5 N=11	3	3
			10	14	4-6-6 N=12	4	4
			15	12	3-6-6 N=12	5	3
		loose at Sample 6	20	15	3-4-5 N=9	6	4
20.5	522.5	***Boring Terminated at 20.5 Feet***					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None observed while drilling and sampling

None observed 7 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. B-6

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)
0.3	542.5	**4" Topsoil**					
		POORLY GRADED SAND (SP), with gravel, brown, medium dense, fine to coarse					
				7	4-5-5 N=10	1	4
			5	13	4-5-6 N=11	2	8
				15	4-5-6 N=11	3	3
			10	15	3-5-5 N=10	4	3
		loose at Sample 5	15	16	3-3-3 N=6	5	3
20.5	522.5		20	17	3-5-6 N=11	6	3
		Boring Terminated at 20.5 Feet					

GRAPHIC LOG

WATER LEVEL OBSERVATIONS

SAMPLE TYPE

LABORATORY TORVANE/HP (psf)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None observed while drilling and sampling

None observed 7 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. B-7

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 544.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
0.4	543.5	**5" Topsoil**								
		POORLY GRADED SAND (SP), with gravel, brown, medium dense, fine to coarse			X	15	3-4-6 N=10	1		6
			5		X	10	5-6-6 N=12	2		3
		loose at Samples 3 and 4			X	14	3-4-4 N=8	3		3
			10		X	15	3-5-4 N=9	4		3
			15		X	15	3-6-6 N=12	5		3
20.5	523.5		20		X	16	3-5-7 N=12	6		3
		Boring Terminated at 20.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None observed while drilling and sampling

None observed 8 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. B-8

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 540.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
0.5	539.5	**6" Topsoil**							
		CLAYEY SAND (SC), gray, loose							
				X	11	2-3-3 N=6	1		19
		medium dense, some gravel at Sample 2	5	X	10	3-3-7 N=10	2		14
7.0	533			X	12	4-4-5 N=9	3		5
		POORLY GRADED SAND (SP), trace gravel, brown, medium dense, fine to coarse loose at Sample 3	10	X	11	7-6-5 N=11	4		3
			15	X	5	11-13-11 N=24	5		4
		very loose at Sample 6	20	X	3	1-1-2 N=3	6		15
20.5	519.5	***Boring Terminated at 20.5 Feet***							

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Power Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

18' while drilling

18'; 8 hrs. after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/7/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-1

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61 Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	542.5	**6" Topsoil**
		SANDY LEAN CLAY (CL), red brown, medium stiff
3.0	540	**POORLY GRADED SAND (SP)**, with gravel, brown, loose, fine to coarse
		medium dense at Sample 2
		fine to medium, trace gravel at Samples 4, 5 and 6
23.0	520	**POORLY GRADED GRAVEL (GP)**, with sand, brown, medium dense, fine to medium
28.0	515	**POORLY GRADED SAND (SP)**, with gravel, brown, medium dense, fine to coarse
		loose at Sample 8

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
		15	2-3-4 N=7	1		21
5		7	6-9-8 N=17	2		8
		15	4-4-4 N=8	3		10
10		10	3-3-4 N=7	4		6
15		12	3-4-4 N=8	5		6
20		14	4-4-4 N=8	6		4
25		5	4-7-6 N=13	7		16
30		4	4-4-4 N=8	8		11
35		5	5-9-10	9		15

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 39 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24.5' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/8/2016	Boring Completed: 3/8/2016
Drill Rig: 977 - CME 850	Driller: SZ
Project No.: 07165036	Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-1

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
	POORLY GRADED SAND (SP), with gravel, brown, medium dense, fine to coarse *(continued)*						N=19			
			40			1	5-5-5 N=10	10		
			45			12	8-15-14 N=29	11		24
			50			11	8-11-9 N=20	12		24
			55			10	10-13-14 N=27	13		25
			60			11	9-8-10 N=18	14		22
			65			12	9-12-12 N=24	15		26
			70			11	11-12-10 N=22	16		24

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 39 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24.5' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/8/2016 | Boring Completed: 3/8/2016
Drill Rig: 977 - CME 850 | Driller: SZ
Project No.: 07165036 | Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-1

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61 Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
		POORLY GRADED SAND (SP), with gravel, brown, medium dense, fine to coarse *(continued)*							
73.0	470	**POORLY GRADED SAND (SP)**, with gravel, brown, dense, fine to coarse							
			75	X	14	15-22-22 N=44	17		23
			80	X	12	10-20-23 N=43	18		21
		gray below about 85 feet	85						
88.0	455	**POORLY GRADED SAND (GP)**, with gravel, brown, very dense, fine to coarse with clay at Sample 19							
			90	X	14	15-25-31 N=56	19		20
		fine to medium, with clay at Sample 20	95						
			100	X	14	20-25-27 N=52	20		23
			105						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 39 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24.5' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/8/2016 | Boring Completed: 3/8/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-1

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61 Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
	POORLY GRADED SAND (GP), with gravel, brown, very dense, fine to coarse *(continued)*									
			110			12	15-25-29 N=54	21		24
			115							
	fine to medium, dense, with clay at Sample 22		120			12	15-18-23 N=41	22		22
			125							
			130			14	19-31-28 N=59	23		25
	133.0	410								
	Boring Terminated at 133 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 39 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24.5' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/8/2016 | Boring Completed: 3/8/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-2

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.4	542.5	**5" Topsoil**
		SANDY LEAN CLAY (CL), red brown, brown, medium stiff
3.5	539.5	**POORLY GRADED SAND (SP)**, with gravel, brown, medium dense, fine to coarse
		loose, fine to medium at Samples 4 and 6
		trace gravel below about 14 feet
		very loose at Sample 7
35.0	508	

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
		8	2-2-3 N=5	1	1500 (HP)	19
5		14	5-5-7 N=12	2		4
		13	4-5-5 N=10	3		5
10		15	4-4-5 N=9	4		3
15		14	5-5-5 N=10	5		2
20		15	2-2-3 N=5	6		4
25		11	1-1-1 N=2	7		19
30		5	4-4-4 N=8	8		9
35		4	6-8-12	9		17

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 49 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/8/2016
Drill Rig: 977 - CME 850 | Driller: SZ
Project No.: 07165036 | Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-2

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
	POORLY GRADED SAND (SP), trace gravel, brown, medium dense, fine to coarse						N=20			
	loose at Sample 10		40			0	3-3-4 N=7	10		
			45			15	3-6-6 N=12	11		16
			50			6	4-7-9 N=16	12		17
			55			12	8-12-16 N=28	13		20
			60			9	6-11-11 N=22	14		21
			65			13	10-13-13 N=26	15		20
			70			10	14-14-9 N=23	16		20

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 49 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/8/2016
Drill Rig: 977 - CME 850 | Driller: SZ
Project No.: 07165036 | Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-2

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
		POORLY GRADED SAND (SP), trace gravel, brown, medium dense, fine to coarse *(continued)*							
			75	X	12	10-10-17 N=27	17		21
77.0	466								
		POORLY GRADED SAND (SP), trace gravel, brown, dense, fine to coarse							
			80	X	13	10-28-18 N=46	18		16
			85						
		gray, fine to medium below about 86 feet							
			90	X	10	10-18-26 N=44	19		19
			95						
			100	X	13	10-18-20 N=38	20		24
105.0	438		105						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 49 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016	Boring Completed: 3/8/2016
Drill Rig: 977 - CME 850	Driller: SZ
Project No.: 07165036	Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

BORING LOG NO. GT-2

PROJECT: Proposed Muscatine Maintenance Facility

CLIENT: Iowa Department of Transportation

SITE: Highway 61
Muscatine, Iowa

LOCATION See Exhibit A-2

Surface Elev.: 543.0 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY TORVANE/HP (psf)	WATER CONTENT (%)
		POORLY GRADED SAND (SP), brown, very dense, fine to coarse								
			110			13	18-26-28 N=54	21		21
			115							
			120			12	12-20-31 N=51	22		22
			125							
		trace limestone in Sample 23	130			10	12-25-36 N=61	23		23
			135							
138.0	405									
		Practical refusal at 138 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger to 49 feet, then wash bore to boring termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-1 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

24' while drilling

None observed after drilling

Terracon
870 40th Ave
Bettendorf, IA

Boring Started: 3/7/2016 | Boring Completed: 3/8/2016

Drill Rig: 977 - CME 850 | Driller: SZ

Project No.: 07165036 | Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2015.GDT 3/28/16

APPENDIX B

LABORATORY TESTING

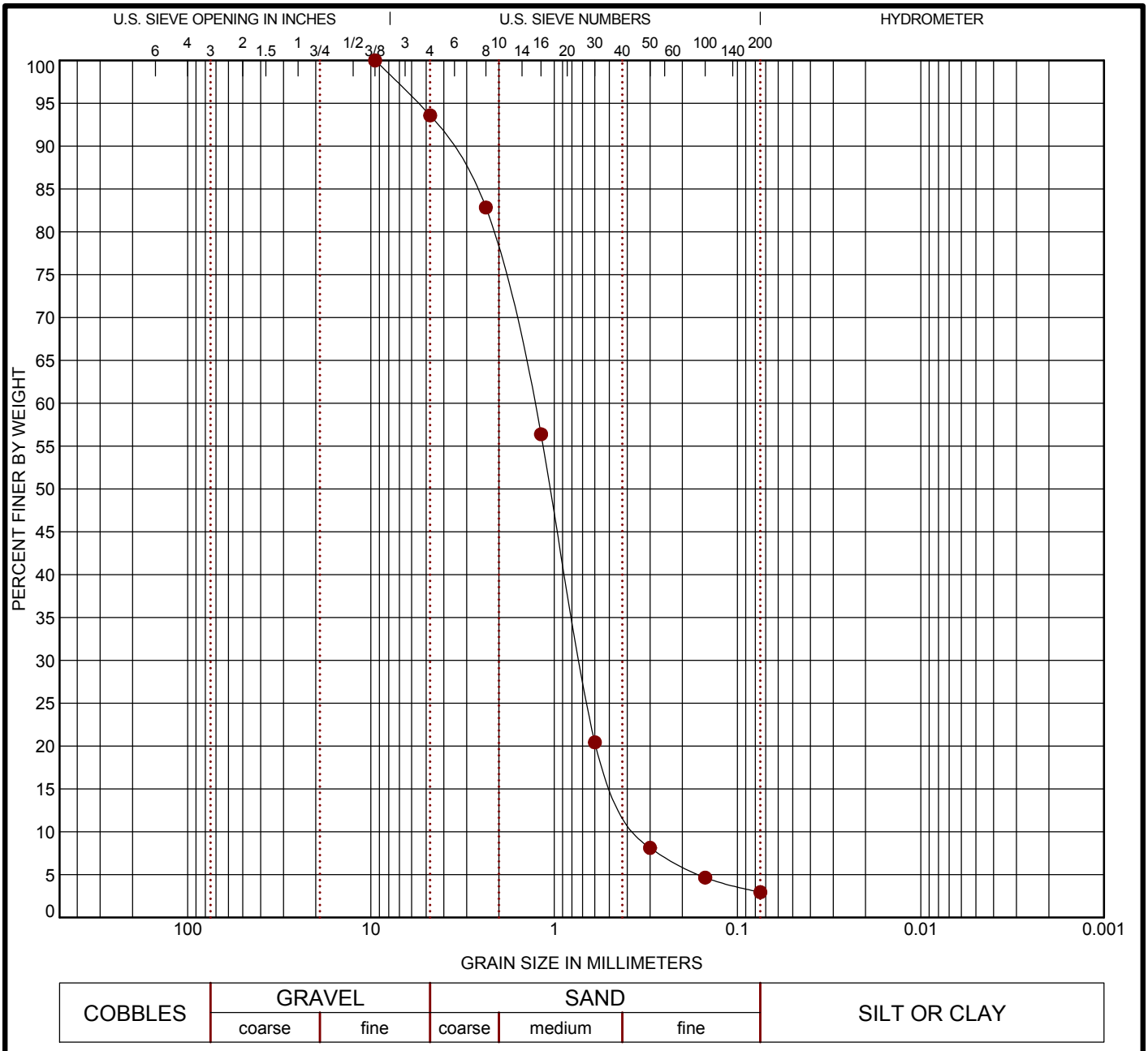
LABORATORY TESTING

The samples obtained from the borings were tested in our laboratory to determine their water contents. A pocket penetrometer was used to help estimate the approximate unconfined compressive strength of some cohesive samples. The pocket penetrometer provides a better estimate of soil consistency than visual examination alone. A grain size analysis, including the percent passing a No. 200 sieve was performed on samples from Borings 8, GT-1, and GT-2. The test results are provided on the boring logs (Exhibits A-3 through A-12) in Appendix A, and on Exhibits B-2 to B-7 in this appendix.

The soil samples were also classified in the laboratory based on visual observation, texture, and plasticity. The soil descriptions and estimated group symbols presented on the boring logs are in general accordance with the Unified Soil Classification System (USCS) and the General Notes in Appendix C (Exhibit C-1). A summary of the USCS is also included in Appendix C (Exhibit C-2). The USDA Textural Classification Triangle (Exhibit C-3) is provided in Appendix C.

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
GT-1	6.5	POORLY GRADED SAND(SP)				1.19	3.89

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
GT-1	6.5	9.5	1.297	0.718	0.333	6.4	90.6	2.9	

PROJECT: Proposed Muscatine Maintenance Facility

SITE: Highway 61
Muscatine, Iowa

Terracon
870 40th Avenue
Bettendorf, Iowa

PROJECT NUMBER: 07165036

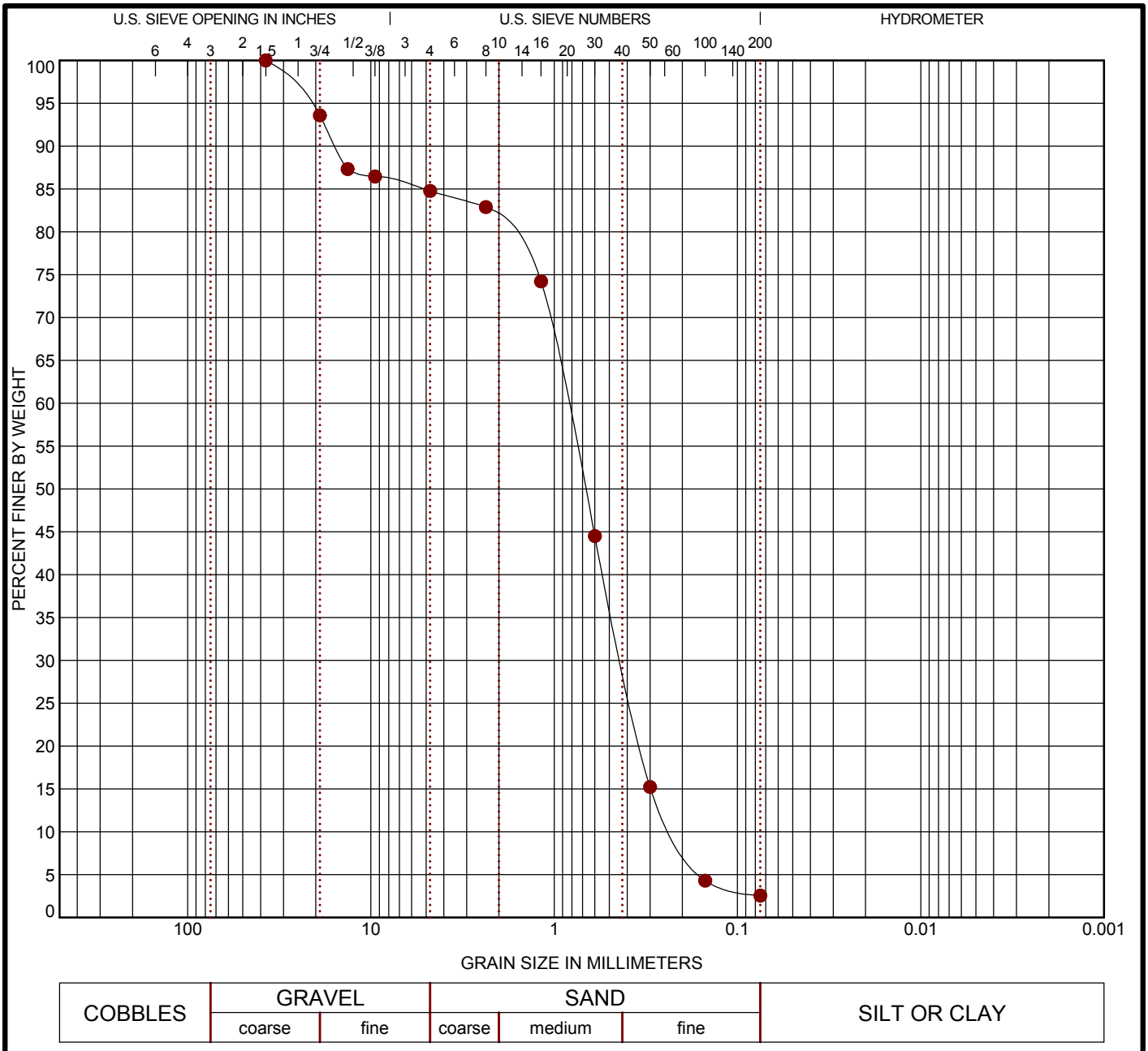
CLIENT: Iowa Department of Transportation

EXHIBIT: B-2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. IDOT GRAIN SIZE: USCS 2 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2012.GDT 3/24/16

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
GT-1	88.5	POORLY GRADED SAND with GRAVEL(SP)				0.99	3.96

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
GT-1	88.5	37.5	0.854	0.426	0.215	15.2	82.2	2.5	

PROJECT: Proposed Muscatine Maintenance Facility

SITE: Highway 61
Muscatine, Iowa

Terracon
870 40th Avenue
Bettendorf, Iowa

PROJECT NUMBER: 07165036

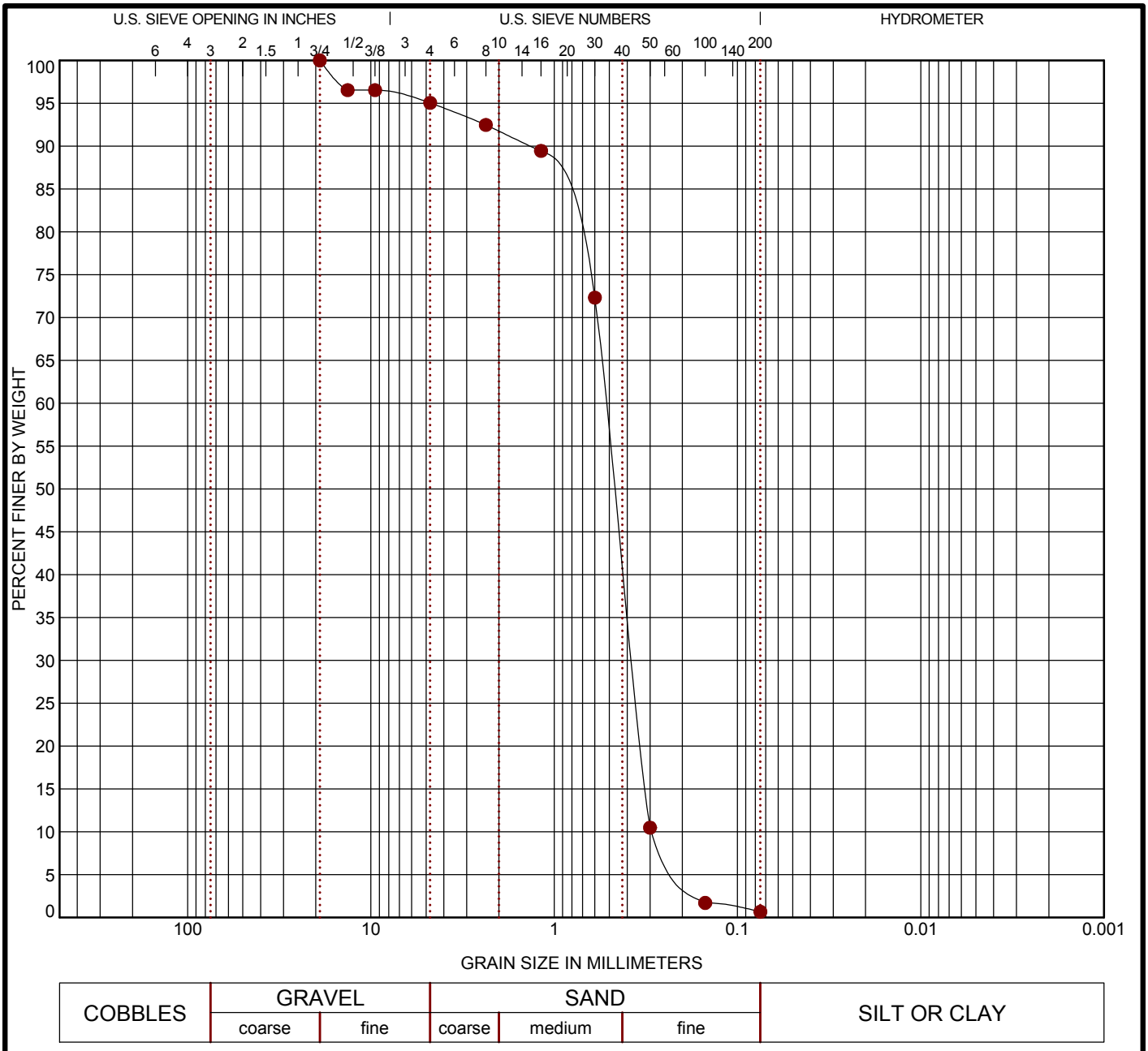
CLIENT: Iowa Department of Transportation

EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. IDOT GRAIN SIZE: USCS 2 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2012.GDT 3/24/16

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
GT-2	49.0	POORLY GRADED SAND(SP)				0.92	1.81

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
GT-2	49.0	19	0.523	0.373	0.289	4.9	94.4	0.7	

PROJECT: Proposed Muscatine Maintenance Facility

SITE: Highway 61
Muscatine, Iowa

Terracon
870 40th Avenue
Bettendorf, Iowa

PROJECT NUMBER: 07165036

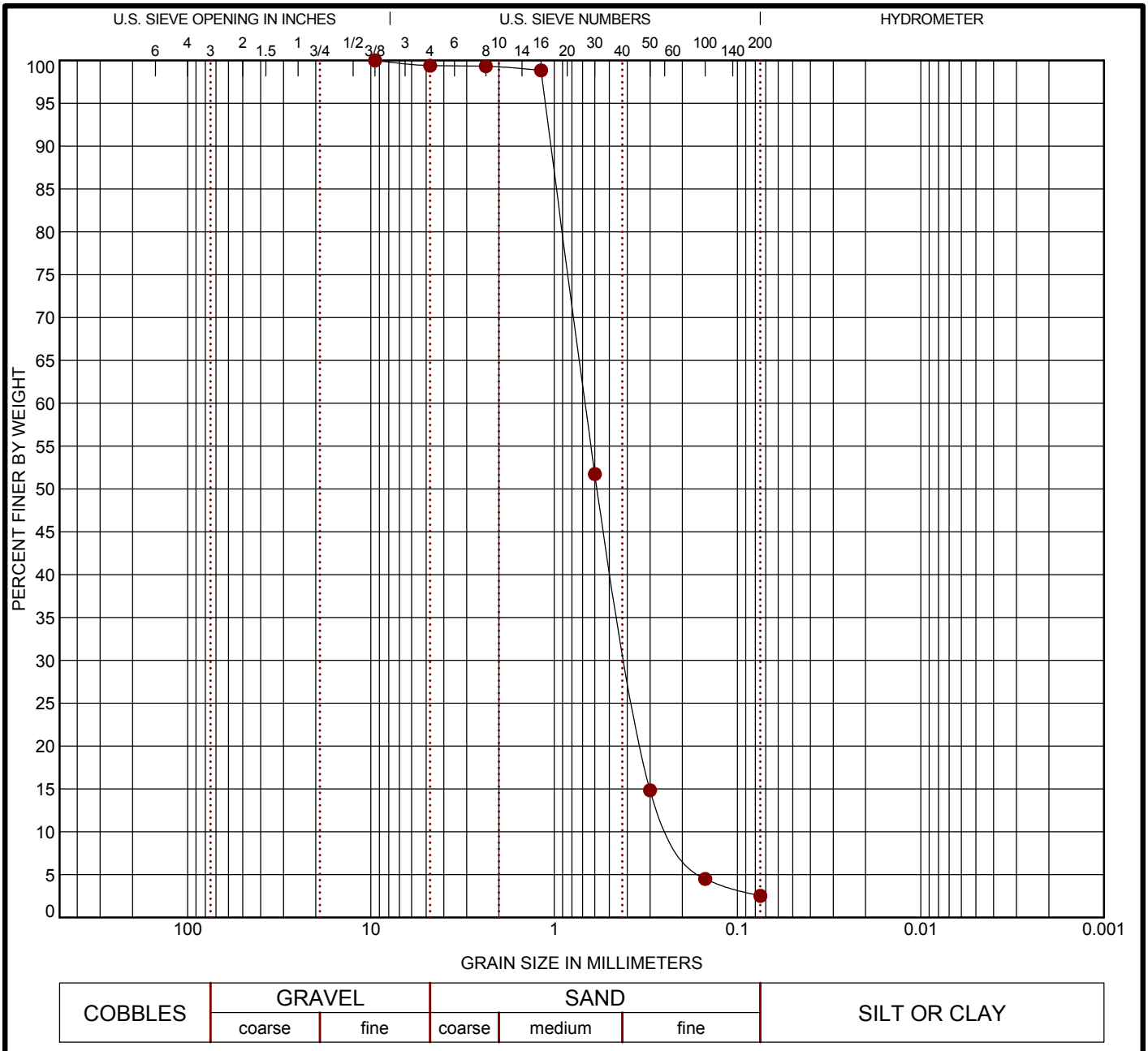
CLIENT: Iowa Department of Transportation

EXHIBIT: B-4

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. IDOT GRAIN SIZE: USCS 2 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2012.GDT 3/24/16

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
GT-2	118.5	POORLY GRADED SAND(SP)				1.09	3.11

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
GT-2	118.5	9.5	0.676	0.399	0.217	0.6	96.9	2.5	

PROJECT: Proposed Muscatine Maintenance Facility

SITE: Highway 61
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Terracon
870 40th Avenue
Bettendorf, Iowa

PROJECT NUMBER: 07165036

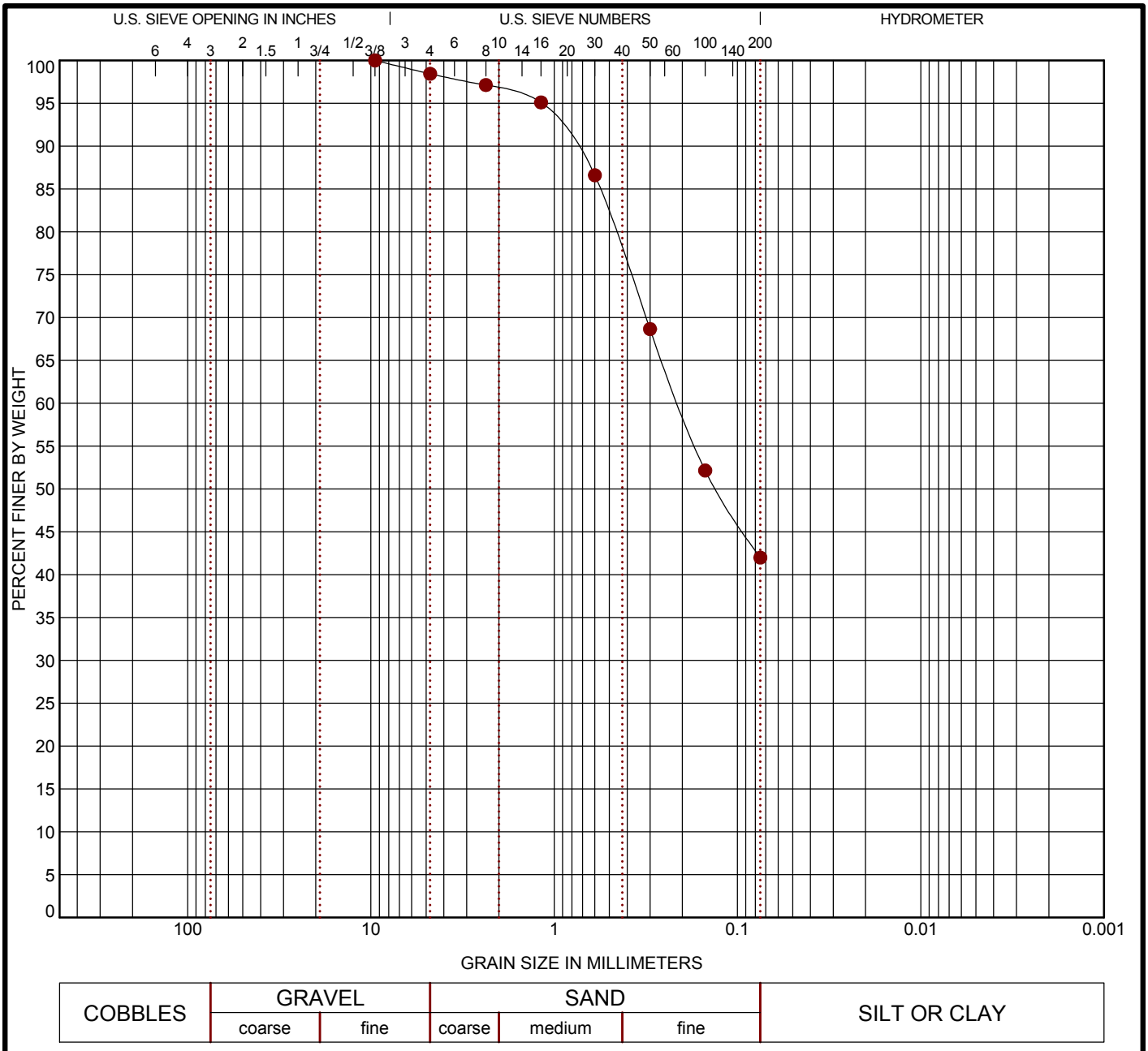
CLIENT: Iowa Department of Transportation

EXHIBIT: B-5

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. IDOT GRAIN SIZE: USCS 2 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2012.GDT 3/24/16

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
B-8	1.5	CLAYEY SAND (SC)					

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
B-8	1.5	9.5	0.209			1.6	56.5	42.0	

PROJECT: Proposed Muscatine Maintenance Facility

SITE: Highway 61
Muscatine, Iowa

Terracon
870 40th Avenue
Bettendorf, Iowa

PROJECT NUMBER: 07165036

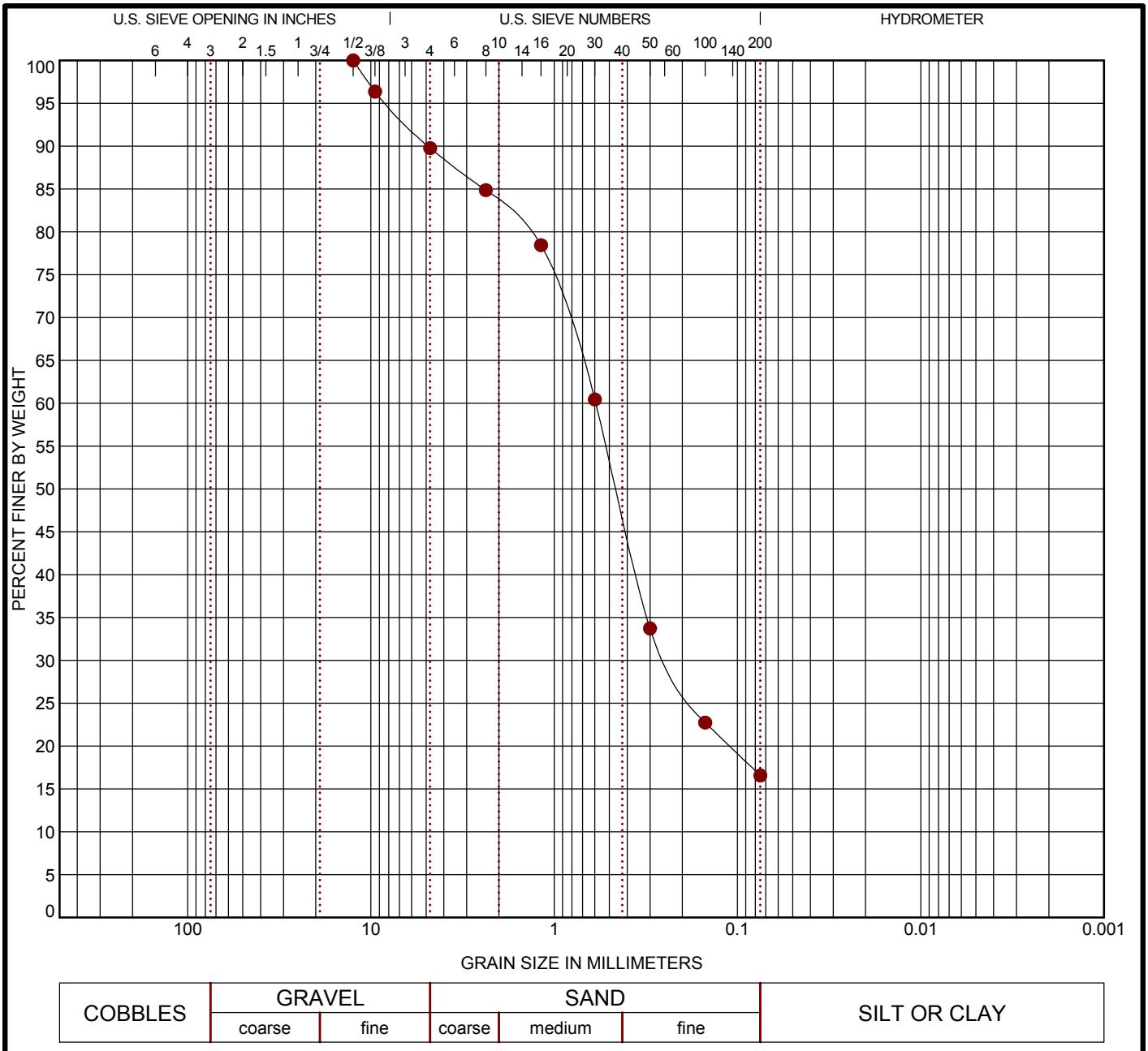
CLIENT: Iowa Department of Transportation

EXHIBIT: B-6

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. IDOT GRAIN SIZE: USCS 2 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2012.GDT 3/24/16

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
B-8	4.0	CLAYEY SAND (SC)					

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
B-8	4.0	12.5	0.593	0.237		10.2	73.2	16.6	

PROJECT: Proposed Muscatine Maintenance Facility

SITE: Highway 61
Muscatine, Iowa

Terracon
870 40th Avenue
Bettendorf, Iowa

PROJECT NUMBER: 07165036

CLIENT: Iowa Department of Transportation

EXHIBIT: B-7

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. IDOT GRAIN SIZE: USCS 2 07165036 - MUSCATINE MAINTENANCE FACILITY.GPJ TERRACON2012.GDT 3/24/16

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

Auger	Split Spoon
Shelby Tube	Macro Core
Ring Sampler	Rock Core
Grab Sample	No Recovery

WATER LEVEL

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally 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 in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

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UNIFIED SOIL CLASSIFICATION SYSTEM

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 [D]	$Cu \geq 6$ 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:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			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:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels 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.
[D] Sands 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

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 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.

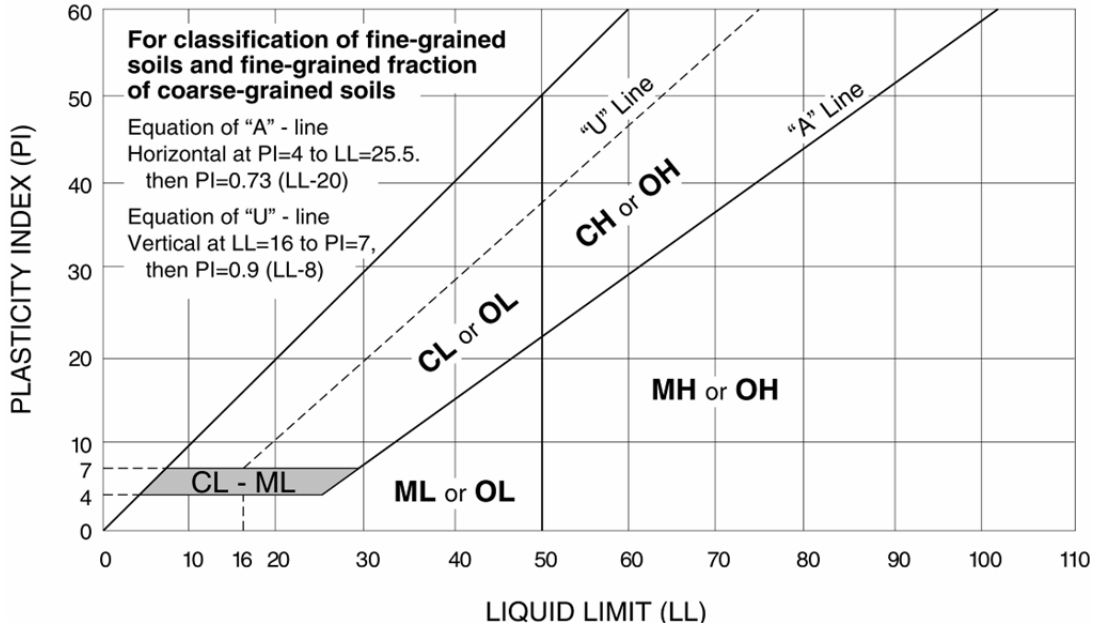

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Exhibit C-2

SECTION 02 3100

GEOTECHNICAL REPORT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Geotechnical Report from Terracon.

END OF SECTION

SECTION 03 0505
UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

A. 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.

B. 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 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Samples: Submit samples of underslab vapor barrier to be used.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Underslab Vapor Barrier: (Maintenance Garage and Reclamation Building Only)
   1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
   2. Thickness: 10 mils.
   3. Basis of Design:
      a. Stego Industries LLC; Stego Wrap Vapor Barrier (10-mil): www.stegoindustries.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

   1. Location of construction joints is subject to approval of the Architect.

E. Samples: For waterstops and vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

G. Field quality-control reports.

1.6 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

   a. High-density overlay, Class 1 or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   c. Structural 1, B-B or better; mill oiled and edge sealed.
   d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

3. Overlaid Finnish birch plywood.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Epoxy-Coated Reinforcing Bars: AST M A 615, Grade 60, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

C. Plain-Steel Wire: ASTM A 1064, as-drawn.

D. Epoxy-Coated Wire: ASTM A 884, Cla ss A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged in each 12-inch wire length.

E. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

F. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884, Class A coated, Type 1, plain steel.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and weld ed-wire reinforcement in pla ce. Manufacture bar supports from steel wire, plastic, or pre cast concrete according to CRSI's "Manual of Standard Pra ctice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire b ar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Cla ss 2 stainless-steel ba r supports.
2. For epoxy-coated reinforcement, use epoxy-c oated or other di electric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or cla ss of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate f rom single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150, Type I, gray.
2. Fly Ash: ASTM C 618, Class F or C.
3. Slag Cement: ASTM C 989, Grade 100 or 120.
4. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

F. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

G. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corporation; Construction Systems.
b. Grace Construction Products; W.R. Grace & Co. -- Conn.
c. Sika Corporation.

H. Water: ASTM C 94 and potable.

2.6 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Sika Greenstreak.

2. Profile: Ribbed without center bulb.
3. Dimensions: 6 inches by 3/8 inch thick; nontapered.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Grace Construction Products; W.R. Grace & Co. -- Conn.
   b. Stego Industries, LLC.
   c. W. R. Meadows, Inc.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      a. BASF Corporation; Construction Systems.
      b. Dayton Superior.
      c. Euclid Chemical Company (The); an RPM company.
      d. Sika Corporation.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form ½ inch deep sealant pocket after removal.
   1. Material: Closed-cell, non-absorbent, compressible polyethylene or polymer foam in sheet form in accordance with ASTM D 4819, Type II.
   2. Products:
      a. W.R. Meadows, Inc.; Deck-O-Foam Joint Filler with pre-scored top strip.
      b. Substitutions: See Section 01 6000 – Product Requirements.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Slag Cement: 35 percent.
4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 20 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Foundation Walls: Normal weight concrete.

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum W/C Ratio: 0.44.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size when exposed to freeze thaw conditions.

B. Slabs-on-Grade, Suspended Slabs: Normal-weight concrete.

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum W/C Ratio: 0.44.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size when exposed to freeze thaw conditions.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Concrete Toppings: Normal-weight concrete.

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum W/C Ratio: 0.44.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 7.5 percent, plus or minus 1.5 percent at point of delivery for 3/8-inch nominal maximum aggregate size when exposed to freeze thaw conditions.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

D. Masonry Bond Beams: Normal-weight concrete.

1. Minimum Compressive Strength: 3,000 psi at 28 days.
2. Maximum W/C Ratio: 0.53.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch .
4. Air Content: 7 percent, plus or minus 1.5 percent at point of delivery for 1/2-inch nominal maximum aggregate size when exposed to freeze thaw conditions.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

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

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed form work design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

   1. Apply scratch finish to surfaces indicated.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
   a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
   b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days 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 lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

   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 does 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 does 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.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.

    a. Cast and laboratory cure five standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39.

    a. Test laboratory cured specimens as follows: one at 7 days, three at 28 days (one reserve specimen).
    b. A compressive-strength test shall be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 03 3000

SECTION 03 3511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Bond abrasive polished concrete

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 REFERENCE STANDARDS

A. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

B. ASTM D2370 - Standard Test Method for Tensile Properties of Organic Coatings; 1998 (Reapproved 2010).

C. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).

D. SSPC-Paint 36 - Two-Component Weatherable Aliphatic Polyurethane Topcoat, Performance-Based; 2006.

E. CPPA - Concrete Polishing Association of America

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

1.06 MOCK-UP

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Mock-Up Size: 10 feet square.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

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

1.08 QUALITY ASSURANCE

A. Manufacturing Qualifications: Company specializing in manufacturing the products specified, with minimum 3 years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years documented experience. Contractor must provide minimum of two locations for review by owner to verify contractors ability to deliver desired results.

1.09 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Salt Inhibitting Concrete Sealer:
   1. Use at following locations:
      a. Maintenance Garage: Truck Storage Bay 110, Mechanics Bay 111 , Parts Room 113, Storage Room 112, Hallway 109 and all concrete approaches.
      b. Reclamation Building: All concrete floors; exposed concrete stem walls, and approaches.
      c. Pole Building and 3 Stall Addition (Alternated #1); All concrete floors and concrete approaches.
      d. Hoop Building: Interior of precast concrete walls and concrete approach into hoop building.
      e. Site Work: Concrete entrance drive, fuel depot, sidewalks, and equipment slabs

B. Polished Finish:
   1. Use at following locations: Throughout Office Area except for Office Storage, Janitor's closet, and IT/Comm Room .

C. Clear Sealer:
   1. Use at the follow locations: Office Storage 108, Janitors Closet 106, IT 105

2.02 DENSIFIERS AND HARDENERS

A. Salt Inhibiting Concrete Sealer: Penetrating water and salt barrier that reacts with concrete, filling pores and dustproofing.
   1. VOC- free, penetrating, semi-transparent liquid
   2. Products:
      a. CreteDefender, P2; www.cretedefender.com
      b. Prosoco, Consolideck Saltguard WB; www.consolideck.com
      c. L & M Construction Chemicals, INc; Aquapel Plus; www.lmcc.com

2.03 COATINGS - CLEAR SEALER

A. High Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.
   1. Composition: Acrylic polymer-based.
   2. Nonvolatile Content: 15 percent, minimum, when measured by volume.
   3. Products:
      a. Dayton Superior Corporation; PENTRA-HARD® GUARD: www.daytonsuperior.com.
      b. L&M Construction Chemicals, Inc., a subsidiary of Laticrete International, Inc.: www.lmcc.com.
      c. Scofield: Formula One Liquid Dye Concentrate; www.scofield.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 POLISHED CONCRETE SYSTEM

A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.
   1. Penetrating, solvent-borne acrylic concentrate diluted with acetone and applied to ground or polished floors. Local sand is acceptable.
   2. Acceptable Systems:
      a. L&M Construction Chemicals, Inc: www.lmcc.com.
      b. W.R. Meadows, Inc; Induroshine and Bellatrix Concrete Enhancer: www.wrmeadows.com/sle.
      c. Scofield: Formula One Guard S: www.scofield.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 TIE DOWN FIXTURES

A. Provide Buske #527 hold down device in floor as shown on drawings with Buske #526 cover.

1. Provide drainage through concrete sub-base aggregate to drain water out of tie-down device.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

B. Grinding: typical grit sequence.
   1. 50/70 Metal
   2. 100/120 Metal
   3. 30/50 Resin

C. Repairs to surface imperfections.

D. Application of densifier.

E. Honing: typical grit sequence
   1. 100/120 Resin
   2. 200/220 Resin
   3. 400 Resin

F. Polishing: typical grit sequence
   1. 800 Resin
   2. 1500 Resin
   3. 3000 Resin

G. Application of an impregnating microfilming product

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

3.04 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
   1. Final Polished Sheen: High-gloss finish; other sheens are included as comparison to illustrate required sheen; final sheen is before addition of any sealer or coating, regardless of whether that is also specified or not. Reflective clarity : 10, Reflective sheen: 80, Grit range: 800 or higher, Minimum number of abrasive passes: 7
   2. High Gloss Finish: Finish that looks wet and shows mirror-like reflections of side and overhead images.

B. Protect finished surface as required and as recommended by manufacturer of polishing system.

3.05 SCHEDULE

ROOM NO.	ROOM NAME	FINISH	SEALER
100	Entry	Smooth	Polished Concrete System
101	Hallway	Smooth	Polished Concrete System
102	Office	Smooth	Polished Concrete System
103	Mens Restroom	Smooth	Polished Concrete System
104	Womens Restroom	Smooth	Polished Concrete System

105	IT/Com Room	Smooth	Clear Sealer
106	Janitors Closet	Smooth	Clear Sealer
107	Conference Room	Smooth	Polished Concrete System
108	Office Storage	Smooth	Clear Sealer
109	Hallway	Light Broom	Salt Inhibitting Sealer
110	Truck Storage Bay	Smooth	Salt Inhibitting Sealer
111	Mechanics Bay	Smooth	Salt Inhibitting Sealer
112	Storage	Smooth	Salt Inhibitting Sealer
113	Parts Room	Smooth	Salt Inhibitting Sealer
Approach Aprons		Medium Broom	Salt Inhibitting Sealer
Sidewalks		Medium Broom	Salt Inhibitting Sealer
A. Reclamation Building			
101	Brine Production	Light Broom	Salt Inhbitting Sealer
102	Brine Tank Storage	Medium Broom	Salt Inhibitting Sealer
103	Wash Bay	Medium Broom	Salt Inhibitting Sealer
Stem Walls		Smooth	Salt Inhibitting Sealer
Approach Aprons		Medium Smooth	Salt Inhibitting Sealer
B. Pole Building & 3 Stall Addition (Alternate #1)			
Floor Slab		Light Broom	Salt Inhibitting Sealer
Approach Aprons		Medium Broom	Salt Inhibitting Sealer
C. Hoop Building			
Interior Precast Walls		Suppliers Standard	Salt Inhibitting Sealer
Aproach Aprons		Medium Broom	Salt Inhibitting Sealer
D. Site Work:			
Concrete Entrance and Drive		Smooth	Salt Inhibitting Sealer
Fuel Depot		Smooth	Salt Inhibitting Sealer
Sidewalks & Stoops		Light Broom	Salt Inhibitting Sealer

END OF SECTION

SECTION 03 4100

PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Precast roof double tees.
   2. Precast insulated wall panels.
   3. Precast slabs.

B. Related Requirements:

   1. Section 03 3000 "Cast-in-Place Concrete" for placing connection anchors in concrete.
   2. Section 05 1200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site one week prior to commencing work of this section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.

C. Shop Drawings:

   1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
   2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
   3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
   4. Indicate separate face and backup mixture locations and thicknesses.
   5. Indicate type, size, and length of welded connections by AWS standard symbols.
   6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
   7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.

8. Include and locate openings larger than 10 inches. Where additional structural support is required, include header design.
9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
10. Indicate relationship of precast structural concrete units to adjacent materials.
11. Indicate estimated camber for precast floor slabs with concrete toppings.
12. Indicate shim sizes and grouting sequence.
13. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Material Certificates: For the following:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Insulation.
6. Structural-steel shapes and hollow structural sections.

D. Material Test Reports: For aggregates, by a qualified testing agency.

E. Source quality-control reports.

F. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant as follows:

a. Group C, Category C3 – Prestressed Straight Strand Structural Members or Group C, Category C4 – Prestressed Deflected Strand Structural Members.

B. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect Category S1 - Simple Structural Systems.

C. Installer Qualifications: An experienced precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project installed by erector in Category S1 - Simple Structural Systems and who can produce an Erectors' Post Audit Declaration, according to PCI MNL 127, "PCI Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products."

D. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

E. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

F. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

1.7 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabricators: Participates in the Precast Concrete Institute plant certification program and is designated as a PCI Certified plant. Manufacturers include, but are not limited to, the following:

1. Coreslab Structures, Omaha, Nebraska.
2. PDM Precast, Inc., Des Moines, Iowa.
3. Wells Concrete, Albany, Minnesota.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design precast structural concrete units.

B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

C. Structural Performance: Fabricator to design precast units to support superimposed dead loads, live loads, seismic loads, sway displacement, diaphragm loads, lateral earth loads, and wind loads as indicated on drawings and as required for compliance with the current International Building Code. All precast insulated wall panels and roof double tees shall be prestressed.
   1. Design precast structural concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of ACI 318.

      a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of minus 18 to plus 120 deg F.

   2. Walls shall be designed as shear walls to resist wind loading. Roof double tees and slabs shall be designed as shear diaphragms to resist wind loading.

D. Structural Design:
   1. Provide complete design, calculations, and drawings, prepared and signed by a professional engineer experienced in the design of architectural and structural precast units and licensed in the State of Iowa.
   2. Maintain the general design concept as shown without increasing or decreasing size of members and without altering profiles and alignment, except as accepted by the Architect.
   3. Make the necessary provisions in the design to accommodate all stresses to be encountered.
   4. Every precast panel shall be free to move to accommodate the forces acting on it, such as temperature, wind, and building deformations, using a system of bearing and tie-back supports as generally indicated on the drawings. The precast contractor shall be responsible for designing and detailing all supports using the general information shown on the Drawings as a guide only. Special cases of support encountered during the design process shall be brought to the attention of the Architect for purposes of consultation. Typical inserts shown shall be designed and detailed by the precast fabricator.

2.3 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

C. Surface Retarder: Chemical set retarder, capable of temporarily delaying setting of newly placed concrete mixture to depth of reveal specified.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

C. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497 or ASTM A 1064, flat sheet.

F. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 PRESTRESSING TENDONS

A. Pretensioning Strand: ASTM A 886, Grade 270, indented, seven-wire, low-relaxation strand.

2.6 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
7. Plasticizing Admixture: ASTM C 1017, Type I.
8. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.7 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36.

B. Carbon-Steel-Headed Studs: ASTM A 108, Grade 1010 through 1020, cold finished, AWS D1.1, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A 283, Grade C.

D. Malleable-Iron Castings: ASTM A 47, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A 27, Grade 60-30.

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572.

G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B or Grade C.

H. Wrought Carbon-Steel Bars: ASTM A 675, Grade 65.

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563; and flat, unhardened steel washers, ASTM F 844.

K. High-Strength Bolts and Nuts: ASTM A 325 or ASTM A 490, Type 1, heavy hex steel structural bolts; heavy hex carbo n-steel nuts, ASTM A 563; and hardened carbon-steel washers, ASTM F 436.

1. Do not zinc coat ASTM A 490 bolts.

L. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123 or ASTM A 153.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.

2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

M. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

N. Welding Electrodes: Comply with AWS standards.

O. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.8 BEARING PADS

A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi, ASTM D 412.
2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881, of type, grade, and class to suit requirements.

2.10 INSULATED FLAT-WALL PANEL ACCESSORIES

A. Extruded-Polystyrene Board Insulation: ASTM C 578, with thickness of 6 inch sandwiched between exterior and interior precast concrete panels.

B. Wythe Connectors: Manufacturer's standard to connect wythes of precast concrete panels.

2.11 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.
   1. Limit use of fly ash to 20 percent replacement of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

   1. Compressive Strength (28 Days): 5000 psi minimum.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: Limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.12 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

   1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

   1. Edge and Corner Treatment: Uniformly chamfered.

2.13 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements.

Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1 and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A 775, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
5. Protect strand ends and anchorages with a minimum of 1-inch thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

L. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.

M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

O. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.14 CASTING INSULATED WALL PANELS

A. Cast, screed, and consolidate wythe supported by mold.

B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.

C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.

D. Cast, screed, and consolidate top wythe to meet required finish.

E. Maintain temperature below 150 deg F in bottom concrete wythe.

2.15 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.16 COMMERCIAL FINISHES

A. Grade A Finish: Repair surface blemishes and fill air holes with the exception of air holes 1/16 inch in width or smaller, and form marks where the surface deviation is less than 1/16 inch. Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.

B. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

C. Apply roughened surface finish according to ACI 318 to precast concrete units that receive concrete topping after installation.

2.17 SOURCE QUALITY CONTROL

A. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C 1610, ASTM C 1611, ASTM C 1621, and ASTM C 1712.

B. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.

C. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.

1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:

    a. Project identification name and number.
    b. Date when tests were performed.
    c. Name of precast concrete fabricator.
    d. Name of concrete testing agency.
    e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

E. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

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

C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.

C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Field cutting of precast units is not permitted without approval of Architect.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Welding: Comply with applicable requirements in AWS D1.1 and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.

H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
2. Fill joints completely without seepage to other surfaces.
3. Trowel top of grout joints on roof s smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
4. Place grout end cap or dam in voids at ends of hollow-core slabs.
5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
6. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 REPAIRS

A. Repair precast structural concrete units if permitted by Architect.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.6 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

3.7 SCHEDULES

A. Precast insulated wall panels: As noted on plans.

B. Precast roof double tees: As noted on plans.

C. Precast hollowcore plank: As noted on plans.

D. Precast foundations for hoop building: As noted on plans.

END OF SECTION 03 4100

SECTION 03 4500
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete wall panels with integral insulation.

B. Supports, anchors, and attachments.

C. Intermediate and perimeter joint seals.

D. Grouting under panels.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Admixtures.

B. Section 07 9005 - Joint Sealers: Perimeter joints with sealant and backing.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

E. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

G. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

H. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

I. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2014.

J. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

L. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

M. IAS AC157 - Accreditation Criteria for Fabricator Inspection Programs for Reinforced and Precast/Prestressed Concrete; 2010.

N. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2007.

O. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; 2010, Seventh Edition.

P. PCI MNL-122 - Architectural Precast Concrete; 2007, Third Edition.

Q. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988, Second Edition.

R. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

A. See Section 01 3000 - 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.

1.06 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in Des Moines, Iowa.

B. Fabricator Qualifications:
   1. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.
   2. Fabricator Qualifications: Precast concrete fabricator accredited by IAS according to IAS AC157.

C. Welder Qualifications: Qualified within previous 12 months in accordance with AWS D1.1/D1.1M and AWS D1.4/D1.4M.

1.07 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. Mark units with date of production in location that will be concealed after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete: Office Wall Panels
   1. Wells Concrete.
   2. Coreslab Structures
   3. PDM Precast.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRECAST UNITS

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
   1. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   2. Calculate structural properties of units in accordance with ACI 318.
   3. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   4. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

B. Finish Type C: Sand blast exposed-to-view precast unit surfaces to medium exposure. Protect adjacent surfaces.

C. Finish Type Ashlar Stone lower 4'-0" at Office Area exterior only: Textured finish. Remove excess concrete from joints and faces of units cast with form liner or other texture. Protect adjacent surfaces.

2.03 REINFORCEMENT

A. Comply with requirements of Section 03 2000.

B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi).
   1. Deformed billet-steel bars.

C. Steel Welded Wire Reinforcement (WWR): ASTM A 185.

2.04 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

C. Lightweight Structural Aggregate: ASTM C330/C330M.

D. Air Entrainment Admixture: ASTM C260/C260M.

E. Grout:
   1. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

2.05 FORM LINERS

A. Manufacturers:
   1. Fitzgerald Formliners: www.formliners.com.
   2. Greenstreak: www.greenstreak.com.
   3. Symons Corporation: www.symons.com.

B. Material: Acrylonitrile butadiene styrene.

2.06 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.

2.07 INSULATION

A. Sandwiched Integral Insulation: Rigid extruded polystyrene or Pre-cast wall provider's standard insulation.
   1. Provide insulation thickness of 6 inches .

2.08 ACCESSORIES

A. Bearing Pads: Vulcanized elastomeric compound molded to size; Shore A Durometer 60; 1/8 inch thick, smooth both sides.

2.09 FABRICATION

A. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

B. Use form liners in accordance with manufacturer's instructions.

C. Maintain consistent quality during manufacture.

D. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

E. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

F. Cast rigid insulation into units.

G. Remove protective coating from thin brick using method recommended by manufacturer. Do not damage brick or concrete material in joints.

2.10 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 1/8 in.
   2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet.
   3. Maximum Variation from Thickness: Plus or minus 1/8 in.
   4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
   5. Maximum Bowing of Members: Plus or minus length/360.

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 Architect.

E. Weld units in place. Perform welding in accordance with AWS D1.1/D1.1M.

F. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135 .

END OF SECTION

SECTION 04 2000
DECORATIVE UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative Concrete Block.

B. Mortar and Grout.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000- Cast-in-Place Concrete

B. Section 04 2200 - Concrete Unit Masonry

C. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.

D. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

B. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

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 C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.

G. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

I. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.

J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

M. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

N. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, and masonry accessories.

C. Samples: Submit four samples of Burnished Block 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 with integral water repellent admixture.

F. Maintenance Materials: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.07 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.08 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 (Garage Bays - Refer to 04 2200) and Burnished Block (Office Only in this section): Comply with referenced standards and as follows:

B. Manufacturers:
   1. Concrete Materials Co.: www.concretematerialscompany.com
   2. Anchor Block Company.
   3. Glen-Gery Brick Co.
   4. Marquet Products.
   5. Masonry Products Inc.
   6. Rock Valley Block and Title.
   7. Sibley Concrete Products.
   8. Dur-O-Wal.
   9. Wal-Truss.
   10. Amcon.
   11. Gage Bros.: www.gagebrothers.com
   12. Substitutions: See Seciton 01 6000 - Product Requirements.

C. Description:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches, except where depth varies on the drawings. Stacked Bond in Office Area Only.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, and bond beams.
   3. Pre-Faced Burnished Block Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.
      a. Colors and styles: Selected from standard colors.
      b. Manufacturers:
         1) Amcon; Colored Series; (Used as basis of design)
         2) Substitutions: See Section 01 6000 - Product Requirements.
   4. Provide Burnished Blocks with "bullnosed" corners at all outside corners.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.
   1. Colored Mortar: Premixed cement as required to match Architect's color sample.

B. Mortar Aggregate: ASTM C144.

C. Grout Aggregate: ASTM C404.

D. Water: Clean and potable.

E. Accelerating Admixture: Nonchloride type for use in cold weather.

F. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: Refer to 04 2200 - Concrete Unit Masonry; size as indicated on drawings.

B. Joint Reinforcement: Refer to 04 2200 - Concrete Unit Masonry and drawings.

C. Anchors: Refer to 04 2200 - Concrete Unit Masonry and drawings.

2.04 FLASHINGS

A. Galvanized Steel Flashing: ASTM A653/A653M, with G90/Z275 coating, 26 gage, 0.0179 inch base metal thickness.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 1/2 inch wide by maximum lengths available.

C. Cavity Vents:
   1. Type: Polyethylene tubing.
      a. Manufacturers:
         1) Blok-Lok Limited: www.blok-lok.com.
         2) CavClear/Archovations, Inc: www.cavclear.com.
         3) Mortar Net Solutions: www.mortarnet.com.
         4) Substitutions: See Section 01 6000 - Product Requirements.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Interior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION (REFER TO 04 2200 - CONCRETE UNIT MASONRY)

3.01 SCHEDULES

A. Interior Garage Partitions: Concrete Masonry Unit Construction scored 8 inch thick concrete block, type N color mortar to match, and type N pointing mortar, colored to match. Running Bond with raked joints

B. Interior Office Burnished Block Partitions: type N color mortar, color to match block. Stacked bond with raked joints.

END OF SECTION

SECTION 04 2200

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in concrete unit masonry.
2. Steel Lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.
4. Cavity wall insulation.

C. Related Requirements:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

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

1. Masonry units.

   a. Include data on material properties and material test reports substantiating compliance with requirements.
   b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

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

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

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

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

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

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

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.

   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C 90.
   1. Density Classification: Normal weight, unless otherwise indicated.
   2. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

D. Concrete Building Brick: ASTM C 55.
   1. Density Classification: Normal weight.
   2. Size (Actual Dimensions): 3-5/8 inches high by 7-5/8 inches long.

E. Decorative CMUs: ASTM C 90.
   1. Density Classification: Normal weight.
   2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
   3. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

2.5 MORTAR AND GROUT MATERIALS

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

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Masonry Cement: ASTM C 91/C 91M.

C. Mortar Cement: ASTM C 1329/C 1329M.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Colored Masonry Cement:

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

J. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.7 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
   2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
   3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
   4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Tie Section: Triangular-shaped wire tie made from 0.187-inch diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

   1. Tie Section: Triangular-shaped wire tie made from 0.25-inch diameter, hot-dip galvanized steel.

E. Partition Top Anchors: 0.105-inch thick metal plate with a 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars bent to configuration indicated.

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

   1. Do not use calcium chloride in mortar or grout.
   2. Use masonry cement or mortar cement mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

E. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1. Application: Use epoxy pointing mortar for exposed mortar joints with pre-faced CMUs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

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

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch , with a maximum thickness limited to 1/2 inch (12.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch .
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch .
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch .

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth . When resuming work, clean masonry surfaces that are to receive

mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated. Leave gap for LL deflection.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Wet joint surfaces thoroughly before applying mortar.
3. Rake out mortar joints for pointing with sealant.

D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches .

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units or rigid anchors.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners,] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry :

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide lintels where shown and where openings of more than 12 inches are shown without structural steel or other supporting lintels.

3.10 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 64 inches.

3.11 FIELD QUALITY CONTROL

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

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

END OF SECTION 04 2200

SECTION 05 1200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general construction provisions of the Contract including Common Sections (including Division I) and other Divisions and Section of the Specifications to which the products, materials and system(s) specified herein are attached, supporting, protecting or related.

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Grout.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Beam and girder connections not otherwise noted shall be designed, fabricated and erected as a standard connection in accordance with the latest edition of AISC Manual of Steel Detailing. Details shown are typical: similar details apply to similar conditions unless otherwise indicated. Connection concepts to be approved by Architect/Engineer. Judgment regarding appropriateness of specific connections to be determined by Architect/Engineer.

B. Construction: Type 2, simple framing.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of top coats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who complies with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges", current edition CSE. Installer to have minimum of three years experience.

B. Fabricator Qualifications: A qualified fabricator who complies with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges", current edition. Fabricator to have minimum of three years experience.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cl eaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

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

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that sh op primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles, M and/or S-Shapes: ASTM A 36.

C. Plate and Bar: ASTM A 36.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53, Type E, Grade B.

1. Weight Class: Standard.
2. Finish: Black, except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.
2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.

a. Finish: Plain.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: AS TM F 1852, Type 1, heavy hex or round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain.

D. Headed Anchor Rods: ASTM F 1554, Grade 36.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A36 carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

E. Threaded Rods: ASTM A 36.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM F 436.
3. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

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

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

H. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to in accessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize exterior lintels and shelf angles attached to structural-steel frame and located in exterior walls.
3. Galvanize all exterior steel.

2.9 SOURCE QUALITY CONTROL

A. Owner may engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.
1. Set base plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.

C. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Owner may engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
   1. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

B. Contractor shall provide the following testing by testing agency or qualified personnel:
   1. Shop Bolted Connections: Inspect or test in accordance with AISC specifications.
   2. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
      a. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
      b. Perform visual inspection of all welds.
   3. Field Bolted Connections: Inspect in accordance with AISC specifications.
   4. Field Welding: Inspect and test during erection of structural steel as follows:
      Certify welders and conduct inspections and test as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
      a. Perform visual inspection of all welds.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05 1200

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. Joist accessories.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.1 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Provide holes in chord members for connecting and securing other construction to joists.

C. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

D. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

E. Camber joists according to SJI's "Specifications.".

F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.2 PRIMERS

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

2.3 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A 36 steel with integral anchorages of sizes and thicknesses indicated. Hot-dip zinc coat according to ASTM A 123.

C. Steel bearing plates with integral anchorages are specified in Section 05 5000 "Metal Fabrications."

D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

E. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.4 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework where indicated using high-strength structural bolts. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

C. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
2. Apply a compatible primer of same type as primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting sections.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 2100

SECTION 05 3100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof deck.

2. Composite floor deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. Epic Metals Corporation.
3. New Millennium Building Systems, LLC.
4. Nucor Corp.
5. Verco Decking, Inc., a Nucor company.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

   a. Color: Manufacturer's standard Gray top surface with white underside.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches.
4. Design Uncoated-Steel Thickness: As indicated on plans.
5. Span Condition: As indicated on plans.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.2 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. Epic Metals Corporation.
3. New Millennium Building Systems, LLC.
4. Nucor Corp.
5. Verco Decking, Inc., a Nucor company.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth: 2 inches.
3. Design Uncoated-Steel Thickness: As indicated on plans.
4. Span Condition: As indicated on plans.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

I. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: As indicated on plans.
3. No mechanical fasteners are permitted in connecting roof deck to bar joists.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on plans.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. Weld Spacing: Space and locate welds as indicated on plans.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

A. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION 05 3100

SECTION 05 5100
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated stairs.

B. Structural steel stair framing and supports.

C. Handrails and guards.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

F. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

G. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

J. 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.

K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

M. NAAMM AMP 510 - Metal Stairs Manual; 1992, Fifth Edition.

N. NAAMM MBG 531 - Metal Bar Grating Manual; 2009.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's stamp or seal on each sheet of shop drawings.

C. Welders' Certificates.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.04 QUALITY ASSURANCE

A. Structural Designer Qualifications: Prefessional Structural Engineer experienced in design of this work and licensed in Iowa, or personeel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
   2. Dimensions: As indicated on drawings.
   3. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   4. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   5. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
      a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
      b. Welds Exposed to View: Ground smooth and flush.
      c. Mechanical Joints: Butted tight, flush, and hairline.
      d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
      e. Exposed Edges and Corners: Eased to small uniform radius.
      f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 PREFABRICATED STAIRS

A. Welded Steel Crossover Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Materials: Carbon steel; ASTM A1011/A1011M, Grade 36, minimum, galvanized.
   3. Finish: Powder Coat, Manufacturer's standard safety yellow.
   4. Manufacturers: (1'-6" high, 24" wide)
      a. Precision Ladders, Inc.; www.precisionladders.com.
      b. FS Industries; www.fsindustries.com .
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Alternating Tread Stairs: Welded metal unit; factory fabricated to the greatest degree possible.
   1. Design Requirements:
      a. Stair Load Capacity: Support the following without exceeding the allowable working stress of the material.
         1) Single Point Load: 1000 pounds.
         2) Distributed Load: 100 pounds per square foot.
      b. Guardrail and Handrail Capacity: Support the following without exceeding the allowable working stress of the material.
         1) Single Point Load: 200 pounds.

2) Distributed Load: 50 pounds per linear foot.

c. Support the following without exceeding the allowable working stress of the material.

1) Single Point Load: 1000 pounds.

2) Distributed Load: 100 pounds per square foot.

2. Materials: Carbon steel; ASTM A1011/A1011M, Grade 36 minimum, galvanized.

a. Stair Angle: as noted on the drawings.

b. Components: Manufacturer's standard handrails, guardrails, non-skid treads and stringers.

c. Finish: Manufacturer's standard safety yellow powder coat.

d. Accessories: Manufacturer's standard foot divider with rubber bumper strip.

3. Products:

a. Lapeyre Stair, Inc; Alternating Tread Stair: www.lapeyrestair.com.

b. Precision Ladders, Inc.; www.precisionladders.com.

c. Vestil.

d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 HANDRAILS AND GUARDS

A. Guards:

1. Top Rails: Round pipe or tube rails unless otherwise indicated.

a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.

b. 42" high rails

2. 42" high Gate - Constructed like handrails.

a. Hinge and Latch: Galvanized steel hinges galvanized steel quick release "U" latch.

b. Finish: Powder Coat, Manufacturer's standard safety yellow.

3. End and Intermediate Posts: Same material and size as top rails.

a. Horizontal Spacing: As indicated on drawings.

b. Mounting: Welded to top surface of stringer.

4. Materials: Carbon Steel ASTM A1011/A1011Mm Grade 36 minimum, galvanized

5. Finish: Powder Coat, Manufacturer's standard safety yellow.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating 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 per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.05 SCHEDULES

A. Provide Prefabricated Alternating stair to Mechanical Mezzanine from Truck Storage Bay. Guardrail at landing to mezzanine.

B. Provide Prefabricated Alternating Stair from Mezzanine to roof hatch

C. Handrail and Gatea at Mechanical Mezzanine.

END OF SECTION

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Balcony railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.

E. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

C. Allow for expansion and contraction of members and building movement without damage to connections or members.

D. Dimensions: See drawings for configurations and heights.
   1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
   2. Intermediate Rails: 1-1/2 inches diameter, round.
   3. Posts: 1-1/2 inches diameter, round.

E. 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 bolting anchors.

F. Provide slip-on non-weld mechanical fittings 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.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing, galvanized.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Galvanizing: In accordance with requirements of ASTM A123/A123M.

D. Finish: Powder Coat, Manufacturer's standard safety yellow.

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. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 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. Anchor railings securely bolting anchors in top of concrete knee wall.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.04 SCHEDULE

A. Reclamating Building: 42" high Guardrails A.F.F. of Wash Bay in Reclamation Building. Set inserts in concrete for bolting anchors. Bolt to anchor so guardrail will be removable to allow access and to remove brine tanks per drawings.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Rough opening framing for doors, windows, and roof openings.

C. Sheathing.

D. Underlayment.

E. Roof-mounted curbs.

F. Roofing nailers.

G. Roofing cant strips.

H. Preservative treated wood materials.

I. Miscellaneous framing and sheathing.

J. Communications and electrical room mounting boards.

K. Concealed wood blocking, nailers, and supports.

L. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.

B. Section 06 1753 - Shop-Fabricated Wood Trusses.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2012.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

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

E. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood Protection Association; 2003.

F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

G. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc; 2013.

H. PS 1 - Structural Plywood; 2009.

I. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

J. PS 20 - American Softwood Lumber Standard; 2010.

K. SPIB (GR) - Grading Rules; 2014.

L. WWPA G-5 - Western Lumber Grading Rules; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Iowa Department of Transportation's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   1. Lumber Grading Agency: Certified by NIST PS 20.
   2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.

B. Design structural shop-fabricated trusses under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Iowa.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. 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.
   3. 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.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01 6000 - Product Requirements for requirements.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

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 EXPOSED DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings.

C. Surfacing: S4S.

D. Moisture Content: S-dry or MC19.

E. Columns Framing (2 by 6 through 4 by 16):
   1. Species: Douglas Fir.
   2. Grade: No. 1.

2.04 TIMBERS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry (23 percent maximum).

C. Posts 5 inches and over in thickness:
   1. Species: Douglas Fir-Larch.

2. Grade: Select Structural.

2.05 CONSTRUCTION PANELS

A. Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Nominal Thickness: 3/4" plywood

B. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Thickness: 1/2 inch, or 15/32 plywood, nominal.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

D. Roof/Wall Sheathing (at 3 hr fire wall): Fier Retardant treated (Drycon) plywood; 3/4" thick.

2.06 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.
   3. Nails, Brads, and Staples: ASTM F 1667.
   4. Power-Driven Fasteners: NES NER-272.
   5. Wood Screws: ASME B18.6.1.

B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.

C. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

D. Sill Flashing: As specified in Section 07 6200.

E. Water-Resistive Barrier: Plastic sheet complying with ICC-ES AC38.

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. 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 AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

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 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. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA (WFCM) Wood Frame Construction Manual.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

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.

B. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

C. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.
   10. Equipment suspended from ceiling.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. At long edges use sheathing clips where joints occur between roof framing members.
   2. Nail panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.
   1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over burnished block 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.

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 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.09 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - 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.

3.10 SCHEDULES

Application:	Type:
Pole Building Posts	S/P/F species, 19 percent maximum moisture content, treated
Wall Sheathing- Exterior	1/2 inch Plywood, except where noted on drawings.
Roof Sheathing	3/4 inch Plywood
Overhead Door Blocking	Treated
Door Jambs	S/P/F species, 19 percent maximum moisture content
Door Thresholds	S/P/F species, 19 percent maximum moisture content
Roof Curbs and blocking	S/P/F species, 19 percent maximum moisture content
Door	S/P/F species, 19 percent maximum moisture content
Telephone Panel Boards	3/4 inch thick plywood, square edges
Brine Building Interior walls	1/2" Plywood
Brine Building Framing	S/P/F species, 19 percent maximum moisture content, treated
Pole Building Framing	S/P/F species, 19 percent maximum moisture content

END OF SECTION

SECTION 06 1219
STRUCTURAL INSULATED PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural insulated panels for walls and roofs.

B. Fasteners and adhesives.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Bearing support, stud framing, field-fabricated panel connections, miscellaneous blocking and nailers.

B. Section 07 2500 - WEATHER BARRIERS: Water-resistive barrier over sheathing.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

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 C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

E. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2014.

F. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a.

G. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2013.

H. ICC-ES AC05 - Acceptance Criteria for Sandwich Panel Adhesives; 2010.

I. PS 1 - Structural Plywood; 2009.

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 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide structural insulated panel manufacturer's product literature including structural properties, design load capacities and installation instructions.

C. Shop Drawings: Fully dimensioned fabrication and installation details for structural insulated panels. Indicate dimensions, materials, connections and arrangement of joints. Include anchorage, size and type of fasteners, and accessories.
   1. Include calculations that indicate compliance with the applicable building code and the structural insulated panel manufacturer's requirements.
   2. Include seal of Professional Engineer registered in Des Moines, Iowa on drawings and calculations.
   3. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the structural insulated panel manufacturer's requirements.
   4. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.

D. Designer's Qualification Statement.

E. Manufacturer's Qualification Statement.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Iowa Department of Transportation's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Des Moines, Iowa.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   1. Member of Structural Insulated Panel Association (SIPA).
   2. Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural insulated panels in manufacturer's packaging, if any, and with manufacturer labels and markings intact.

B. Cover structural insulated panels with waterproof covering during transportation and storage. Keep dry.

C. Protect edges of wood construction panels and foam cores.

D. Fully support structural insulated panels off the ground.

E. Do not lift structural insulated panels by wood construction panel layer.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Insulated Panels:
   1. Energy Panel Structures; www.epsbuildings.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STRUCTURAL INSULATED PANELS

A. Structural Insulated Panels: Provide structural insulated panels capable of withstanding design loads including dead load, live load, wind load and seismic load.

B. Structural Insulated Wall Panel: Plywood construction panel laminated to both sides of rigid extruded polystyrene insulation board.
   1. Panel Size: 4 feet by 8 feet minimum.
   2. Overall Thickness: 6-1/2 inches minimum.
   3. Span Rating: 24/16, minimum.
   4. Edge Treatment: Square edge.
   5. Thermal Resistance: R-value of 21 minimum
   6. Provide panels with fastening guide marked on exterior face.

C. Structural Insulated Roof Panel: Plywood construction panel laminated to both sides of rigid extruded polystyrene insulation board.
   1. Panel Size: 4 feet by 8 feet minimum.
   2. Overall Thickness: 12-1/4 inches minimum.
   3. Span Rating: 24/16, minimum.
   4. Edge Treatment: Square edge.
   5. Thermal Resistance: R-value of 49 minimum
   6. Provide panels with fastening guide marked on exterior face.

2.03 MATERIALS

A. Plywood: 15/32 inch thick, PS 1, Grade C-D, Exposure I.

B. Expanded Polystyrene (EPS) Insulation Board:
   1. Density: ASTM C578, Type I; 0.9 lb/cu ft, minimum, when tested according to ASTM D1622/D1622M.
   2. Thermal Resistance: R-value of 4.3 deg F hr sq ft/Btu, minimum, when tested at 1 inch thickness in accordance with ASTM C518 or ASTM C177.

C. Laminating Adhesive: Manufacturer's standard; complying with ASTM D2559.

D. Dimension Lumber:
   1. Sizes: Nominal sizes as indicated on drawings, S4S.
   2. Moisture Content: S-dry or MC19.

E. Brine/ Reclamation Building Interior Wall and Ceiling Finish- Fiberglass Reinforced Plastic wall sheeting preapplied to plywood for interior face of sips wall and roof panels.
   1. Color: White
   2. Texture: Pebble
   3. PVC or vinyl Silhouetted Trims.
      a. End Caps, 8 ft minimum.
      b. Division Bar, 8 ft minimum
      c. Inside Corner, 8 ft minimum
      d. Oitside Corner, 8 ft minimum
   4. Manufacturers
      a. Nudo Products; www.nudo.com
      b. Glasteel; www.glassteel.com
      c. Kemlite; www.cranecomposites.com

F. Alternate #1- 3 Bay Addition to Pole Building Interior Wall and Ceiling Finish- Painted plywood
   1. See Section 09 9000 - Painting and Coating
   2. Color: White

G. Weather Barrier Joint Tape: Manufacturer's standard; 6 inches wide.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Common Nails: ASTM F1667.
   3. Panel Screws: Pancake head; minimum thread diameter 0.255 inch, minimum shank diameter of 0.190 inch and minimum head diameter 0.625 inch.

B. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

C. Sill Flashing: As specified in Section 07 6200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine foundations, sills, framing and other surfaces to receive structural insulated panels. Verify conditions suitable for installation. Report unsatisfactory conditions to Architect. Do not proceed with structural insulated panel work until unsatisfactory conditions corrected.

3.02 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

B. Coordinate installation of rough carpentry members specified in other sections.

3.03 INSTALLATION

A. Install structural insulated panels in accordance with manufacturer's instructions.
   1. Comply with manufacturer's written recommendation for number, size and placement of fasteners.

2. Join structural insulated panel edges according to manufacturer's written recommendation.

B. Restrictions:
   1. Do not over cut oriented strand board or plywood face when field-cutting openings.
   2. Do not install electrical chases inside structural insulated panels.
   3. Do not install plumbing inside structural insulated panels without consulting manufacturer and obtaining written recommendations.
   4. Protect structural insulated panel core from solvents and solvent vapors.

C. Prevent damage to structural insulated panels.

D. When structural insulated panels have oriented strand board or plywood on one side only, install panel with wood face on exterior of structure.

E. Install structural insulated panels plumb, square and true to line.

F. Seal panel joints with manufacturer's recommended sealant.

G. Repair or replace damaged panels.

3.04 PROTECTION

A. Do not leave panels exposed to moisture. Remove wet panels or allow to dry completely before installation of sealants, tape, weather barrier and siding or other veneer.

B. Protect installed structural insulated panels from subsequent construction operations.

C. Cover top and edges of unfinished panel work. Protect from weather and prevent accumulation of water in cores.

3.05 SCHEDULE

A. Reclamation Building- Walls and ceiling. Treated plywood with FRP Interior

B. Alternate #1- 3 Stall Addition- walls and ceiling with painted plywood interior.

END OF SECTION

SECTION 06 1753
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated wood trusses for roof framing.

B. Bridging, bracing, and anchorage.

C. Wood Girder Trusses.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

1.03 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. SPIB (GR) - Grading Rules; 2014.

C. TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2007 and errata.

D. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; 2011.

E. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; 1989.

F. WWPA G-5 - Western Lumber Grading Rules; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, fire retardant, wood preservative treatment and metal bracing components.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   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.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
   4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

C. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
   1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
   2. Indicate sizes, stress grades, and species of lumber.
   3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
   4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
   5. Show splice details and bearing details.

D. Delegated-Design Submittal: For metal plate connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, Licensed in Iowa, responsible for their preparation.

E. For metal connector-plate manufacturer professional engineer and fabricator.

F. For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

G. For metal-plate connected wood trusses, signed by officer of truss fabricating firm.

H. Evaluation Reports: For the following from ICC-ES:
   1. Wood-preservative-treated lumber.
   2. Fire-retardant-treated wood.
   3. Metal-plate connectors.
   4. Metal truss accessories.

1.05 QUALITY ASSURANCE

A. Truss Design, Fabrication, and Installation: In accordance with TPI 1, TPI DSB-89, and BCSI 1.

B. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
   1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

C. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum 3 years of documented experience.
   1. Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Engineer and authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle and erect trusses in accordance with TPI BCSI 1.

B. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.

C. Protect trusses from weather by covering with waterproof sheeting, securely anchored.

D. Provide air circulation around stacks and under coverings.

E. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

F. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design metal-plate connected wood trusses.

B. Structural Performance: Provide metal-palate connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
   1. Design Loads: As indicated.
   2. Maximum Deflection Under Design Loads: As indicated.

C. Comply with applicable requirements and recommendations of the following publications:
   1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
   2. TPI DSB, "Recommended Design Specifications for Temporary Bracing of Metal Plate Connected Wood Trusses."

3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, and Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.02 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board for Review. Provide lumber graded by an agency certified by the ALSC Board for Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Provide dressed lumber, S4S.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 1000 - Rough Carpentry.

2.03 MANUFACTURERS

A. Truss Plate Connectors:
   1. Alpine Engineered Products, Inc: www.alpeng.com.
   2. MiTek Industries, Inc: www.mii.com.
   3. Truswal Systems: www.truswal.com.
   4. Eagle Metal Products.
   5. Jager Building Systems, Inc.
   6. Robbins Engineering, Inc.
   7. Substitutions: See Section 01 6000 - Product Requirements.

B. Source Limitations: Obtain metal connector plates from single manufacturer.

C. General: Fabricate connector plates to comply with TPI 1.

D. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low alloy steel Type A (HSLAS Type A), or high-strength low alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch thick.

E. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low alloy steel Type A (HSLAS Type A), or high-strength low alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

2.04 TRUSSES

A. Wood Trusses: Designed and fabricated in accordance with TPI 1 and TPI DSB-89 to achieve structural requirements indicated.
   1. Species and Grade: Douglas Fir, WWPA Grade S45.
   2. Connectors: Steel plate.
   3. Design Roof Live and Dead Load: 40 lbs/sq ft.
   4. Roof Deflection: 1/240, maximum.

2.05 MATERIALS

A. Lumber:
   1. Moisture Content: Between 7 and 19 percent.
   2. Lumber fabricated from old growth timber is not permitted.
   3. Provide sustainably harvested lumber, certified or labeled as specified in Section 01 6000.

B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.

C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.06 ACCESSORIES

A. Fasteners: Hot-dip galvanized steel, type to suit application.
   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
   2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
   1. Use for interior locations unless otherwise indicated.

D. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low alloy steel Type A (HSLAS Type A), or high-strength low alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless-Steel Sheet: ASTM A 666, Type 316.
   1. Use for exterior locations and where indicated.

F. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

G.

2.07 FABRICATION

A. Fabricate trusses to achieve structural requirements specified.

B. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

C. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

D. Assemble truss members in design configuration indicated: use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

E. Connect truss members by metal connector plates located and securely embedded simultaneously in both side of wood members by air or hydraulic press.

F. Brace wood trusses in accordance with TPI DSB-89 and BCSI 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that supports and openings are ready to receive trusses.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Lifting of trusses shall be at factory-designated locations, using factory-approved slings, booms, or hooks, or lift truck at factory-approved location.

B. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.

C. Set members level and plumb, in correct position, and following spacing indicated on plans.

D. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

E. Do not field cut or alter structural members without approval of Architect/Engineer.

F. Install permanent bridging and bracing.
   1. Install bracing to comply with Section 06 1000 - Rough Carpentry.
   2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

G. Frame openings between trusses with lumber in accordance with Section 06 1000.

H. Coordinate placement of decking with work of this section.

I. Protect wood that has been treated with inorganic born from weather. If, despite protection, inorganic boron treated wood becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

J. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

K. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

L. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
   1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

3.04 SCHEDULES

A. Pole Building: Gable Trusses: 44-foot maximum span truss, 7-feet, 48 inches o.c. spacing, 2'-0" overhang, 4/12 slope, bearing at ends on wood framing members.

B. Reclamation Building: Gable Trusses: 58-foot span truss approximately, 48-inches o.c., 2'-0" overhang, 4/12 slope, bearing at ends on wood framing members.

C. Alternate #1, 3 Bay Addition to Pole Building: 50 foot maximum span, 48 inches o.c., 2'-0" overhang, 4/12 slope, bearing at ends on wood framing members.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood casings and moldings.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work and cabinet hardware.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

D. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2003.

E. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

G. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; 2011.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide instructions for attachment hardware, finish hardware, and colors.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, accessories, to a minimum scale of 1-1/2 inch to 1 ft.

D. Samples: Submit two samples of casework manufacturer's product brochures, plastic laminates, paint colors, hardware items, casing and base trim, ceiling panels and window treatment colors, finish plywood, illustrating wood grain and specified finish.

E. Coordinate work with mechanical rough-in, electrical rough-in, installation of associated and adjacent components, and substrate

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS - NOT USED

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Grade.

B. Unless otherwise indicated provide products of quality specified by AWI Architectural Woodwork Quality Standards Illustrated for Premium grade.

C. Unless otherwise indicated provide products of quality specified by Woodwork Institute Manual of Millwork for Premium grade.

D. Interior Woodwork Items:

1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000 - Product Requirements.

2.03 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install components with nails, screws, and bolts as appropriate, using care to avoid damage to surfaces or fasteners. Install adhesive-mounted components with correct adhesive, gun-applied or trowel-applied as appropriate, using care to produce a smooth surface. Remove excess adhesive from adjacent surfaces.

E. Install prefinished paneling with full bed contact adhesive applied to substrate.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Cabinet hardware.

C. Factory finishing.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 12 3600 - Countertops.

C. Section 09 9123 - Interior Painting: Site finishing of cabinet exterior.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

D. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

E. ANSI A208.1 - American National Standard for Particleboard; 2009.

F. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

G. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

H. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

I. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

J. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

K. PS 20 - American Softwood Lumber Standard; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 2 inches square, illustrating proposed cabinet and shelf unit substrate and finish.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Teragren: www.teragren.com: Iowa Metro Hardwoods Co. 800-351-9293.

B. Moso Veneer: www.mosoveneer.com

C. Danzer Specialty Veneers, Inc.: www.interforest.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Grade.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets:
   1. Finish - Exposed Interior Surfaces: Decorative laminate.
   2. Finish - Concealed Surfaces: Manufacturer's option.
   3. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   4. Casework Construction Type: Type A - Frameless.
   5. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
   6. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
      a. Premium Grade:
         1) Provide vertical run and match for doors, drawer fronts and false fronts within each cabinet unit.
   7. Cabinet Design Series: As indicated on drawings.
   8. Adjustable Shelf Loading: 50 lbs. per sq. ft.
      a. Deflection: L/144.
      b. 3/4" thick; 1" thick over 30" width
   9. Casework Back: back 1/2" particle board with white melamine finish .
   10. Cabinet Style: Flush overlay.
   11. Cabinet Exposed faces, Doors, and Drawer Fronts: Flush style; 3/4" thickness .
   12. Drawer Side Construction: Multiple-dovetailed.
   13. Drawer Construction Technique: Dovetail joints.

2.03 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000.

2.04 LAMINATE MATERIALS

A. Manufacturers:
   1. Wilsonart: www.wilsonart.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

C. Provide specific types as follows:
   1. Horizontal Surfaces: HGL, 0.039 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
   3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, colors as scheduled, finish as scheduled.

2.05 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 Architect from manufacturer's standard range.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.
   1. Manufactured by Amerock, or approved equal.

D. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: 100 lb. minimum, Commercial Grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.

E. Hinges: European style concealed self-closing type, steel with polished finish.

2.07 FABRICATION

A. Cabinet Style: Flush overlay.

B. Cabinet Doors and Drawer Fronts: Flush style.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

D. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

E. Provide cutouts for plumbing fixtures and as required on plans. Verify locations of cutouts from on-site dimensions with Owner. Seal cut edges.

2.08 FACTORY FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: Semigloss.

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.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units, countertops, and back and side-splashes.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall, underside of floor slabs, and exterior wall behind wall finish, below overhead doors, and in metal door frames

B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

C. Fill perimeter window and door shim spaces and cracks with caulk on cracks 1/2" or smaller and spray foam in cracks 1/2" to 2" wide.

D. Board insulation over membrane waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 03 4100 - Structural Precast Concrete: Insulation in precast panels.

B. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.

C. Section 07 2500 - WEATHER BARRIERS: Separate air barrier and vapor retarder materials.

D. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

E. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

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

E. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. Samples: Submit manufacturer's sample, minimum 6 inches square.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying material name and manufacturer.

B. Storage: Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Heated Concrete Slabs: Expanded Polystyrene board.

B. Insulation at Perimeter of Foundation: Expanded polystyrene board.

C. Lay-In Acoustical Insulation Above Drywall Ceilings: Batt insulation with no vapor retarder.

D. Insulation Over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: ASTM C578, Type IX; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Board Size: 48 by 96 inch.
   4. Board Thickness: 2 inches minimum.
   5. Board Edges: Square.
   6. Water Absorption: 4 percent by volume, maximum.
   7. Board Density: 1.8 lb/cu ft minimum.
   8. Compressive Resistance: 25 psi.
   9. Thermal Resistance: R-value of 4.3 per 1 inch at 75 degrees F mean temperature.
   10. Manufacturers:
      a. ACH Foam Technologies, Foam-Control Plus:www.achfoam.com
      b. Diversifoam Products: www.diversifoam.com.
      c. LiteForm Technologies.
   11. Substitutions: See Section 01 6000 - Product Requirements.

B. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C 1289; Type I, aluminum foil both faces; Class 2, glass fiber-reinforced core.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Compressive Strength: 16 psi
   4. Board Size: 48 by 96 inch.
   5. Thermal Resistance: R-value of 5.7.
   6. Board Edges: Square.
   7. Manufacturers:
      a. Atlas Wall CI Board, division of Atlas Roofing Corporation; EnergyShield: www.atlasroofing.com.
      b. Dow Chemical Company: www.dow.com.
      c. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: - 5 (Class A), Smoke Developed - 35 (Class A), when tested in accordance with ASTM E84.
   2. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   3. Formaldehyde Content: Zero.
   4. Thermal Resistance: 3.5 inch = R-13, 5.5 inch = R-21, R-49 approximately 16".
   5. Thickness: Match wall thickness.

6. Sound Attenuation: STC of .43 - .50.
7. Manufacturers:
   a. CertainTeed Corporation: www.certainteed.com.
   b. Johns Manville: www.jm.com.
   c. Owens Corning Corp: www.owenscorning.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Sheet Vapor Retarder: Black polyethylene film for above grade application, 10 mil thick.

B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

C. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

D. Air Baffle: Soffit insulation baffle.
   1. Manufacturer: Berger Building Products 1-800-523-8852.
   2. Material: Non-porous PVC.
   3. Size: 41 x 22 inches.

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. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER - ONLY AT OVERHEAD DOORS

A. Install boards horizontally on foundation perimeter.

B. 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. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Extend boards over expansion joints, unbonded to wall on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof 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. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Staple or nail facing flanges in place at maximum 6 inches on center.

G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

H. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over member face.

I. Tape seal tears or cuts in vapor retarder.

J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

K. Install insulation baffles in soffit.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

3.07 SCHEDULES

A. Office Area Ceiling Insulation: R49 Fiberglass Insulation, in layers at right angles.

B. Reclamation Building and 3 Stall Addition: R-21 minimum (SIPS panel manufacturer's standard

C. Wall cavity spaces and cracks surrounding door and window frames. (1/2" or less caulk with sealant, 1/2" to 2" gap fill with Spray foam insulation. See section 07 2119)

D. Above Deck Insulation: EPDM Manufacturer's Recommended Rigid insulation on top of precast tees (R-38 minimum).

E. Rigid Insulation: Polyisocyanurate rigid insulation fill inside of hollow metal door and window frames on exterior walls

F. Rigid Insulation: Expanded Polystyrene Under hydronic slab heating tubing (R-10 minimum).

G. Rigid Insulation: Expanded Polystyrente Perimeter foundation walls at overhead doors and Reclamation Building (R-10 minimum)

END OF SECTION

SECTION 07 2119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. At precast concrete roof tees and wall joints
   2. In exterior wall crevices.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

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

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

E. 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).

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

1.05 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation: Class A Fire Rating
   1. BASF Corporation; WALLTITE US Series Closed Cell: www.spf.basf.com.
   2. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam: www.jm.com/sle.
   3. NCFI Polyurethanes: www.ncfi.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, open or closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Regulatory Requirements: Conform to applicable code for flame and smoke limitations.
   2. Aged Thermal Resistance: R-value of 5 (deg F hr sq ft)/Btu, minimum, when tested at 1 inch thickness in accordance with ASTM C518 after aging for 180 days at 41 degrees F.
   3. Water Vapor Permeance: Vapor retarder; 2 perm, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
   4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
   5. Air Permeance: 0.004 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.5 psf.

6. Closed Cell Content: At least 90 percent.
7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Overcoat: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

D. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

3.05 SCHEDULES

A. Spray foam at window and door joints when joint is greater than 1 1/2".

B. Spray foam precast concrete tees precast concrete exterior wall joints.

C. Spray foam at SIPS ceiling panel locations at all cavities.

END OF SECTION

SECTION 07 2500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Water-resistive barrier under exterior cladding.

B. Section 06 1000 - Rough Carpentry: Water-resistive barrier under exterior cladding.

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. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 30 - Antifungal Activity, Assessment on Textile Materials: Mildew and Rot Resistance of Textile Materials; 2013.

B. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.

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

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

G. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

H. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc; 2013.

I. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; ICC Evaluation Service, Inc; 2011.

J. 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 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

1.06 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. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.
   1. Use DuPont Tyvek Commercial Wrap unless otherwise indicated.
   2. Under siding, use one layer of DuPont Tyvek Commercial Wrap, unless otherwise noted.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
   3. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 180 days weather exposure.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   5. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
   6. Products:
      a. DuPont Building Innovations; Tyvek Commercial Wrap with FlexWrap NF, StraightFlash, and Tyvek Tape: www.dupont.com.
      b. Fiberweb, Inc; Typar MetroWrap: www.typar.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 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. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Products:
      a. DuPont Building Innovations; FlexWrap NF: www.dupont.com.
      b. DuPont Building Innovations; StraightFlash: www.dupont.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

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.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.

4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
5. Install water-resistive barrier over jamb flashings.
6. Install air barrier and vapor retarder UNDER jamb flashings.
7. Install head flashings under weather barrier.
8. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

E. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches 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 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 wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches 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 4000 - Quality Requirements, for additional requirements.

B. Do not cover installed weather barriers until required inspections have been completed.

C. 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.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION

SECTION 07 4113
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed steel panels.

B. Fastening system.

C. Factory finishing.

D. Accessories and miscellaneous components.

1.02 RELATED REQUIREMENTS

A. Section 03 4100 - Precast Structural Concrete: Installing recessed flashing reglets.

B. Section 05 1200 - Structural Steel Framing: Roof framing and purlins.

C. Section 06 1000 - Rough Carpentry: Roof sheathing.

D. Section 07 9005 - Joint Sealers: Field-installed sealants.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

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 C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
   1. Include typical panel joint in sample.
   2. Include typical fastening detail.

E. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Iowa Department of Transportation's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Finish Warranty: Provide manufacturer’s special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence

of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 5 year period from date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Roof Panels:
   1. McElroy Metal, Inc., www.mcelroymetal.com
   2. Behlen Manufacturing Co.: www.behlenbuildingsystems.com.
   3. MBCI , www.mbci.com
   4. Merchant & Evans, Inc., www.ziprib.com
   5. Chief Buildings: www.chiefbuildings.com

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Steel Thickness: Minimum 24 gage (0.024 inch).
   2. Maintenance Garage Profile: Standing seam, with minimum 1.0 inch seam height; concealed fastener system for field seaming with special tool.
   3. Pole Building Profile: Lapped seam, with exposed fastener system.
   4. Texture: Smooth.
   5. Width:
      a. Maximum panel coverage of 24 inches at Brine/Reclamation Building and Pole Building.
      b. Maximum panel coverage of 16 inches at Main Garage Office Area

2.03 ATTACHMENT SYSTEM

A. Maintenance Garage Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

B. Brine/Reclamation Building and Pole Building Exposed System: Provide manufacturer's recommended stainless steel fasteners engineered to meet performance requirements and equipped with appropriate sealant separators to provide weathertight connections that will accommodate anticipated thermal movement.

2.04 PANEL FINISH

A. Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil; color and gloss to match sample.

2.05 ACCESSORIES AND MISCELLANEOUS ITEMS

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:

1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Snow/Ice guards on metal roof as shown on drawings.

2.06 FABRICATION

A. Panels: Fabricate panels and accessory items at factory, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Factory-install captive gaskets, sealants, or separator strips at panel joints to provide weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

C. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Install roofing system with exposed fasteners prefinished to match panels.
   3. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.
   2. Incorporate concealed clips at panel joints, and apply snap-on battens to provide weathertight joints.
   3. Provide sealant tape or other approved joint sealer at lapped panel joints.
   4. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

3.06 SCHEDULE

A. Brine/Reclamation Building Roof- Exposed System

B. Pole Building Roof - Exposed System

C. Alternate #1, 3 bay addition to pole building- Exposed System

D. Maintenance Garage Roof - Concealed System

END OF SECTION

SECTION 07 4213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for walls and soffits, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wall panel substrate.

B. Section 07 2500 - WEATHER BARRIERS: Weather barrier under wall panels.

C. Section 07 9005 - Joint Sealers.

1.03 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. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

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

1.04 DESIGN REQUIREMENTS

A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall . Design pressure of 30 lb/sq ft.

B. Maximum Allowable Deflection of Panel: 1/90 of span.

C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

E. Products: Provide continuity of thermal barrier at building enclosure elements .

F. Provide continuity of air barrier and vapor retarder seal at building enclosure elements in conjunction with materials specified in Section 07 2500.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage.

C. Samples: Submit two samples of wall panel and soffit panel, 4 inch by 4 inch in size illustrating finish color, sheen, and texture.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off ground and protected from weather. Prevent twisting, bending, or abrasion, and provide ventilation to stored materials. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after the Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Correct defective Work within a five year period after the Date of Substantial Completion, including defects in water tightness and integrity of seals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Manufacturers:
   1. McElroy Metal, Inc; www.mcelroymetal.com
   2. MBCI: www.mbci.com.
   3. Metal Sales Manufacturing Corporation; TLC Panel: www.metalsales.us.com.
   4. Behlen Manufacturing Co; www.behlenbuildingsystems.com
   5. Butler Manufacturing Co.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior panels, interior liner panels, soffit panels, and subgirt framing assembly.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Maximum Allowable Deflection of Panel: 1/90 of span.
   4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   7. Corners: Factory-fabricated in one continuous piece with minimum 18 inch returns.
   8. Exterior Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.
   9. Exterior Panel Back Coating: Panel manufacturer's standard siliconized polyester wash coat.

B. Exterior Panels:
   1. Profile: Vertical; style as indicated.
   2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
   3. Material: Precoated steel sheet, 24 gage, 0.0239 inch minimum thickness.
   4. Panel Width: 24 inches.
   5. Color: As selected by Architect from manufacturer's standard line.

C. Soffit Panels:
   1. Profile: Style as indicated.
   2. Material: Precoated steel sheet, 24 gage, 0.0239 inch minimum thickness.
   3. Color: As selected by Architect from manufacturer's standard line.

D. Subgirts:
   1. Profile as indicated; to attach panel system to building.

E. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

F. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

G. Anchors: Galvanized steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

C. Sealants: As specified in Section 07 9005.

2.05 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest practicable lengths.

C. Fabricate corners in one continuous piece with minimum 18 inch returns.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that weather barrier has been installed over substrate completely and correctly.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.03 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports. Lap panel ends minimum 2 inches.

E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.06 SCHEDULE

A. Pole Building and Alternate #1, 3 Bay heated Addition: Walls

END OF SECTION

SECTION 07 4633
PLASTIC SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vinyl siding and trim.

B. Metal soffit and trim.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Siding substrate.

B. Section 06 1000 - Rough Carpentry: Water-resistive barrier under siding.

C. Section 07 2100 - Thermal Insulation: Insulation board applied over sheathing before siding installation.

D. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.

D. ASTM D3679 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding; 2013.

E. ASTM D4477 - Standard Specification for Rigid (Unplasticized) Poly(Vinyl Chloride) (PVC) Soffit; 2009.

F. ASTM D5206 - Standard Test Method for Windload Resistance of Rigid Plastic Siding; 2013.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 3000.

B. See Section 01 3000 - Administrative Requirements, for submittal procedures.

C. 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. Installation methods.

D. Color Charts: Where colors are not specified, provide samples of manufacturer's entire color line for selection.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Not less than 3 years of experience with products specified.

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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Alside, Inc: www.alside.com.

B. CertainTeed Corporation: www.certainteed.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. General Requirements:
   1. Siding: Comply with ASTM D3679.
   2. Soffit: Comply with ASTM D4477.
   3. Wind Resistance: Capable of withstanding minimum of 30 psf negative pressure, when tested in accordance with ASTM D5206.
   4. Horizontal Flammability, when tested in accordance with ASTM D635:
      a. Burn Distance: 0.79 inch, maximum.
      b. Burn Time: Less than 5 seconds.

B. Horizontal Vinyl Siding:
   1. Profile: Dutchlap, Single 4-1/2-Inch; 4-1/2 inches wide; 4-1/2 inch exposure.
   2. Thickness: 0.038 inch, minimum.
   3. Length: 12 feet, minimum.
   4. Nailing Hem: Single layer, with 1-1/8 inch long nail holes at maximum 18 inches on center.
   5. Finish: Smooth.
   6. Color: As selected by Architect from manufacturers full range of available colors.

C. Metal Soffit :
   1. Profile: pencil rib.
   2. Thickness: 0.038 inch, minimum.
   3. Length: 12 feet, minimum; where available, provide up to 12 foot by 12 foot panels.
   4. Nailing Hem: Single layer, with 1-1/8 inch long nail holes at maximum 18 inches on center.
   5. Finish: Smooth.
   6. Color: Match siding.

D. Accessories: Provide coordinating accessories made of same material as required for complete and proper installation whether or not specifically shown on the drawings.
   1. Color: Match adjacent siding or soffit panels.
   2. Length:
      a. Corner Posts: 10 feet, minimum.
      b. Other Trim: 12.5 feet, minimum.
   3. Profiles: Provide types as indicated on drawings.

E. Fasteners: Aluminum nails, alloy 5056 or 6110, with minimum tensile strength of 63,000 pounds per square inch; length as required to penetrate framing at least 3/4 inch.

F. Joint Sealers: As specified in Section 07 9005.

G. Exterior Soffit Vents: One piece, perforated, ASTM B221 (ASTM B221M), 6063 alloy, T5 temper, aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate conditions before beginning installation; verify dimensions and acceptability of substrate.

B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

C. Do not proceed with installation until unacceptable conditions have been corrected.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install siding, soffit, and trim in accordance with manufacturer's printed installation instructions.

B. Attach securely to framing, not sheathing, with horizontal components true to level and vertical components true to plumb, providing a weather resistant installation.

C. Install joint sealers between siding/soffit/trim and adjacent construction, using procedures specified in Section 07 9005.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations shown on the drawings. Provide vent area shown on drawings.

E. Clean dirt from surface of installed products, using mild soap and water.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

3.04 SCHEDULE

A. BRINE/RECLAMATION BUILDING WALLS

END OF SECTION

SECTION 07 5300
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane, fully adhered conventional application.

B. Insulation, to match roof deck slope.

C. Flashings.

D. Roofing cant strips and stack boots.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.

B. Section 07 2100 - Thermal Insulation: Rigid insulation over membrane waterproofing.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets, and Parapet Cap.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

E. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).

F. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.

G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).

H. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

J. FM DS 1-28 - Wind Design; 2007.

K. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of associated counterflashings installed under other sections.

B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and membrane layout and seam locations.

D. Samples for Verification: Submit two samples 6x6 inches in size. .

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, and wind velocity during application.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NRCA ML104 and manufacturer's instructions.
   1. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience and approved by manufacturer.

1.07 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. Protect foam insulation from direct exposure to sunlight.

1.08 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.

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 or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide 20 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:
   1. Carlisle Roofing Systems, Inc; Sure-White EPDM: www.carlisle-syntec.com.
   2. Firestone Building Products Co: RubberGard White EPDM, www.firestonebpco.com.
   3. GenFlex Roofing Systems: Flex White EPDM, www.genflex.com.
   4. Versico, a division of Carlisle Construction Materials Inc; VersiGard White EPDM: www.versico.com.
   5. Mule-Hide Products Co, Inc: www.mulehide.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation:
   1. Atlas Roofing Corporation: www.atlasroofing.com.
   2. GAF: www.gaf.com/sle.
   3. Dow Chemical Co: www.dow.com.
   4. Owens Corning Corporation: www.owenscorning.com.
   5. Versico, a division of Carlisle Construction Materials Inc; SecurShield Insulation: www.versico.com/sle.

6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over insulation.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); non-reinforced; complying with minimum properties of ASTM D 4637.
   1. Thickness: 0.060 inch.
   2. Sheet Width: 24 inch, minimum; factory-fabricate into largest sheets possible.
   3. Color: White.
   4. Tensile Strength: 1305 psi, measured in accordance with ASTM D412.
   5. Ultimate Elongation: 300 percent minimum, measured in accordance with ASTM D412.
   6. Hardness: 65 +/-10, measured in accordance with ASTM D2240, using Type A durometer.
   7. Tear Strength: 150 lbf/in, measured in accordance with ASTM D624.
   8. Water Absorption: +3.6 percent increase in weight, maximum, measured in accordance with ASTM D 471 7 day immersion change in mass.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane: Fully adhered.

D. Flexible Flashing Material: Same material as membrane; conforming to the following:
   1. Thickness: 0.060 inch.
   2. Tensile Strength: 1,305 psi.

2.04 INSULATION

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type I, aluminum foil both faces; Class 2, glass fiber-reinforced foam core and with the following characteristics:
   1. Compressive Strength: 16 psi
   2. Board Size: 48 by 96 inch.
   3. Board Thickness: 1 1/2" to 2 1/2" inch.
   4. Thermal Resistance: Multi-layered to provide R-value of 38 average insulation value.
   5. Board Edges: Square.
   6. Manufacturers:
      a. Atlas Roofing Corporation: www.atlasroofing.com.
      b. Dow Chemical Company: www.dow.com.
      c. GAF; EnergyGuard PolyIso Insulation: www.gaf.com/sle.
      d. Hunter Panels, LLC; H-Shield: www.hpanels.com.
      e. Versico, a division of Carlisle Construction Materials Inc; SecurShield Insulation: www.versico.com/sle.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

C. Insulation Fasteners: Appropriate for purpose intended.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Insulation Adhesive: As recommended by insulation manufacturer.

F. Sealants: As recommended by membrane manufacturer.

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 nailing strips are in place.

3.02 CONCRETE DECK PREPARATION

A. Verify adjacent precast concrete roof members do not vary more than 1/4 inch 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 VAPOR RETARDER AND INSULATION - UNDER MEMBRANE

A. Attachment of Insulation:
   1. Embed first layer of insulation in full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.
   2. Fully adhere each subsequent layer of insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

D. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

E. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

F. Do not apply more insulation (minimum insulation R-38) than can be covered with membrane in same day.

3.04 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. Fully Adhered Application: Apply adhesive to substrate at rate required by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.06 CLEANING

A. Remove bituminous markings from finished surfaces.

B. 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.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials, using 5/8 inch exterior grade plywood over 1 1/2 inch rigid insulation board.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.

B. Sealants for joints within sheet metal fabrications.

C. Reglets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 06 1000 - Rough Carpentry: Wood blocking for batten seams.

C. Section 07 4113 - Metal Roof Panels: Roofing system.

D. Section 07 7123 - Manufactured Gutters and Downspouts.

E. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

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 C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

F. CDA A4050 - Copper in Architecture - Handbook; current edition.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 3 years of documented 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.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage (0.0239) inch 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 Architect from manufacturer's standard colors.

2.02 ACCESSORIES

A. Fasteners: Galvanized steel .

B. Primer: Zinc molybdate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

F. Sealant: Type 1 specified in Section 07 9005.

G. Plastic Cement: ASTM D4586/D4586M, Type I.

H. Reglets: Recessed type, sawn into precast concrete walls. Keep sawn reglets straight and parallel to roofing edge. See detail sheets.

2.03 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. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch 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. Fabricate flashings to allow toe to extend 2 inches over roofing . Return and brake edges.

2.04 FACTORY FINISHING

A. PVDF (polyvinylidene fluoride) top coat: Multiple-layer, thermally cured, fluoropolymer system conforming to AAMA 2604.

B. Primer Coat: Manufacturer's standard system, compatible with finish system.

PART 3 EXECUTION

3.01 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.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Insert flashings into reglets to form tight fit. Secure in place with plastic wedges. Seal flashings into reglets with sealant.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

A. Flashing in precast concrete: 24-gauge Pre-finished Galvalume steel, color to match window and door frames, bituminous back-paint.

B. Scuppers: 24-gauge Pre-finished Galvalume steel, color to match downspouts, bituminous back-paint.

C. Coping, Cap, and Parapet Flashings: 24-gauge Pre-finished Galvalume steel, color to match standing-seam metal roofing, bituminous back-paint.

D. Counterflashings at Roofing Terminations (over roofing base flashings): EPDM

E. Pipe and vent boots: EPDM screwed to roofing and sealed with sealant.

F. Reclamation Building, and Pole Building eave and gable fascia: Factory-fabricated, pre-finished metal fascia. Attach using fasteners colored to match. Color: As selected.

G. Reclamation Building, and Pole Building soffits: Factory-fabricated, pre-finished, and perforated soffit metal. Attach using fasteners colored to match. Color: As selected.

H. Pipe and vent boots: EPDM screwed to roofing and sealed with sealant.

END OF SECTION

SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

1.02 RELATED REQUIREMENTS

A. Section 07 4113 - Metal Roof Panels: Standing Seam Metal Roofing.

B. Section 07 6200 - Sheet Metal Flashing and Trim.

C. Section 09 9113 - Exterior Painting: Field painting of metal surfaces.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

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 A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

E. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

H. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Conform to SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Conform to applicable code for size and method of rain water discharge.

C. Maintain one copy of each document on site.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

C. Product Data: Provide data on prefabricated components.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gutters and Downspouts:
   1. ATAS International, Inc: www.atas.com.
   2. Cheney Flashing Company: www.cheneyflashing.com.

3. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc.: www.saf.com/persys.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Polyvinyl Chloride (PVC): ASTM D2665, virgin vinyl, SDR 35 pipe and fittings, high impact type, colorfast; color as selected.

B. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch thick.
   1. Finish: Plain, shop pre-coated with modified silicone coating.
   2. Color: As selected from manufacturer's standard colors.

C. Primer: Zinc molybdate type.

D. Protective Backing Paint: Zinc molybdate alkyd.

2.03 COMPONENTS

A. Gutters: SMACNA rectangular style profile.

B. Downspouts: SMACNA Rectangular profile.

C. Connectors: Furnish required connector pieces for PVC (polyvinyl chloride) components.

2.04 ACCESSORIES

A. Splash Blocks: Precast concrete type, size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

B. Downspout Boots: Plastic.

2.05 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.06 FINISHES

A. Modified silicone polyester coating: Baked enamel system conforming to AAMA 2603.

B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters 1/8 inch per foot, 1 percent minimum.

C. Connect downspouts to downspout boots at 6 inches minimum above grade. Seal connection watertight.

D. Connect downspouts to storm sewer system except as noted on drawings to have spalch blocks. Seal connection watertight.

END OF SECTION

SECTION 07 7200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof hatches.

1.02 RELATED REQUIREMENTS

A. Section 07 4113 - Metal Roof Panels.

B. Section 07 7123 - Manufactured Gutters and Downspouts.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project. Show dimensioned location and number for each type of roof accessory.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Iowa Department of Transportation's name and registered with manufacturer.

PART 2 PRODUCTS

2.01 ROOF HATCHES

A. Manufacturers - Roof Hatches:
   1. Bilco Company; Model NB-50TB: www.bilco.com/sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Hatches and Smoke Vents, General: Factory-assembled steel frame and cover, complete with operating and release hardware.
   1. Mounting: Provide frames and curbs suitable for mounting conditions indicated on the drawings.
   2. Thermally Broken Hatches: Added insulation to frame and cover; available in all manufacturer's standard, single leaf sizes; special sizes available upon request
   3. For Ships Ladder Access: Single leaf; 30 by 54 inches.

C. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Galvanized steel, 14 gage, 0.0747 inch thick.
   2. Finish: Factory prime paint.
   3. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.

D. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.
   4. Latch: Upon closing, engage latch automatically and reset manual release.
   5. Manual Release: Pull handle on interior.
   6. Locking: Padlock hasp on interior.

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 Architect of unsatisfactory preparation before proceeding.

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. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 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

SECTION 07 8123
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 1200 - Structural Steel Framing.

B. Section 05 2100 - Steel Joist Framing.

C. Section 07 8100 - Applied Fireproofing: Conventional cementitious and mineral fiber fireproofing.

D. Section 09 9123 - 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 3000 - 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 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 100 sq ft of steel in areas designated by Architect.
   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 Architect.
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 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 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Intumescent Fireproofing:
1. Albi Manufacturing Division of StanChem Inc: www.albi.com.
2. Carboline Company; A/D Firefilm III: www.carboline.com.
3. Substitutions: See Section 01 6000 - 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).

2.03 MATERIALS

A. Fire Resistive 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: 25, maximum.
   b. Smoke Developed Index: 50, maximum.
2. For Interior Use:
   a. Hardness: 45, minimum, when tested in accordance with ASTM D2240, Type D durometer.

B. Sealers and Primer: As required by tested and listed assemblies, and as recommended by fireproofing manufacturer to suit specific substrate conditions.

C. Finish: As selected by Architect from manufacturer's standard finish.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.04 ACCESSORIES

A. Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

C. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

D. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

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. If substrate preparation is the responsibility of another installer, notify Architect 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. Apply coats at manufacturer’s recommended rate to achieve dry film thickness required for fire resistance ratings designated for each condition.

D. Apply intumescent fireproofing by spraying to maximum extent possible. If necessary, complete coverage by roller application or other method acceptable to manufacturer.

E. Achieve uniform finished appearance complying with approved mock-up.

F. Coordinate application of fireproofing with the other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

G. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

H. Spray apply fireproofing 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 fireproofing manufacturer.

I. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

J. For applications over encapsulant materials, including lockdown encapsulant, apply fireproofing that differs in color form that of encapsulant over which it is applied.

K. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

L. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

M. Cure fireproofing according to fireproofing manufacturer's written recommendations.

N. Where indicated , apply fireproofing to produce the following finishes:
   1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected
   2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
   3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
   4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.
   5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish o smooth out the texture, eliminate surface markings, and square off edges.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000 - 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 Architect.

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.

3.07 SCHEDULE

A. Provide intumescent fire protection on steel column located in Office Area only.

END OF SECTION

SECTION 07 8400
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 09 2116 - 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. ITS (DIR) - Directory of Listed Products; current edition.

D. FM 4991 - Approval Standard for Firestop Contractors; 2013.

E. FM (AG) - FM Approval Guide; current edition.

F. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

H. UL (FRD) - Fire Resistance Directory; current edition.

1.04 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.05 SUBMITTALS

A. See Section 01 3000 - 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. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 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.
   2. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:.
   2. With minimum 3 years documented experience installing work of this type.
   3. Licensed by authority having jurisdiction.

1.07 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 FIRESTOPPING - GENERAL REQUIREMENTS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.02 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Penetrations Through Walls By:
   1. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. Insulated Pipes:
      a. 1 Hour Construction: UL System W-J-5028; Hilti FS-ONE Intumescent Firestop Sealant.
   3. HVAC Ducts, Insulated:
      a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.03 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Penetrations By:
   1. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System W-L-1206; Hilti FS-ONE Intumescent Firestop Sealant.
   2. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   3. Insulated Pipes:
      a. 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
   4. HVAC Ducts, Insulated:
      a. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

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 and damming 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. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

E. Apply firestopping material, in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

F. Compress fibered material to maximum 40 percent of its un-compressed size.

G. Place intumescent coating in sufficient coats to achieve rating required.

H. Remove dam material after firestopping material has cured.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Clean adjacent surfaces of firestopping materials.

B. Protect adjacent surfaces from damage by material installation.

3.06 SCHEDULES

Type Fire Rating	
Fire-rated precast concrete roof:	1 hour

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Firestopping sealants.

B. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.

C. Section 32 1313 - Concrete Paving

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 D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).

F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Manufacturer's Installation Instructions: Indicate surface preparation and perimeter conditions requiring special attention.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 3 years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.

1. Color: Standard colors matching finished surfaces.
2. Polyurethane Products:
   a. BASF Construction Chemicals-Building Systems; Sonolastic NP2: www.buildingsystems.basf.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

C. Type 2 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.

D. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.

E. Type 5 - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
1. Color: Gray.
2. Applications: Use for:
   a. Joints in sidewalks and vehicular paving.
3. Products:
   a. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
   b. BASF Construction Chemicals-Building Systems; MasterSeal SL-1: www.buildingsystems.basf.com.
   c. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com.
   d. Substitutions: See Section 01 6000 - Product Requirements.

F. Type 4 - Self-Leveling Polysulfide Sealant: ASTM C920, Grade P, Class 25, Uses T, I, M, A, O; two component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, self-leveling type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

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 where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

3.06 SCHEDULE

A. Exterior Joints for Which No Other Sealant Type is Indicated: Type 1 .

B. Construction and Expansion Joints in Sidewalks, Parking, and Driveway Paving: Type 5.

C. Lap Joints in Exterior Sheet Metal Work: Type 2.

D. Perimeter of aluminum door and window frames: Type 1.

E. Under Exterior Door Thresholds: Type 1.

F. Interior Joints for Which No Other Sealant is Indicated: Type 1.

G. Control and Expansion Joints in Interior Concrete Slabs and Floors: Type 5.

H. Joints Between Plumbing Fixtures and Walls and Floors, and Between Countertops and Walls: Type 3.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

C. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

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 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.

I. 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.

J. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

L. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

N. ITS (DIR) - Directory of Listed Products; current edition.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

Q. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

R. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2013.

S. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

T. NAAMM HMMA 862 - Guide Specifications for Commercial Security Hollow Metal Doors and Frames; 2013.

U. NAAMM HMMA 863 - Guide Specifications for Detention Security Hollow Metal Doors and Frames; 2014.

V. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Doors and Frames; 2013.

W. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

X. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

Y. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

Z. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

AA. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

AB. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - 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; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes installation requirements.

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.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.08 COORDINATION

A. Section 01 3000 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with door opening construction and door hardware installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Assa Abloy Curries: Model 777E,with Curries Thermal Hollow Metal Frame used as basis of design. www.assaabloydss.com.
   2. Assa Abloy CECO Trio-E, with CECO Thermal Hollow Metal Frame.
   3. Substitutions: See Section 01 6000 - 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. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. 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.
8. Zinc Coating for Typical Interior and/or Exterior Locations: 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.
9. Finish: Factory primed, for field finishing.

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.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Grade: Curries Trio-E Door used as basis of design.
   2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
   3. Door Thickness: 1-3/4 inch, nominal.
   4. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
   5. Insulating Value: U-value of 0.29, when tested in accordance with ASTM C1363.
   6. Weatherstripping: Refer to Section 08 7100.

B. Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
   2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
   3. Door Thickness: 1-3/4 inch, nominal.

C. Panels: Same construction, performance, and finish as doors.

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. General:
   1. Comply with the requirements of grade specified for corresponding door.
      a. Frames for Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
   2. Finish: Same as for door.

3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

C. Exterior Door Frames: Knock-down type.
1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness. 18 Gage.
2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
3. Thermal break Gasket
4. Weatherstripping: Separate, see Section 08 7100.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

E. Door Frames, Fire-Rated: Knock-down type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed.

B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

C. 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.

D. Drip Edge: Weld at head of jamb on exterior doors.

2.06 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating on openings in concrete or masonry only.

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. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Coordinate installation of hardware.

F. Coordinate installation of glazing.

G. Coordinate installation of electrical connections to electrical hardware items.

H. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified door and frame standards or custom guidelines indicated.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.06 SCHEDULE

A.

Opening Number	Wall Type	Door Type Interior/Exterior	
100A	Precast Wall Entry Door	Exterior	Insulated
101A	Masonry Wall Passage Door	Interior	Insulated
102A	Masonry Wall Passage Door	Interior	
103A	Masonry Wall Passage Door	Interior	
104A	Masonry Wall Passage Door	Interior	
105A	Precast Wall Passage Door	Interior	
106A	Masonry Wall Passage Door	Interior	
107A	Masonry Wall Passage Door	Interior	
108A	Masonry Wall Passage Door	Interior	
109A	Masonry Wall DBL Passage Door	Interior	
109B	Precast Wall Entry Door	Interior	
110A	Precast Wall Entry Door	Exterior	Insulated
110B	Precast Wall Entry Door	Exterior	Insulated
110C	Precast Wall Entry Door	Exterior	Insulated
110D	Precast Wall Entry Door	Exterior	Insulated
111A	Precast Wall Entry Door	Exterior	Insulated
111B	Precast Wall Entry Door	Exterior	Insulated
112A	Masonry Wall Dbl Passage Door	Interior	
113A	Masonry Wall Dbl Passage Door	Interior	
201A	Precast Wall Passage Door	Interior	
202A	Masonry Wall Passage Door	Interior	
203A	Masonry Wall Passage Door	Interior	
P100A	Wood Wall Entry Door	Exterior	Non-Insulated
P100B	Wood Wall Entry Door	Exterior	Non-Insulated
P101A addn)	Wood Wall Entry Door	Exterior	Insulated (Alt. #1-3 bay

3.07 DOOR TYPES

A. Precast Wall Exterior Entry Door: Insulated steel door with Thermal Break Hollow Metal Frame; 36 x 84 inches, glazed design as indicated on Drawings; with thermally-broken, low-profile threshold. Frames will be anchored to pre-cast concrete. See section 08 7100 for hardware and closer specifications

B. Masonry Wall Interior Passage Door: Steel door with metal frame, construction; 36 x 84 inches, flush design. Frame shall be flush to masonry wall surface, and grouted. Equip with closer and silencers. No threshold. See section 08 7100 for hardware and closer specifications.

C. Precast Wall Interior Passage Door: Steel door with metal frame, construction; 36 x 84 inches, flush design. Frame shall be Anchored to Precast wall surface. Equip with closer and silencers. No threshold. See section 08 7100 for hardware and closer specifications

D. Masonry Double Passage Door: Double-leaf Steel doors in metal frame, 72 x 84 inches. Flush design, no center mullion, with astragal, with surface-mounted vertical rod exit device, closers and coordinator. No threshold. Frame shall be flush masonry wall surface and grouted. See section 08 7100 for hardware and closer specifications.

E. Framed Wall Exterior Entry Doors: Steel Door with metal frame, non-rated construction; 36 x 84 flush design. Equip with closer and silencers, threshold. See Section 08 7100 for hardware and other specifications.

END OF SECTION

SECTION 08 1613
FIBERGLASS DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic (FRP) doors.

B. Frames for fiberglass reinforced plastic doors.

C. Hinges and other door hardware.

D. Accessories.

1.02 REFERENCE STANDARDS

A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.

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

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard details, installation instructions, and hardware and anchor recommendations.

C. Shop Drawings: Show layout and profiles; include assembly methods.
   1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
   2. Indicate wall conditions, door and frame elevations, sections, materials, gages, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on Drawings to identify details and openings.

D. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

E. Verification Samples: Submit door surface samples for each finish specified, 10 inch by 10 inch in size, illustrating finishes, colors, and textures.

F. Maintenance Data: Include instructions for repair of minor scratches and damage.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Iowa Department of Transportation's name and registered with manufacturer; include detailed terms of warranty.

H. Maintenance Materials: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Package products with protective covering and identify with descriptive labels.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than 3 years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with not less than 3 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
   1. Store at temperature and humidity conditions recommended by manufacturer.
   2. Do not use non-vented plastic or canvas shelters.
   3. Immediately remove wet wrappers.

C. Store in position recommended by manufacturer, elevated minimum 4 inch above grade, with minimum 1/4 inch space between doors.

1.07 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty covering materials and workmanship, including degradation or failure due to chemical contact.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laminated Fiberglass Doors:
   1. Ceco Door Products: www.cecodoor.com.
   2. Corrim Company: www.corrim.com.
   3. Fib-R-Dor: www.fibrdor.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.
   1. Door and frame pre-assembled, complete with hinges; shipped with braces, spreaders, and packaging as required to prevent damage.
   2. Mechanical Durability: Tested to ANSI/SDI A250.4 Level A (1,000,000 cycles), minimum; tested with hardware and fasteners intended for use on project.
   3. Screw-Holding Capacity: Tested to 900 psi, minimum.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A; when tested in accordance with ASTM E84.
   5. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
   6. Chemical Resistance: Resist degradation due to exposure to tap water and distilled water.
      a. Brine making components.
   7. Sizes: As indicated on drawings.
   8. Clearance Between Door and Frame: 1/8 inch, maximum.
   9. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.
   10. Provide frame anchors that allow for variation in rough opening size; do not field cut doors or frames to fit.

2.03 COMPONENTS

A. Doors: Through-color gel coating on fiberglass reinforced polyester resin construction with reinforced core.
   1. Thickness: 1-3/4 inches, overall.
   2. Door Construction: Fiberglass faces laminated to core with subsequently applied gel coating, or molded in one piece including gel coating on all sides.

3. Subframe and Reinforcements: Resin impregnated kraft honeycomb, Polyproylan honeycomb, and Polyisocyanurate foam..
4. Waterproof Integrity: All edges, cut-outs, and hardware preparations factory fabricated of fiberglass reinforced plastic; provide cut-outs with joints sealed independently of glazing or louver inserts or trim.
5. Hardware Preparations: Factory reinforce, machine, and prepare for all hardware including field installed items; provide solid blocking for each hardware item; make field cutting, drilling or tapping unnecessary; obtain manufacturer's templates for hardware preparations.
6. Bottom Rail: Provide height necessary to allow up to 1-1/4 inches to be field cut off bottom of door without impairing door strength or durability.
7. Gel Coating: Ultraviolet stabilized polyester, marine grade NPG-isophthalic, with slightly textured semi-gloss final finish.
8. Gel Coating Thickness: Minimum 15 mils wet, plus/minus 3 mils.
9. Gel Coating Color: As selected from manufacturer's standard colors.
10. Thermal insulation value of door: R-11 at foam core (U-value = 0.09)

B. Frames: Profiles and dimensions as indicated on drawings; same type and construction used in mechanical durability test for doors.
1. Construction for Non-Fire-Rated Doors: Use one of the following:
a. Molded fiberglass with gel-coating matching doors.
b. Fiberglass pultrusions with gel-coating matching doors
c. Fiberglass pultrusions primed for field painting.
2. Corner Joints: Mitered with concealed corner blocks or angles of same material as frame; fiberglass and aluminum joined with screws; steel and stainless steel spot welded; sealed watertight with silicone sealant.
3. At hardware cut-outs provide continuous backing or mortar guards of same material as frame, sealed watertight.
4. Frame Anchors: Stainless steel, Type 304; provide 3 anchors in each jamb for heights up to 84 inches with one additional anchor for each additional 24 inches in height.

C. Hinge and Hardware Fasteners: Stainless steel, Type 304; wood screws.

2.04 ACCESSORIES

A. Glazing and Louver Stops: Pultruded fiberglass unless otherwise indicated or required by fire rating; provided by door manufacturer to fit factory made openings, color and texture to match door; fasteners not penetrating waterproof integrity.
1. Glazed Openings: Provide removable stops on one side.
2. Opening Sizes: As indicated on drawings.

B. Thresholds: Pultruded fiberglass, with skid resistant surface, full width of door opening, 1/2 inch high by 6 inches wide; same color as frame.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean and prepare substrate in accordance with manufacturer's directions.

C. Protect adjacent work and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

C. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints; fill jambs with grout as walls are laid up.

D. In stud walls, install frames prior to building walls; anchor frames to studs using concealed anchors.

E. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

F. Repair or replace damaged installed products.

3.04 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.05 CLEANING

A. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

3.07 DOOR TYPE

A. Framed wall with siding exterior entry door (Reclamation Building): fiberglass door with weather stripped metal frame 36" x 84" with thermally broken, frame anchored to slab, low profile threshold.

B. Corrosion resistant frame and door on all fiberglass doors.

Schedule: Reclamation Building Only

101A	Wood Wall Entry Door	Exterior
103A	Wood Wall Passage Door	Interior
103C	Wood Wall Entry Door	Exterior
103D	Wood Wall Entry Door	Exterior

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall access door and frame units.

B. Access door and frame units, fire-rated, in wall and ceiling locations.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

1.05 COORDINATION

A. Coordinate Work under provisions of Section 01 3000 - Administrative Requirements.

B. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

PART 2 PRODUCTS

2.01 ACCESS DOOR AND PANEL APPLICATIONS

A. Walls, Unless Otherwise Indicated:
   1. Material: Steel.
   2. Size: 12 by 12 inch, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.
   5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.

B. Fire Rated Walls: See drawings for wall fire ratings.
   1. Material: Steel.
   2. Size: 12 by 12 inch, unless otherwise indicated.
   3. Uninsulated, single thickness door panel.
   4. Tool-operated spring or cam lock; no handle.

C. Fire Rated Ceilings: See drawings for ceiling fire ratings.
   1. Material: Steel.
   2. Size: 22" x 34" inch, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.

2.02 MANUFACTURERS

A. Wall and Ceiling Access Doors:
   1. Acudor Products Inc: www.acudor.com.
   2. Karp Associates, Inc: www.karpinc.com.
   3. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESS DOORS AND PANELS

A. Units in Fire Rated Assemblies: Fire rating equivalent to the fire rated assembly in which they are to be installed.
   1. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.
   2. Provide certificate of compliance from authority having jurisdiction indicating approval of fire rated doors.

2.04 WALL AND CEILING UNITS

A. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
   1. Door Style: Single thickness with rolled or turned in edges.
   2. Frames: 16 gage, 0.0598 inch, minimum.
   3. Single Thickness Steel Door Panels: 1/16 inch, minimum.
   4. Insulation: Non-combustible mineral or glass fiber.
   5. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly that access doors are being installed.
   6. Steel Finish: Primed, field painted.
   7. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
   8. Hardware:
      a. Hardware for Fire Rated Units: As required for listing.
      b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      c. Latch/Lock: Tamperproof tool-operated cam latch.
      d. Inside Latch Release: Mechanism that allows the panel to be opened from the inside.
      e. Gasketing: Extruded neoprene, around the perimeter of the door panel.

B. Fire Rated Door and Frame Units in Walls:
   1. In Precast:
      a. 1 hour A label fire rating.

C. Fire Rated Door and Frame Units in Ceilings:
   1. In Gypsum Board on Metal Furring:
      a. 1 hour A label fire rating.

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. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

D. Access frames installed in masonry shall be installed flush with masonry.

3.03 SCHEDULE

ROOM NO.	ROOM NAME	CEILING	FINISH
105	IT/COMM ROOM	ATTIC ACCESS	PAINTED (SEE DWGS)
103	RECLAMATION BLDG	ATTIC ACCESS	PAINTED (SEE DWGS)
P101	ALT #1 POLE BLDG	ATTIC ACCESS	PAINTED (SEE DWGS)

END OF SECTION

SECTION 08 3613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead insulated sectional doors, electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Rough wood framing for door opening.

B. Section 07 9005 - Joint Sealers: Perimeter sealant and backup materials.

C. Section 08 7100 - Door Hardware: Lock cylinders.

D. Section 08 8000 - Glazing: Glazing for door lights.

E. Section 09 9113 - Exterior Painting: Finish painting.

F. Section 26 0534 - Conduit: Empty conduit from control units to door operator.

G. Section 26 2717 - Equipment Wiring.

1.03 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. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011.

D. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

E. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.

F. NEMA MG 1 - Motors and Generators; 2014.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

C. Product Data: Show component construction, anchorage method, and hardware.

D. Samples: Submit two panel finish samples, illustrating color and finish.

E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.

F. Operation Data: Include normal operation, troubleshooting, and adjusting.

G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

H. 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 manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for electric motor and transmission.

D. Provide 10 year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Manufacturers:
   1. Clopay Corporation; Product Model 3720: www.clopaydoor.com.
   2. Wayne-Dalton, a Division of Overhead Door Corporation; Thermalspan 200: www.wayne-dalton.com.
   3. Overhead Door; Thermacore Model 592: www.overheaddoor.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DOOR COMPONENTS

A. Steel Doors: Stile and rail steel with solid panels construction with high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
   2. Door Nominal Thickness: 2 inches thick.
   3. Exterior Finish: Factory finished with acrylic baked enamel; color as selected by Architect.
   4. Interior Finish: Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
   5. Glazed Lights: Three glazed lights per panel , one row, 24 x 6 inches minimum, evenly spaced; set in place with resilient glazing channel.
   6. Operation: Electric.

B. Door Panels: Stile and rail construction, of steel sheet .0172 inch thick minimum, with welded joints; rabbeted weather joints at meeting rails.

C. Glazing: Annealed float glass; double pane, argon filled glass; clear; 5/8 inch thick.

D. Stiffener plates to be added to top two panels.

2.03 DOOR COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch thick; 3 inch wide, continuous one piece per side; High bay track galvanized steel mounting brackets 1/4 inch thick.

B. Rollers: Support rollers shall have stainless steel axels, sealed steel bearings, and High-Density-Polyurethane (HDPE) tires.

C. Hinge Assemblies: Heavy duty hinges and adjustable rollers holders and HDPE rollers of stainless steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side (Truck Storage and Mechanics Bay and Pole Building doors).

D. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
   1. For Manual Operation: Requiring maximum exertion of 25 lbs force to open.

E. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

F. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

G. Head Weatherstripping: EPDM rubber seal, one piece full length.

H. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

I. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Float Glass: Provide float glass glazing, unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).

C. Insulation: Foamed-in-place polyurethane, bonded to facing.
   1. R value of 17.5.

2.05 ELECTRICAL OPERATION (TYPE 1 OPERATORS)

A. Electrical Characteristics:
   1. 3/4 hp; manually operable in case of power failure, transit speed of 12 inches per second.
   2. 115 volts, single phase, 60 Hz.

B. Motor: NEMA MG1, Type 1 (Type 1 Operator), NEMA MG1, Type 4 and 12 with carwash modification (Type 2 Operator).

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

E. Electric Operator: Side mounted on cross head shaft (Type 1), adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.

F. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator. Waterproof three button, momentary type control in Wash Bay and Brine Building.
   1. 24 volt circuit.
   2. Surface mounted.
   3. Locate at inside door jamb (Operator Type 1).

G. Radio Control Antenna Detector.

H. Hand Held Transmitter: (Type 1 Operators) Digital control, resettable.
   1. Provide 20) programmable 4 button operators.

I. Photo Electric Sensor: furnish system to detect obstructions and reverse door without requiring door to contact obstruction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Install treated lumber frame construction. See plans for location of lumber.

C. Anchor assembly to wood frame construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

G. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9005.

H. Install perimeter trim and weatherstripping.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch in ten feet.

B. Maximum Variation from Level: 1/16 inch in ten feet.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

3.08 SCHEDULE

Opening No.:	Door Type	Operator Type
110E	HDPE	Type 1
110F	HDPE	Type 1
110G	HDPE	Type 1
110H	HDPE	Type 1
110J	HDPE	Type 1
110K	HDPE	Type 1
110L	HDPE	Type 1
110S	HDPE	Type 1
110T	HDPE	Type 1
111C	HDPE	Type 1
111D	HDPE	Type 1
P101B	HDPE	Type 1 (Alternate #1- 3 Stall Addition)
P101C	HDPE	Type 1 (Alternate #1- 3 Stall Addition)
P101D	HDPE	Type 1 (Alternate #1- 3 Stall Addition)

END OF SECTION

SECTION 08 3613.10
NON- INSULATED SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead Non-insulated sectional doors, manually operated.

B. Operating hardware and supports.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Rough wood framing for door opening.

B. Section 07 9005 - Joint Sealers: Perimeter sealant and backup materials.

C. Section 08 7100 - Door Hardware: Lock cylinders.

D. Section 08 8000 - Glazing: Glazing for door lights.

E. Section 09 9113 - Exterior Painting: Finish painting.

1.03 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. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

D. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

C. Product Data: Show component construction, anchorage method, and hardware.

D. Samples: Submit two panel finish samples, illustrating color and finish.

E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.

F. Operation Data: Include normal operation, troubleshooting, and adjusting.

G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

H. 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 manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for electric motor and transmission.

D. Provide 10 year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Manufacturers:
   1. Clopay Corporation; Product Model 520: www.clopaydoor.com.
   2. Wayne-Dalton, a Division of Overhead Door Corporation; Model 220: www.wayne-dalton.com.
   3. Overhead Door; Model 420: www.overheaddoor.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DOOR COMPONENTS

A. Steel Doors: Stile and rail steel with solid panels construction with standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
   2. Door Nominal Thickness: 2 inches thick.
   3. Exterior Finish: Factory finished with acrylic baked enamel; color as selected by Architect.
   4. Interior Finish: Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
   5. Operation: Pull rope.

B. Door Panels: Stile and rail construction, of steel sheet .058 inch thick minimum, with welded joints; rabbeted weather joints at meeting rails.

C. Door Reinforcement: 2 1/4" U-Bar Strut required on all panels.

2.03 DOOR COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch thick; 3 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.

B. Hinge Assemblies: Heavy duty hinges and adjustable rollers holders and HDPE rollers of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side Pole Building doors.

C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
   1. For Manual Operation: Requiring maximum exertion of 25 lbs force to open.

D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

F. Head Weatherstripping: EPDM rubber seal, one piece full length.

G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

H. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Install treated lumber frame construction. See plans for location of lumber.

C. Anchor assembly to wood frame construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Install perimeter trim and weatherstripping.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch in ten feet.

B. Maximum Variation from Level: 1/16 inch in ten feet.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

A. Clean doors and frames.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

3.08 SCHEDULE

Opening No.:	Door Type	Operator Type
P100C	HDPE	Manual
P100D	HDPE	Manual
P100E	HDPE	Manual
P100F	HDPE	Manual
P100G	HDPE	Manual
P100H	HDPE	Manual
P100J	HDPE	Manual
P100K	HDPE	Manual
P100L	HDPE	Manual
P100M	HDPE	Manual

END OF SECTION

SECTION 08 3620

SECTIONAL OVERHEAD DOOR FOR RECLAMATION BUILDING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes Sectional Overhead Door for Brine Building.

B. Related Sections:
   1. Section 03 3000 - Cast-In-Place Concrete: Execution requirements for placement of accessories in concrete floor construction.
   2. Section 06 1000 - Wood Blocking and Curbing: Rough wood framing and blocking.
   3. Section 07 9005 - Joint Sealers: Perimeter sealant and backup materials.
   4. Section 26 2726 - Wiring Devices: Electrical requirements for equipment in this section.

1.02 REFERENCES

A. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
   2. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   3. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   5. Door and Access Systems Manufacturers Association International:
      a. DASMA 102 - Specifications for Sectional Overhead Type Doors.

1.03 SYSTEM DESCRIPTION

A. Upward-acting Sectional Steel Overhead Doors for vehicle passage which are factory-prefabricated and counter-balanced.
   1. Panels; High-Density Polyethylene
   2. Lift type; High lift track.
   3. Operation; Electric power operator with remote control and push-buttons.

B. Lift Type: High lift operating style with track and hardware.

C. Operation: Electrically-powered operator.
   1. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code and ANSI/DASMA 102.

1.04 SUBMITTALS

A. Section 01 3000 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit Manufacturer's product data for each type of sectional door. Include component construction, anchorage method, and hardware. Include both published data and any specific data prepared for this project.

C. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

D. Samples: Submit two panel finish samples illustrating color and finish.

E. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.05 CLOSEOUT SUBMITTALS

A. Section 01 7000 - Execution Requirements: Closeout procedures.

1.06 QUALITY ASSURANCE

A. Provide doors, tracks, counter-balance mechanisms, hinges, rollers, and mounting hardware from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

B. Perform Work in accordance with DASMA 102, Application Type; Commercial.

C. Products Requiring Electrical Connection: Listed and classified by U.L. (Underwriters Laboratories, Inc.), as suitable for purpose specified.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience, and approved by manufacturer.

1.08 WARRANTY

A. Section 01 7000 - Execution Requirements: Product warranties and product bonds.

B. Furnish ten-year manufacturer's standard written warranty against corrosion and wear.

C. Furnish five-year contractor's warranty against corrosion of secondary parts.

PART 2 PRODUCTS

2.01 CLEAR POLYCARBONATE SECTIONAL OVERHEAD DOOR

A. Manufacturers:
   1. Airlift Doors, Inc. - “Alaska Extreme Package", clear, polycarbonate sectional overhead doors (Basis of Design)
   2. American Garage Door Supply, Inc.
   3. Chamberlain
   4. Substitutions: Section 01600 - Product Requirements

B. Construction shall be:
   1. 3-inch-thick frames, of 6063 T-3 extruded aluminum sections
   2. integral thermal break
   3. continuous-section hinge with periodic neoprene PVC bushing
   4. 5/8-inch-thick triple-wall translucent polycarbonate panels
   5. Thermal rating: R-3 minimum

C. Track and Rollers:
   1. Standard-Lift track shall be; roll-formed 3-inch wide heavy-duty stainless steel track.
   2. Rollers shall have stainless steel stems, wear-resistant UHMW polyethylene tires, and double-sealed precision ball bearings.

D. Operator Type 3: 3/4 HP operator for Highly-Corrosive Indoor Locations with narrow side clearance: NEMA 4X and NEMA 12 enclosure. Fan-cooled TEFC motor. Jack-shaft type with; adjustable safety friction clutch, brake system actuated by independent voltage solenoid controlled by motor starter, enclosed gear-driven limit switch, enclosed magnetic cross-line reversing starter, mounting brackets, and hardware.
   1. Pushbutton Station: Waterproof standard three-button (open-stop-close) momentary contact type, with 24-volt circuit, in NEMA 4X and NEMA 12 enclosure, bracket mounted.

E. Counterbalance Mechanism (Type 3 Operator):
   1. Cross-head shaft shall be stainless steel.
   2. Helical-wound torsion-spring counter-balance on cross-head shaft shall be galvanized.
   3. Lifting cables and hardware shall be stainless steel.

F. Accessories:
   1. Jamb Weatherstripping: Extruded aluminum section; full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
   2. Head Weatherstripping: EPDM rubber seal, one piece, full length.

3. Hand Held Transmitter: (Type 3 Operator) Digital control, resettable.
   a. Provide 20) programmable, 2 button transmitter.
4. Photo Electric Sensor: furnish system which detects obstruction and reverses direction of door without requiring contact with obstruction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

3.02 PREPARATION

A. Contractor shall be responsible for ordering all parts required to produce a complete operating system.
   1. Contractor shall be responsible for corrosion resistance of all parts, mounting and fastening hardware, electric operator, and electrical enclosures and connections.
   2. Verify mounting requirements with lift manufacturer, and order extended cross-head shaft if necessary.
   3. Prepare opening to permit correct installation of door unit.
   4. Apply primer and finish coat to exposed and concealed wood surfaces.

3.03 INSTALLATION

A. Anchor assembly to wall construction or building framing without distortion or stress.

B. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

C. Fit and align door assembly including counter-balance hardware.

D. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9005.

E. Install perimeter weatherstripping.

3.04 ADJUSTING

A. Section 01 7000 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust door assembly to smooth operation and in full contact with weatherstripping.

3.05 CLEANING

A. Section 01 7000 - Execution Requirements: Final cleaning.

B. Remove temporary labels and visible markings.

3.06 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 7000 - Execution Requirements: Protecting installed construction.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

3.07 SCHEDULE

OPENING NO.: DOOR TYPE:OPERATOR TYPE:

A. Wash Bay

103B	Translucent Polycarbonate	Type 3
103E	Translucent Polycarbonate	Type 3

B. Brine Production
   1. 101B Translucent Polycorbonate Type 3

END OF SECTION

SECTION 08 5113
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash and operating sash.

B. Factory glazing.

C. Operating hardware.

D. Insect screens.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Rough opening framing.

B. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.

C. Section 08 8000 - Glazing.

D. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

E. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

F. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

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 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2002 (Reapproved 2010).

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).

N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

O. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2014.

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, and installation requirements.

D. Samples: Submit two samples, 12 by 12 inch in size illustrating typical corner construction, accessories, and finishes.

E. Submit two samples of operating hardware.

F. Certificates: Certify that windows meet or exceed specified requirements.

G. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer: Company specializing in installation of commercial aluminum windows of types required, with not fewer than 5 years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide 5 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 5 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. Peerless Products, Inc: Model G555, www.peerlessproducts.com. (Used as Basis of Design)
   1. EFCO, a Pella Company; Series 450X Thermal: www.efcocorp.com.

B. Kawneer Company, Inc.: www.kawneer.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Frame Depth: 4 inches.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   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. Deflection: Maximum allowable deflection for any member supporting a single lite of glass: 3/4 inch.
   7. Air Infiltration: Limit air infiltration through assembly to 0.1 cu ft/min/sq ft of wall area, measured at a specified differential pressure across assembly in accordance with ASTM E283.
   8. Water Infiltration Test Pressure Differential: 15 pounds per square foot.
   9. Thermal Movement: Design to accommodate thermal movement caused by 180 degrees F surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.
   10. Condensation Resistance Factor: 50 minimum.
   11. Overall U-value, Including Glazing: 0.237, maximum.
   12. Life Cycle Requirements: No damage to fasteners, hardware parts or other components that would render operable windows in operable and not reduction in air and water infiltration resistance when tested according to AAMA 910.

B. Performance Requirements:
   1. Design and size windows to withstand the following load requirements, when tested in accordance with ASTM E330 using test loads equal to 1.5 times the design wind loads with 10 second duration of maximum load:
      a. Design Wind Loads: Comply with requirements of ASCE 7.
      b. Positive Design Wind Load: 90 lbf/sq ft.
      c. Negative Design Wind Load: 90 lbf/sq ft.
      d. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   3. Water Leakage: None, when measured in accordance with ASTM E331 and E 547.
   4. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, or migrating moisture occurring within system.
   6. Performance Requirements: AAMA/WDMA/CSA 101/I.S.2/A440 R15.

C. Fixed, Non-Operable Type (W-3):
   1. Construction: Thermally broken.
   2. North Glazing: Double; Clear, low-e
   3. East Glazing: Double; gray tinted; low-e.
   4. Exterior Finish: High performance organic coating.
   5. Interior Finish: High performance organic coating.
   6. Color: White both sides.

D. Outswinging Casement Type (W1);
   1. Construction: Thermally broken.
   2. Provide screens.
   3. Glazing: Double; clear; low-e.
   4. Exterior Finish: High performance organic coating.
   5. Interior Finish: High performance organic coating.
   6. Color: White both sides.

2.03 COMPONENTS

A. Frames: 2 inch wide by 2 inch deep profile, of 4.25 inch thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.

B. Glazing: As specified in Section 08 8000.

C. Insect Screens: Extruded aluminum frame with mitered and reinforced corners; screen mesh taut and secure to frame; secured to window with adjustable hardware allowing screen removal without use of tools.
   1. Hardware: Spring loaded steel pins; four per screen unit.
   2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
   3. Frame Finish: Same as frame and sash.

D. Operable Sash Weatherstripping: Neoprene; permanently resilient, profiled to achieve effective weather seal.

E. Glazing Materials: As specified in Section 08 8000.

F. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

G. Sealant and Backing Materials: As specified in Section 07 9005.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.05 HARDWARE

A. Sash lock: Lever handle with cam lock .

B. Operator: Pivot Shoe Roto Operator fitted to projecting sash arms with limit stops.

C. Projecting Sash Arms: Cadmium plated steel, friction pivot joints with nylon bearings, removable pivot clips for cleaning.

2.06 FABRICATION

A. Fabricate components with smallest possible clearances and shim spacing around perimeter of assembly that will enable window 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.

D. Arrange fasteners and attachments to ensure concealment from view.

E. Prepare components with internal reinforcement for operating hardware.

F. Provide internal drainage of glazing spaces to exterior through weep holes.

G. Assemble insect screen frames with mitered and reinforced corners. Secure wire mesh tautly in frame. Fit frame with four, spring loaded steel pin retainers.

H. Double weatherstrip operable units.

I. Factory glaze window units.

2.07 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system; color as scheduled.

B. Operator and Exposed Hardware: color as selected from manufacturer's standards.

C. Apply 1 coat of bituminous coating to concealed aluminum and steel surfaces in contact with dissimilar materials.

D. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

E. Install sill and sill end angles.

F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

G. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.

H. Install operating hardware not pre-installed by manufacturer.

I. Install glass and infill panels in accordance with requirements specified in Section 08 8000.

J. Install perimeter sealant in accordance with requirements specified in Section 07 9005.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.04 FIELD QUALITY CONTROL

A. Test installed windows for compliance with performance requirements for water penetration, in accordance with ASTM E1105 using uniform pressure and the same pressure difference as specified for laboratory testing.
   1. Test all windows.
   2. If any window fails, test additional windows at Contractor's expense.

B. Replace windows that have failed field testing and retest until performance is satisfactory.

3.05 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

A. Remove protective material from factory finished aluminum surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

3.07 SCHEDULE

Opening Number:	Window Type:	Building Location:
102C	W1	Office
102D	W1	Office

107B	W1	Conference Room
107C	W1	Conference Room
107D	W1	Conference Room
107E	W1	Conference Room
107F	W1	Conference Room
110M	W3	Storage Bay
110N	W3	Storage Bay
110P	W3	Storage Bay
110Q	W3	Storage Bay
110R	W3	Storage Bay
110X	W3	Storage Bay
110U	W3	Storage Bay
110V	W3	Storage Bay
110W	W3	Storage Bay
111E	W3	Mechanics Bay
111F	W3	Mechanics Bay
111G	W3	Mechanics Bay

END OF SECTION

SECTION 08 5123
HOLLOW METAL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Primed hollow metal windows with fixed sash.

B. Factory-installed glazing .

1.02 REFERENCE STANDARDS

A. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

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 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).

E. 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).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, fasteners, anchors, and glass.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work; installation requirements.

D. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Iowa Department of Transportation's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing windows specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect factory finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Windows:
   1. Assa Abloy Curries. www.assabloydss.com.
   2. Assa Abloy Ceco: www.assabloydss.com
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 HOLLOW METAL WINDOWS

A. Hollow Metal Windows: Formed steel sheet sections, factory fabricated, factory finished, with vision glass, related flashings, anchorage and attachment devices.
   1. Sash Configuration: Fixed non-operable lights.
   2. Frame Members: Thermally broken.

B. Performance Requirements: Provide products that comply with the following:
   1. Member Deflection: Limit member deflection to 1/200 of the longer dimension; with full recovery of glazing materials.
   2. Air Infiltration: Limit air infiltration through assembly to 0.06 cfm/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E283.
   3. Water Leakage: None, when measured in accordance with ASTM E331 with a test pressure difference of 2.86 lbf/sq ft.

2.03 COMPONENTS

A. Frames: 2 inch by 6 5/8 inch deep profile; flush glass stops of screw fastened type.

2.04 MATERIALS

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; 16 gage, 0.053 inch thick base metal.

B. Fasteners: Steel, galvanized.

2.05 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As specified in Section 08 8000 of Types as indicated below:
   1. Glass in Interior Lights: Type Tempered.

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 and hairline.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners to conceal from view.

E. Prepare components with reinforcement for operating hardware.

F. Factory-glaze window units.

2.07 FINISHES

A. Window Frames: Prime painted finish.

B. Concealed Steel Items:
   1. Galvanized in accordance with requirements of ASTM A123/A123M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install window frames and glass and glazing in accordance with manufacturers instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install glass in accordance with Section 08 8000, to glazing method required to achieve performance criteria.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches in 3 ft non-cumulative or 1/8 inches per 10 ft.

3.04 CLEANING

A. Remove labels and visible markings.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

3.05 SCHEDULE

A. OPENING NUMBER	WALL TYPE	WINDOW TYPE
102B	MASONRY	(W2) INTERIOR

END OF SECTION

SECTION 08 5313

VINYL WINDOWS FOR RECLAMATION BUILDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vinyl-framed, factory-glazed windows.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - WEATHER BARRIERS: Sealing frames to weather barrier installed on adjacent construction.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 8000 - Glazing.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 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 this section with minimum three years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Windows:
   1. Alside, Inc; Performance Series Silver: www.alside.com.
   2. Pella Corporation; 350 Series: www.pellacommercial.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESCRIPTION

A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
   1. Configuration: As indicated on drawings.
      a. Product Type: FW - Fixed window.
   2. Color: White.
   3. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
   4. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.

5. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
6. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.

B. Performance Requirements: Provide products that comply with the following:

2.03 COMPONENTS

A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions and acoustic rating indicated.

B. Frame Depth: 2-11/16 inch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.

C. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.

3.02 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer and appropriate for application indicated.

3.03 CLEANING

A.

OPENING NO.	WINDOW TYPE	BUILDING LOCATION
101C	W4	Brine/Reclamation Bldg

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Lock cylinders for doors that hardware is specified in other sections.

E. Thresholds.

F. Weatherstripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 3613 - Sectional Doors: Hardware for same, except cylinders; installation of cylinders.

C. Section 28 1300 - Access Control : Electronic access control devices.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

D. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.

E. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

F. BHMA A156.3 - American National Standard for Exit Devices; 2014.

G. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

H. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.

I. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.

J. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.

K. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2011.

L. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

M. BHMA A156.21 - American National Standard for Thresholds; 2014.

N. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.

O. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.

P. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

R. NFPA 101 - Life Safety Code; 2015.

S. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by all affected installers.

D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

C. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements .
   2. Submit manufacturer's parts lists and templates.

D. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Iowa Department of Transportation's name and registered with manufacturer.

I. Maintenance Materials and Tools: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Hardware Supplier Qualifications: Company specializing in supplying the type of products specified in this section with at least three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for door closers.

PART 2 PRODUCTS

2.01 DOOR HARDWARE SUPPLIERS

A. Best Lock Corporation.

B. Bommer Industries, Inc.

C. Hager Companies.

D. LCN Closers.

E. Norton.

F. Pemko.

G. Schlage Lock Co.

H. Von Duprin, Inc.

I. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOOR HARDWARE - GENERAL

A. Provide hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
   4. Applicable provisions of NFPA 101, Life Safety Code.
   5. Fire-Rated Doors: NFPA 80.
   6. Hardware on Fire-Rated Doors, Except Hinges: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.
   7. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
   8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

D. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.

2.03 HINGES

A. Hinges: Provide hinges on every swinging door.
   1. Provide five-knuckle, oilite bearings, template type, ANSI A 156.7, stainless steel, full mortise butt hinges unless otherwise indicated.
   2. Provide ball-bearing hinges at all doors.
   3. Provide hinges in the quantities indicated.
   4. Provide non-removable pins on exterior outswinging doors.
   5. Where electrified hardware is mounted in door leaf, provide power transfer hinges.
   6. Pins: Furnish nonferrous hinges with non-removal pins (NPR) at exterior and locked outswinging doors, non-rising pins at interior doors.

B. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7; standard weight, unless otherwise indicated.

C. Quantity of Hinges Per Door:
   1. Doors up to 60 inches High: Two hinges.
   2. Doors From 60 inches High up to 90 inches High: Three hinges.
   3. Doors 90 inches High up to 120 inches High: Four hinges.

D. Manufacturers - Hinges:
   1. Assa Abloy Brands; McKinney: www.assaabloydss.com.
   2. Bommer Industries, Inc: www.bommer.com.
   3. Hager Companies: www.hagerco.com.
   4. Stanley Black & Decker: www.stanleyblackanddecker.com.

2.04 PUSH/PULLS

A. Push/Pulls: Comply with BHMA A156.6.
   1. Provide push and pull on doors not specified to have lockset, latchset, exit device, or auxiliary lock.
   2. On solid doors, provide matching push plate and pull plate on opposite faces.

B. Manufacturers - Push/Pulls:
   1. Schlage; AL Series, Saturn, 626 Finish. www.schlage.com (Used as Basis of design)
   2. Assa Abloy Brands; McKinney: www.assaabloydss.com.
   3. Hager Companies: www.hagerco.com.

2.05 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking. Furnish locksets compatible with Best Lock cylinders or cores. Typical 2 3/4 inch backset. Furnish ANSI A 115.2 strikes with extended lips to protect trim from being marred by latch bolt.
   1. Hardware Sets indicate locking functions required for each door.
   2. If no hardware set is indicated for a swinging door provide an office passage handle.
   3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Keying: Master keyed.
   1. Include construction keying.

C. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.06 CYLINDRICAL LOCKSETS: INTERCHANGEABLE CORE TYPE CYLINDERS

A. Cylinders and keys provided by Iowa DOT

B. Locking Functions: As defined in BHMA A156.2, and as follows.
   1. Passage, f75: No locking, always free entry and exit.
   2. Entrance F82A, key not required to lock, key or push button unlocks.
   3. Office: F81, key not required to lock, remains locked upon exit.
   4. Classroom: F84, key required to lock.
   5. Storage/ Utility: F86, key required to lock, may not be left unlocked.

2.07 ELECTRIC STRIKES

A. Electric Strikes: Complying with BHMA A156.31 and UL (DIR) listed as a Burglary-Resistant Electric Door Strike; style to suit locks.

B. Manufacturers - Electric Strikes:
   1. HES; 9600 Series (Used as basis of Design).
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.08 EXIT DEVICES:

A. Exit Devices

B. Surface mounted verticle rod type on equipment doors, rim type on all others with cross bars.

C. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt.

D. Locking Functions: Functions as defined in BHMA A156.3, and as follows:
   1. Entry/Exit, Always-Latched: Key outside locks and unlocks lever, no latch holdback (dogging).

2. Entry/Exit, Always-Locked: Key outside retracts latchbolt but does not unlock lever, no latch holdback.

E. Manufacturers - Exit Devices:
1. Von Duprin, an Allegion brand: 99 Series www.allegion.com/us. (Used as basis of design)

2.09 CLOSERS

A. Closers - Basis of Design: LCN, 4040 Series.
1. Closers: Complying with BHMA A156.4.
2. Provide surface-mounted, door-mounted closers unless otherwise indicated.
3. Provide a door closer on every exterior door.
4. Provide a door closer on every fire and smoke rated door. Spring hinges are not an acceptable self-closing device unless specifically so indicated.
5. On pairs of swinging doors, if an overlapping astragal is present, provide coordinator to ensure the leaves close in proper order.
6. Adjustability: Furnish controls for regulating closing, latching, speeds and backchecking.
7. Arms: Tyle to suit individual condition; parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees.
8. Location: Mount closers on inside of exterior doors, room side of interior doors typical, mount on pull side of other doors.
9. Operating Pressure: Maximum operating pressure as follows:
   a. Interior Doors: Maximum 5 pounds
   b. Exterior doors: Maximum 8.5 pounds
   c. Fire Rating Doors: As required for fire rating, maximum 15 pounds.
10. At corridors, locate door-mounted closer on room side of door.
11. At outswinging exterior doors, mount closer in inside of door.

B. Manufacturers - Surface Mounted Closers:
1. LCN, an Allegion brand: 4040 Series; www.allegion.com/us. (Used as basis of design)

2.10 STOPS AND HOLDERS

A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
1. Provide wall stops, unless otherwise indicated.
2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

B. Wall Stops: ANSI A 156.1, Grade 1, convex pad wall stop

C. Floor Stops: ANSI A 156.1 Grade 1, standard floor type, furnish with accessories as required for application indicated.

D. Magnetic Holder/Releases: Complying with BHMA A156.15; fail safe; doors release to close automatically when electrical current is interrupted; holding force: 25 to 40 pounds-force.

E. Manufacturers - Wall and Floor Stops/Holders:
1. Assa Abloy Brands; McKinney: www.assaabloydss.com.
2. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha.

2.11 GASKETING, THRESHOLDS, AND KICKPLATES

A. Gaskets: Complying with BHMA A156.22.
1. On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
2. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.

a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.

3. On each exterior door, provide door bottom sweep, unless otherwise indicated.

B. Thresholds: Complying with BHMA A156.21.

1. At each exterior door, provide a threshold, maximum 1/2 inch in height, unless otherwise indicated.
2. Field cut threshold to frame for tight fit.
3. Fasteners At Exterior Locations: Non-corroding.

C. Manufacturers - Gasketing and Thresholds:

1. Pemko Manufacturing Co: www.pemko.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.12 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates:

1. Kickplate: Provide on push side of every door with closer, except aluminum storefront and glass entry doors.

B. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.

C. Manufacturers - Protection Plates and Architectural Trim:

1. Hager Companies: www.hagerco.com.
2. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.13 FIRE DEPARTMENT LOCK BOX

A. Fire Department Lock Box - Basis of Design: Knox Box Rapid Entry System as required by Muscatine Fire Department.

B. Fire Department Lock Box: Heavy-duty, surface mounted, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.

1. Capacity: Holds 10 keys.
2. Finish: Manufacturer's standard dark bronze.
3. Manufacturers - Fire Department Lock Box:
   a. Knox Company; Knox-Box Rapid Entry System: www.knoxbox.com.

2.14 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:

1. Applicable provisions of Federal, State, and local codes.
2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
3. Applicable provisions of NFPA 101, Life Safety Code.
4. Fire-Rated Doors: NFPA 80.
5. All Hardware on Fire-Rated Doors : Listed and classified by UL as suitable for the purpose specified and indicated.
6. Hardware for Smoke and Draft Control Doors : Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
7. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

2.15 KEYING

A. Lock Cylinders and keys: Furnished and installed by Iowa Department of Transportation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as instructed by the manufacturer.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item.
   1. Locksets: 2 3/4 inch.
   2. Push/Pulls: 6 inch.
   3. Exit Devices: 2 3/4 inch.

E. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 4000 - Quality Requirements.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

3.05 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.07 SCHEDULE

HARDWARE SETS

4.01 HARDWARE SETS - GENERAL

A. These Hardware Sets indicate requirements for single doors of that type, with conditional requirements for pairs and other situations.

B. Pairs of Swinging Doors: Provide one of each specified item on each leaf unless specifically stated otherwise. Treat pairs as two active leaves unless otherwise indicated.

4.02 SWING DOORS -- NOT REQUIRING KEY LOCKING

A. HW-1: Mens & Womens Restroom (Door 103A, 104A)
   1. Closer.
   2. Push/Pull.
   3. Kick Plate.
   4. Door stop, wall mounted rubber bumper.
   5. Hinges.
   6. Silencers.
   7. Smoke Seals

B. HW-2: Office (102A)
   1. Latchset, Office F81
   2. Hinges
   3. Closer

4. Silencers.
5. Fire Seals
6. Door stop, wall mounted rubber bumper.
7. Hinges.

C. HW-3: Entry Vestibule (101A, 109B))
1. Latchset, Passage F75
2. Hinges
3. Closer
4. Entry/Exit Device (Always latched but not locked)
5. Weather Stripping
6. Door stop, wall mounted rubber bumper.
7. Silencers.

D. HW-4: Storage/ Utility (105A, 106A, 108A, 202A, 203A)
1. Latchset F86.
2. Closer
3. Fire seal
4. door bumper

E. HW-4F: Utility (201A)
1. Passage F75
2. Hinges
3. Closer
4. Entry/Exit Device
5. Fire Seal
6. Door Stop.

F. HW-5: Conference Room (107A)
1. Class Room Lockset, F84
2. Hinges
3. Closer
4. Entry/Exit Device
5. Door stop, wall mounted rubber bumper.
6. Silencers.
7. Fire Seal
8. Kick Plate, 24"H x 35" W

G. HW-6: Parts Room/ Storage Room- Pair Doors (112A, 113A)
1. Storage Latchset, F86 (Active Leaf)
2. HInges
3. Closer, inside surface mounted.
4. Pair: Astragal, coordinator and flushbolts.
5. Silencers.
6. Smoke seals.
7. Kickplate, 24" H x 35" W, active leaf.

H. HW-7: Hallway - Pair, Normally Open (109A)
1. Passage Latchset, F75
2. Hinges
3. Closer, each leaf.
4. Exit Device, Vertical Rod, Always-Unlocked, each leaf.
5. Silencers
6. Holder/Release, Fail-Closed, Magnetic, each leaf, with power supply and fire alarm interface.
7. Kick Plate (24" H x 35" W) both leaves

4.03 RECLAMATION BUILDING

A. HW-10: Entrance (101A, 103C, 103D)

1. Stainless Steel Latchset F82A
2. Stainless Steel Hinges.
3. Closer- Stainless Steel Cover
4. Stainless Steel Entry/Exit Rim Device (Always locked)
5. weatherstripping
6. Threshold

B. HW-11: Passage (103A)
1. Stainless Steel Latchset F75.
2. Stainless Steel Hinges
3. weather stripping

4.04 POLE BUILDING/ ALTERNATE #1- 3 STALL ADDITION

A. HW-20: Entrance (P100A, P100B, P101A)
1. Latchset, F82A
2. Hinges
3. Closer
4. Entry/Exit Rim Device (Always Locked)
5. weather stripping
6. Threshold

4.05 SWING DOORS -- ELECTRICAL ACCESS CONTROL

A. HW-50: Entry Door (100A)
1. Card Reader, located where indicated.
2. Latchset, F82A
3. Hinges
4. Closer.
5. Entry/Exit Device, Electric Bolt Retraction (Always Latched)
6. Electric Strike
   a. Fail-Secure, remainng locked in event of fire alarm activation or power failure
   b. Key Override and fee egress at all times
   c. Entry Control: upon signal from access control device
7. Silencers
8. Weather Stripping
9. Threshold
10. Knox Box- Beside entry door.

B. HW-53: Entry Door (110A, 110B, 110C, 110D, 111A, 111B)
1. Card Reader, located where indicated.
2. Latchset, F82A
3. Closer.
4. Exit Device, Always-Locked, Electric Bolt Retraction
5. Electric Strike.
   a. Fail-secure, remaining locked in event of fire alarm activation or power failure.
   b. Key override and free egress at all times.
   c. Entry Control: Upon signal from access control device, outside trim unlocks.
6. Hinges.
7. Silencers.
8. Weatherstripping
9. Threshold

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 5113 - Aluminum Windows: Glazing furnished by window manufacturer.

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. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

E. ASTM C1036 - Standard Specification for Flat Glass; 2011.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

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

I. ASTM E773 - Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units; 2001.

J. ASTM E774 - Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units; 1997.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

M. GANA (GM) - GANA Glazing Manual; 2009.

N. GANA (SM) - GANA Sealant Manual; 2008.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples __ by __ inch in size of glass and plastic units, showing coloration and design.

E. Certificates: Certify that products meet or exceed specified requirements.

F. Maintenance Materials: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

A. Type IG-1 - Sealed Insulating Glass Units: Vision glass, double glazed.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear for North facing windows and doors
      b. Tint: Gray for east, west, or south facing windows and doors.
      c. Coating: Low-E (passive type), on #2 surface.
   3. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear for North facing windows and doors
      b. Tint: Gray for east, west, and south facing windows and doors.
   4. Total Thickness: 1 inch.
   5. Argon gas fill between panes

2.02 GLAZING UNITS

A. Type S-1 - Single Vision Glazing:
   1. Application: All interior glazing unless otherwise indicated.
   2. Type: Annealed float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch.

B. Type S-3 - Single Safety Glazing: Non-fire-rated.
   1. Application: Provide this type of glazing in the following locations:
      a. Glazed lites in interior doors, except fire doors.
      b. Glazed lite in window Type W2.
      c. Other locations indicated on the drawings.
   2. Type: Fully tempered float glass as specified.
   3. Tint: Clear.
   4. Thickness: 1/4 inch.

2.03 EXTERIOR GLAZING ASSEMBLIES

A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
3. Glass thicknesses listed are minimum.

2.04 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 Kind FT.
   3. Tinted Types: ASTM C1036, Class 2 - Tinted, color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

2.05 GLAZING COMPOUNDS

A. Manufacturers:
   1. Bostik Inc: www.bostik-us.com.
   2. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
   3. Pecora Corporation: www.pecora.com.
   4. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   5. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Butyl Sealant, Type 1: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

C. Silicone Sealant, Type 2: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; Clear color.

2.06 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; 1 x 1 size; black color.

D. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

F. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

G. Fill gap between glazing and stop with butyl type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

H. Apply cap bead of butyl type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.04 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

B. Locate and secure glazing pane using glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.05 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.06 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.07 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.

3.08 SCHEDULE

A. Aluminum Windows: Type IG-1, exterior wet/dry method with Type 1 compound.

B. Hollow Metal Window: Type S-3, interior with type 1 compound

C. Hollow Steel Frames - Interior: Interior wet method with Type [2] compound.

D. Steel Doors:
   1. Interior: Type [S-1], interior wet method with Type 1 compound.
   2. Exterior: Type [IG-1], exterior west method, with Type 2 compound

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal channel ceiling framing.

C. Acoustic insulation.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Building framing and sheathing.

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 2100 - Thermal Insulation: Acoustic insulation.

D. Section 07 9005 - Joint Sealers: Acoustic sealant.

E. Section 09 2216 - Non-Structural Metal Framing.

F. Section 09 3000 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

F. 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.

G. 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.

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

K. ASTM E413 - Classification for Rating Sound Insulation; 2010.

L. GA-216 - Application and Finishing of Gypsum Board; 2013.

M. GA-600 - Fire Resistance Design Manual; 2015.

N. ICC (IBC) - International Building Code; 2015.

O. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Ceilings and Soffits: One (1) hour fire rating.
   2. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. 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.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.

B. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

C. Pre-Engineered Drywall Suspension System for flat drywall ceiling.
   1. Pre-engineered system consisting of main tees and furring cross channels of cross tees that join to support screwed gypsum board ceiling. Suspend by hanger wires to steel roof structure.
   2. Manufacturer: USG Drywall suspension system, www.usg.com (Used as basis of design)

D. 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 and fastened as indicated on drawings.

2.03 BOARD MATERIALS

A. 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 and ceilings, unless otherwise indicated.
   2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board for walls and Type C for ceilings, UL or WH listed.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
   4. Glass Mat Faced Products: Use in Reclamation Building
      a. Georgia-Pacific Gypsum; DensArmor Plus.
      b. National Gypsum Company; Gold Bond eXP Interior Extreme Gypsum Panel.
      c. USG Corporation; USG Sheetrock Brand Glass-Mat Panels Mold Tough.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

B. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

D. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Brace entire suspension system as per manufacturers recommendations.
   3. Install bracing as required at exterior locations to resist wind uplift.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, metal, using longest practical lengths.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish in IT Communication Room.
   2. Level 1: Wall and ceiling areas above acoustical ceilings, whether or not accessible in the completed construction.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 2216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ceiling and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking within stud framing.

B. Section 07 2100 - Thermal Insulation: Acoustic insulation.

C. Section 07 2100 - Thermal Insulation: Insulation.

D. Section 08 3100 - Access Doors and Panels.

E. Section 08 5200 - Wood Windows: Product requirements for window anchors.

F. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

C. 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.

D. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
   1. Framing Manufacturer: Current member of Steel Stud Manufacturers Association.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. Dietrich Metal Framing: www.dietrichindustries.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

A. 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.

B. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

C. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

D. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.

E. Fasteners: ASTM C1002 self-piercing tapping screws.

F. Sheet Metal Backing: 0.036 inch thick, galvanized.

G. Anchorage Devices: Power actuated or expansion bolts in drilled holes in floor slabs, drilled expansion bolts or screws with sleeves in precast members, through-bolts or screws with drilled pilot holes in heavy metal framing. The use of tie wire alone is not acceptable.

H. Acoustic Insulation: As specified in Section 07 2100.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type II - Organic.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

3.04 SCHEDULE

A. Soffit and Fascia framing: light-gauge metal framing and bracing.

B. Mechanical Box-out area above office hallway and IT/Communication as shown on the drawings.

END OF SECTION

SECTION 09 5100
SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

B. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

D. 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 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two full size samples illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, of suspension system main runner, cross runner, and connector.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Materials: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: 10 sq ft of each type and size.
   3. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

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 documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. USG: www.usg.com.

B. 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.

C. Acoustical Tile: Mineral fiber, ASTM E1264 Type III, with to the following characteristics:
   1. Size: 24 x 24 inches (300 x 300 mm).
   2. Thickness: 3/4 inches.
   3. Composition: Mineral fiber.
   4. Edge: Square.
   5. Surface Color: White.
   6. Products: "F" Fissured Ceiling, Item Noe. 131 by USG

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.

B. 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.

C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
   1. Finish: White.
   2. Products: DX/DXL 26 by Armstrong

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. 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.

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 C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of l/360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

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. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

G. Where round obstructions 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 hold-down clips on panels within 10 ft of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1700 - Standard Specification for Solid Vinyl Tile; 2013a.

D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

E. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
   1. For linoleum flooring, report rapidly-renewable content and urea-formaldehyde content.

1.05 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Height: 4 inch except for 6 inch in Restrooms
   2. Thickness: 0.125 inch thick.
   3. Finish: Satin.
   4. Color: Color as selected from manufacturer's standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. 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.

3.02 INSTALLATION

3.03 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.04 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.05 SCHEDULE

Room Number:	Room Name:
101	Hallway
102	Office
103	Office- Men's Restroom
104	Office- Women's Restroom
107	Conference Room

END OF SECTION

SECTION 09 8400
ACOUSTIC ROOM COMPONENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mineral fiber core panels and mounting accessories.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

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

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005 (Reapproved 2012).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.

B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.

C. Protect panel edges from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustical Panels:
   1. Sonex, Classic Colortec: Gray color.
   2. Illbruck, Inc..

2.02 FABRIC-COVERED ACOUSTICAL PANELS

A. Panels: 100 percent open cell fiber free "willtec" melamine foam panel.
   1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Mineral Fiber Core Panels:
   1. Density: 18 to 20 lb/cu ft.
   2. Noise Reduction Coefficient (NRC): 0.50 to 0.60 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
   3. Panel Width: 24 inches.
   4. Panel Height: 48 inches.
   5. Panel Thickness: 2 inch.
   6. Color: Gray

2.03 FABRICATION

A. General: Fabricate panels to sizes and configurations indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.04 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical panels. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical panels in locations indicated, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until completion of the work.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

3.05 SCHEDULE

Room Name:	Acoustic Component:	Mounting Height:
Storage Bay/ Mechanics Bay	Sonex Classic 2 x 4 Tiles	Bottom of concrete tees

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.
   2. Prime surfaces to receive wall coverings.
   3. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically so indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

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 D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

D. GreenSeal GS-11 - Paints and Coatings; 2013.

E. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit 1 paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

E. Maintenance Materials: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 5 years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.06 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 and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 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 coatings 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: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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. Paints:
   1. Diamond Vogel Paints: www.diamondvogel.com.
   2. Benjamin Moore & Co: www.benjaminmoore.com.
   3. Pratt & Lambert Paints: www.prattandlambert.com.
   4. Sherwin-Williams Company: www.sherwin-williams.com.
   5. Pittsburgh Paint.

D. Primer Sealers: Same manufacturer as top coats.

E. Block Fillers: Same manufacturer as top coats.

F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings 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. 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.
3. Supply each coating material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings 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.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - All Exterior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry, cement board, primed wood, and primed metal.
1. Preparation as specified by manufacturer.
2. Two top coats and one coat primer recommended by manufacturer.
3. Primer On Concrete and Concrete Masonry: One heavy coat latex block filler (100 percent acrylic) squeegeed into pores.

B. Paint CE-OP-3A - Concrete/Masonry, Opaque, Alkyd, 3 Coat:
1. One coat of block filler.

C. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Semi-gloss: Two coats of alkyd enamel; oil based 2 coats.

2.04 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry, wood, uncoated steel, shop primed steel, and galvanized steel.
1. Two top coats and one coat primer.
2. Top Coat Product(s):
   a. Sherwin-Williams ProMar 200 Zero VOC Interior Latex. (MPI #43, 44, 52, 54, 144)
3. Primer(s): As follows unless other primer is required or recommended by manufacturer of top coats:
   a. Gypsum Board: MPI #50, Interior Latex Primer Sealer.
   b. Concrete: MPI #3, Alkali Resistant Water Based Primer.
   c. Concrete Masonry: MPI #4, Latex Block Filler; heavy coat squeegeed into pores.
   d. Steel -- Shop Primer: MPI #76, Quick Dry Alkyd Primer for Metal.
   e. Galvanized Steel: MPI #134, Water Based Galvanized Primer.
   f. Galvanized Steel: Cementious primer.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
1. Medium duty applications include doors and door frames.
2. Two top coats and one coat primer.
3. Satin: MPI gloss level 4; use this sheen at all locations.

C. Paint WI-OP-3A - Wood, Opaque, Alkyd, 3 Coat:
   1. One coat alkyd primer sealer.
   2. Semi-gloss: Two coats of alkyd enamel.

D. Paint CI-OP-2A - Concrete/Masonry, Opaque, Alkyd, 2 Coat:
   1. One coat of block filler.

E. Hoop Building: Metal Corrosion resistant coating
   1. Cathodit Rust Arrestor applied to all metal anchor plates and bolts to precast wall panels in hoop building.
   2. Manufacturer: Rhomar Industries, BLack-Max; www.rhomar.com

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating 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 mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

M. Interior 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.

N. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's 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.

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 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

A. Concrete, Concrete Block, Brick Masonry: Finish all surfaces exposed to view.
   1. Interior: CI-OP-3L, semi-gloss.

B. Wood: Interior Walls in Alt. #1- 3 Bay addition.
   1. Interior plywood and trim: WI-OP-3A, semi-gloss.

C. Exterior Steel Doors and Frames: Finish all surfaces exposed to view; MI-OP-3A, gloss.

D. Interior Steel Doors and Frames: Finish all surfaces exposed to view; I-OP-MD-DT, satin.

E. Steel Fabrications: Finish all surfaces exposed to view.
   1. Exterior: ME-OP-3A, gloss; finish all surfaces, including concealed surfaces, before installation.
   2. Interior: MI-OP-3L, satin.

F. Hoop Building: Coat exposed metal anchors, plates, bolts, and tensioning nuts to the precast concrete walls with Black-Max. Coating to extend on the precast concrete walls a minimum 12" around the metal anchor system.

END OF SECTION

SECTION 10 1101
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards and Tackboards.

1.02 REFERENCE STANDARDS

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

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Manufacturer's printed installation instructions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Color: White.
   2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
   3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Height: 48 inches.
   6. Length: 8 feet, in one piece.
   7. Frame: Extruded aluminum, with concealed fasteners.
   8. Frame Finish: Anodized, natural.
   9. Accessories: Provide chalk tray.

B. Tackboards: Fine-grained, homogeneous natural cork.
   1. Cork Thickness: 1/8 inch.
   2. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
   3. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
   4. Height: 36 inches.
   5. Length: 48 inches, in one piece.
   6. Frame: Extruded aluminum, with concealed fasteners.
   7. Frame Profile: As indicated on drawings
   8. Frame Finish: Anodized, natural.

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.

B. Secure units level and plumb.

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.

3.04 SCHEDULE

A. Hallway 101: Two 48 x 96 inch tackboards.

B. Conference Room 107: One 48 x 96 inch markerboard.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior directional and informational signs.

B. Installation of interior signs, signs provided by owner.

1.02 RELATED REQUIREMENTS

A. Section 22 0553 - Identification for Plumbing Piping and Equipment.

B. Section 26 0553 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 DOOR AND ROOM SIGNS

A. All signage shall be furnished by owner and shall be installed by contractor.

B. Contractor shall refer to schedule for placement of signs.

C. Interior signs will be attached with double-sided adhesive tape.

D. Monument sign shall be attached with expansion bolts. Contractor shall furnish bolts as required to fasten sign with a minimum of 12 fasteners around the edge.

2.02 SIGN TYPES

A. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: Clear.
   4. Character Color: Contrasting color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install signs after doors and surfaces are finished, in locations scheduled.

B. When sign is located on door surface; attach using double-sided adhesive tape, with bottom edge of sign at 68 inches above finish floor, or 2 inches below frame of light, level and centered on door.

C. When sign is located on wall surface; attach using double-sided adhesive tape, with center of sign at 60 inches above finish floor, at latch side of door, 2 inches from edge of frame, and square with door frame.

D. Install neatly, with horizontal edges level.

E. Protect from damage until Substantial Completion; repair or replace damaged items.

3.03 SCHEDULES

Door Signs: Black Acrylic with Individual Helvetica letters, 1 inch high, white in color, with braille below identifying room name as determined in schedule:

Opening Number:	Side:	Sign Text:
Garage		
102A	push	Office
105A	push	IT/Comm Room
106A	push	Janitors Closet
107A	push	Conference Room
108A	push	Office Storage
109B	Pull	Mechanics Bay
112A	push	Storage
113A	push	Parts Room

On wall near crane stop button Emergency Hoist Stop
push to stop, pull to reset

On wall near boiler stop button Emergency Boiler Stop
push to stop, pull to reset

Near emergency shower/eyewash Emergency Shower

(Mixed text) Emergency Eye Wash

103A Mens Restroom and 104A Womens Restroom: Rest Room Door Graphic: 6 inches high, one each; "male", "female" Handicapped Accessible graphic image and Braille text, located on wall at door jamb adjacent to each rest room door respectively.

4) Monument signs: Aluminum base, with painted letters and Iowa Department of Transportation logo provided by Owner and installed by contractor.

END OF SECTION

SECTION 10 2113.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments, overhead braced, floor mounted.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

B. Coordinate work with placement of plumbing fixtures.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, _2___by__2_ inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Ampco Products, Inc: www.ampco.com.
   2. Comtec Industries: www.comtecindustries.com.
   3. Bradley; Bradmar solid plastic partitions.
   4. Substitutions: Section 01 6000 - Product Requirements.

B. Product Description: Solid plastic, floor and wall mounted, headrail braced partition system, including proprietary mounting brackets, trim, and hardware.

2.02 COMPONENTS

A. Toilet Compartments: Factory fabricated, solid molded doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), floor-mounted headrail-braced.

B. Door and Panel Dimensions:
   1. Thickness: 1 inch.
   2. Door Width: 24 inch.
   3. Door Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 58 inch.
   5. Thickness of Pilasters: 1 inch.

C. Urinal Screens: Wall mounted with two panel brackets, pilaster

2.03 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 in high, concealing floor fastenings.

B. Head Rails: Hollow anodized aluminum, 1 by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.

C. Pilaster Brackets: Polished stainless steel.

D. Wall Brackets: Continuous type, polished stainless steel.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

F. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings.
   3. Door Latch: Slide type with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

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 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. 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.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

3.05 SCHEDULES

A.

Room No.	No. of Stalls	Urinal Screen	Mounting	Bracing	Color
103	2	1	Floor/Wall	Overhead	As Selected
104	2	0	Floor	Overhead	As Selected

END OF SECTION

SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms.

B. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

E. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Toilet Accessories:
   1. ASI - American Specialties, Inc: www.americanspecialties.com.
   2. Bradley Corporation: www.bradleycorp.com.
   3. AJW Architectural Products.
   4. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide keys for each accessory to Owner .

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.

2.04 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, chrome-plated zinc alloy brackets .
   1. Product: Model 5241 manufactured by Bradley as basis of design.

B. Combination Towel Dispenser/Waste Receptacle: Semi-recessed, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
   1. Waste receptacle liner: Reusable, heavy-duty vinyl.
   2. Towel dispenser capacity: Recycled 400 C-fold.
   3. Waste receptacle capacity: 3.3 gallons.
   4. One per mens, womens restrooms

C. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.
   1. One per lavatory in mens and womens restrooms.

D. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Size: 24x36 inches.
   2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Shelf: Stainless steel; gage and finish to match mirror frame, turned down edges, welded to frame; 5 inches deep, full width of mirror.
   5. One mirror per lavatory in mens and womens restrooms.
   6. Product: Model 780 manufactured by Bradley as basis of design.

E. Grab Bars: Stainless steel, nonslip grasping surface finish.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.

F. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. One per toilet in women's restrooms.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on the drawings.

2. Mirrors: 40 inch, measured to bottom of mirrored surface.

D. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

3.05 SCHEDULE

ROOM NO.:	ITEM:	QUANTITY:
103 Men's	Grab Bars	(1) 36 and (1) 42 inches long.
104 Women's	Grab Bars	(1) 36and (1) 42 inches long
Men's Room	Towel Dispenser(Recessed)	One for each room.
Men's Room	Mirror	One for each lavatory.
Men's Room	Soap Dispenser	One for each lavatory.
Men's Room	Toilet Tissue Despenser	One for each toilet.
Women's Room	Toilet Tissue Dispenser	One for each toilet.
Women's Room	Towel Dispenser(Recessed)	One for each room.
Women's Room	Mirror	One for each lavatory.
Women's Room	Soap Dispenser	One for each lavatory.
Women's Room	Napkin Disposal	One for each toilet.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 9123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. Ansul, a Tyco Business: www.ansul.com.
   2. JL Industries, Inc: www.jlindustries.com.
   3. Larsen's Manufacturing Co: www.larsensmfg.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type: Cast steel tank, with pressure gage.
   1. Class A-B-C.
   2. Size 20.
   3. Finish: Baked enamel, RED color.

C. Carbon Dioxide Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Class: B:C type.
   2. Size: 20 pound.
   3. Finish: Baked polyester powder coat, red color.
   4. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed stainless steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.
   1. Size to accommodate accessories.
   2. Trimless type.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

D. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Graphic Identification: Wall sign with arrow.

C. Safety Strap.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure wall brackets rigidly in place at 40 inches A.F.F.

C. Place extinguishers on wall brackets or in recessed cabinet.

D. Position wall signage as follows:
   1. Vertical sign, “Fire Extinguisher” ; placed 6 inches below suspended ceilings in finished areas, and center of sign placed at 95 inches above floor in unfinished areas.

E. Install cabinets plumb and level in wall openings, 36 inches from finished floor to inside bottom of cabinet.

F. Secure rigidly in place.

G. Place extinguishers in cabinets.

3.03 PROTECTION OF WORK

A. Protect fire extinguishers and signage from paint, dust, and dirt resulting from work being done by other trades on adjacent surfaces.

3.04 PROJECT CLOSEOUT

A. Check all pressure gauges to verify all fire extinguishers are fully charged. Recharge any units that are not fully charged.

3.05 SCHEDULES

A. Mechanics Bay, Storage Bay, Hallway 101 Dry Chemical Extinguisher with wall bracket mounting. Located per drawings.

B. Conference Room 107 and Hallway 201: 1 dry chemical extinquisher required placed in 12 inch (300 mm) wide by 30 inch (760 mm) high by 10 inch (250 mm) deep recessed polished stainless steel cabinet. Locate per drawings.

C. Mechanical Room: One fire blanket placed in 24 inch wide (600 mm) by 30 inch high (760 mm) by 10 inch (250 mm) deep surface mounted cabinet.stainles steel cabinet; One Dry Chemical Type, Class 4-A:60-B:C fire extinguisher mounted on bracket.

D. Fuel Depot: One dry chemical 20-B fire extenguisher mounted on bracket and rated for -40 degrees and 120 degrees F.

END OF SECTION

SECTION 10 7500
FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

C. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2012.

1.03 PERFORMANCE REQUIREMENTS

A. Flagpole With Flag Flying: Resistant without permanent deformation to 40 miles/hr wind velocity; non-resonant, safety design factor of 2.5.

1.04 SUBMITTALS

A. Product Data: Provide data on pole, accessories, and configurations.

B. Shop Drawings: Indicate detailed dimensions, base and attachment details, anchor requirements, and imposed loads.

C. Operation Data: Provide operating data for the controller and timer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed Des Moines, Iowa.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole: www.americanflagpole.com.
   2. Concord Industries, Inc: www.concordindustries.com.
   3. Pole-Tech Co., Inc: www.poletech.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Product Description: Commercially-produced flagpole assembly, including mounting base and hardware.

2.02 FLAGPOLES

A. Flagpole: Aluminum.
   1. Design: Straight shaft.
   2. Mounting: Ground mounted type.
   3. Nominal Wall Thickness: 3/16 inches.
   4. Nominal Height: 35 ft; measured from nominal ground elevation.
   5. Mounting: Ground mounted type.
   6. Design: Venetian entasis tapered.
   7. Halyard: External type .

B. Performance Requirements:

1. Flagpole With Flag Flying: Resistant without permanent deformation to 106 miles/hr wind velocity; non-resonant, safety design factor of 2.5.
2. Flagpole Without Flag: Resistant without permanent deformation to 163 miles/hr wind velocity; non-resonant, safety design factor of 2.5.

2.03 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Flag: Provided and installed by owner.

D. Cleats: 9 inch size, aluminum with stainless steel fastenings, two per halyard.

E. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

F. Halyard: (one) 5/16 inch diameter polypropylene, braided, white.

G. Snaps: (four) Chrome-plated solid bronze, spring snaps with vinyl snap covers.

H. Pole Base Attachment: Galvanized steel ground tube.

I. Ornamental flash collar.

2.05 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Concealed Steel Surfaces: Prime painted.

C. Aluminum Pole: Brushed, with clear anodized finish.

D. Finial: Spun aluminum, gold anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as instructed by the manufacturer.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

B. Form cast-in-place concrete foundation with ground sleeve insert.

3.03 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

C. Set brackets for wall set flagpoles anchored securely into wall construction. Seal watertight.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

3.06 SCHEDULES

A. Front Yard Pole: One 35 feet (12.2 m), with U.S. flag, and State of Iowa flag. (Flags provided by DOT)

END OF SECTION

SECTION 11 5213
PROJECTION SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Front projection screen assemblies.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking in walls and ceilings.

B. Section 09 5100 - Suspended Acoustical Ceilings: Suspended panel ceilings for recessed screens.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.

D. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Iowa Department of Transportation's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Experienced in manufacturing products specified in this section.

B. Installer Qualifications: Experienced in installation of the work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver projection screens to project site in manufacturer's original unopened packaging. Inspect for damage and size before accepting delivery.

B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F. Stack according to manufacturer's recommendations.

C. Acclimate screens to building temperatures for 24 hours prior to installation, or in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Maintain interior of building between 60 degrees F and 75 degrees F during and after installation of projection screens.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 3 year manufacturer warranty for projection screen assembly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bretford: www.bretford.com.

B. Da-Lite Screen Company: www.da-lite.com.

C. Draper, Inc: www.draperinc.com.

D. Stewart Filmscreen Corporation: www.stewartfilmscreen.com.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRONT PROJECTION SCREENS

A. Front Projection Screens: Factory assembled unless otherwise indicated.
   1. Location: As indicated on drawings.
   2. In Conference Room 107: Manual, matte light diffusing fabric screen, ceiling recessed.
      a. Screen Viewing Area: 48 inch high x 96 inch wide.

B. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.
   1. Material: Matte white vinyl on fiberglass backing, with nominal gain of 1.0 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
   2. Seams: No seams permitted in fabric up to 96 inch high by 72 inch wide.

C. Masking Borders: White, on four sides.

D. Concealed-in-Ceiling Screen Cases: Steel; integral roller brackets.
   1. Door Slat: Self trim; self-closing and -opening.
   2. Case Finish: Baked enamel.
   3. Case Color: White.
   4. End Caps: Steel; finished to match case.

E. Manually-Operated Screens:
   1. Roller: 1-3/4 inch aluminum; spring loaded with locking device.
   2. Screen Pull: Ring on bottom bar.
   3. Vertical Tensioning: Screen fabric weighted at bottom with steel bar with plastic end caps.
   4. Horizontal Tensioning: Tensioning bar.

F. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that openings for recessed screens are correctly sized.

D. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.02 PREPARATION

A. Coordinate screen installation with installation of projection systems.

B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Install plumb and level.

E. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Window shades and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

B. Section 09 2116 - Gypsum Board Assemblies: Substrate for window shade systems.

1.03 REFERENCE STANDARDS

A. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2002a (Reapproved 2010).

B. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.

E. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken.
   2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Iowa Department of Transportation's name and registered with manufacturer.

I. Maintenance contracts.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum 3 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Fabric: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manually Operated Roller Shades:
   1. Lutron Electronics Co., Inc: www.lutron.com.
   2. Graber, division of Springs Window Fashions: www.graberblinds.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Shade Fabric:
   1. Mermet Corporation; E-Screen - 1%: www.mermetusa.com.
   2. Phifer, Inc; Style 2500 1%: www.phifer.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WINDOW SHADE APPLICATIONS

A. Shades: Translucent shadesSheer shades.
   1. Type: Roller shades.
   2. Color: As selected by Architect from manufacturer’s full range of colors.
   3. Mounting: Inside (between jambs).
   4. Operation: Manual.

2.03 ROLLER SHADES

A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories; fully factory-assembled.
   1. Drop: Regular roll.
   2. Size: As indicated on drawings.

B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation; PVC-free; 100 percent recycled.
   1. Translucent Shades: Soften the light and reveal only shadow-like outlines to the outside; substantial privacy; Openness Factor less than 5 percent.
   2. Flammability: Pass NFPA 701 large and small tests.

C. Roller Tube: As required for type of operation, extruded aluminum with end caps.
   1. Dimensions: Manufacturer's standard, selected for suitability for installation conditions, span, and weight of shades.
   2. Fabric Attachment: Utilize double sided adhesive tape.

D. Hembars and Hembar Pockets: Wall thickness designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.

E. Manual Operation: Clutch operated continuous loop; beaded ball chain.

2.04 ACCESSORIES

A. Fascias: Size as required to conceal shade mounting.
   1. Style: As selected by Architect from shade manufacturer's full selection.

B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.05 FABRICATION

A. Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window sill.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

B. Dimensional Tolerances: As recommended in writing by manufacturer.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Installation Tolerances:
   1. Maximum Offset From Level: 1/16 inch.

C. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

C. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

3.08 SCHEDULE

Opening Number:	Window Size:
102C	4'-0" x 4'-0"
102D	4'-0" x 4'-0"
107B	4'-0" x 4'-0"
107C	4'-0" x 4'-0"
107D	4'-0" x 4'-0"
107E	4'-0" x 4'-0"
107F	4'-0" x 4'-0"

END OF SECTION

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Solid surface at window sills for window type W1

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.

B. ANSI A208.1 - American National Standard for Particleboard; 2009.

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

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

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.

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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.

a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
b. NSF approved for food contact.
c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
d. Finish: Matte or suede, gloss rating of 5 to 20.
e. Surface Color and Pattern: As indicated on drawings.
f. Manufacturers:
1) Wilsonart: www.wilsonart.com.
2) Substitutions: See Section 01 6000 - Product Requirements.

2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
3. Back Splashes: Same material, same construction.

B. Solid Surfacing for windowsills (W1): Solid surfacing sheet of 100% FSC-Certified recycled paper, water based phenolic resin with cashew nut binder and pigment. .
1. Flat Sheet Thickness: 1/2 inch, minimum.
2. Solid Surfacing Sheet and Water Based Phenolic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; Phenolic resin, mineral filler, and pigments; homogenous, low-porous and capable of being worked and repaired using standard woodworking tools; surface coating; color and pattern consistent throughout thickness.
a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
b. NSF approved for food contact.
c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
d. Color/Pattern Family: Solid Color, White.

2.02 ACCESSORY MATERIALS

A. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.
2. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000 - Product Requirements.

B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

A. 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 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.

B. 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, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

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 Architect 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.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Clean countertop surfaces thoroughly.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SCHEDULES

4.01 ROOM NUMBER:ROOM NAME:COUNTERTOP MATERIAL:

102 Office	Solid Surface Window Sill at Window W1
107 Conference Room	High Pressure Laminate at counters
107 Conference Room	Solid Surface Window Sill at Window W1

END OF SECTION

SECTION 13 3100
FABRIC STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom tensioned fabric structure, including fabric, structural steel supporting members, fittings, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete foundations.

B. Section 05 1200 - Structural Steel Framing: Additional requirements for support steel.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

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

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.

1.04 PREINSTALLATION MEETINGS

A. Pre-installation Meeting: Convene a pre-installation meeting at least two (2) weeks before start of installation of tensioned fabric structure.
   1. Require attendance of parties directly effecting work of this section, including Architect, Owner, Contractor, and Tensioned Fabric Installation Superintendent.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data, including test reports on fabric showing compliance with specified properties.

C. Shop Drawings: Submit construction drawings including plans, elevations, details, dimensions, support steel sizing, cables and hardware, clamp/corner plates, fittings, fabric, and fabric layout seams. Include:
   1. Exact interface geometry determination and definitions.
   2. Coordination between fabric and structural supports
   3. Interfaces to foundation supports.
   4. Design loads used in structural calculations.
   5. Foundation reaction loads.
   6. Stamp or seal of design engineer.

D. Erection/Stressing Plan: Submit a compressive erection and stressing plan, including drawings and sketches that clearly show the proposed erection procedure for the fabric roof elements, cables, and structural steel during each stage of construction.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm that is capable of assuming complete responsibility for design, engineering, fabrication, delivery, preparation, installation, adjusting, and cleaning of structure, and:
   1. Having minimum of 5 years experience in design and fabrication of tensioned fabric structures of similar size and complexity to that specified.
   2. Employing a professional staff and qualified consultants experienced with tensioned fabric structures of similar size and complexity to that specified.
   3. Employing integrated CAD and finite element computer software programs to ensure adequacy of design and accurate 3-dimensional computer generated models for fabrication of structure; using the CAD system to prepare construction drawings and interface with the plotting and cutting process, ensuring high precision fabric cutting.

4. Providing installation directly supervised by a superintendent, directly employed by the contractor, with 5 years of experience in installation of tensioned fabric structures of similar size and complexity to that specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in accordance with manufacturer's instructions, in a clean, dry, well ventilated area, above ground on blocking, and do not allow materials to become wet, stained, or dirty.

C. Handle materials so as to protect materials, coatings, and finishes during handling and installation to prevent damage or staining.
   1. Handle fabric in accordance with manufacturer's instructions.
   2. Use care in handling of fabric to avoid damage to fabric material and coating.
   3. Do not damage, crush, or kink cables.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard 10 year fabric warranty.

C. Provide installer's written 1 year workmanship warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tensioned Fabric Structures:
   1. Accu-Steel (Used as Basis of Design)
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TENSIONED FABRIC STRUCTURES

A. Tensioned Fabric Structure: Provide a custom tensioned fabric structure consisting of fabric stretched on steel structural supports, with the following characteristics:
   1. Capable of withstanding the loads specified in ASCE 7 and local building code without damage or failure. For designer's information, the project falls under the following design categories:
      a. Basic Wind Speed: 105 mph.
      b. Exposure Category: B.
      c. Importance Factor: I.
   2. Capable of maintaining structural integrity in event of a tear propagating in fabric, without endangering occupants.
   3. Shape geometry selected for equilibrium based on stress in fabric.
   4. Having a smooth uniform fabric surface with even curved edges and interfaces and without wrinkles, cuts, abrasions, stains, marks, surface defects, or seaming aberrations.
   5. Configuration as indicated on the drawings.
   6. Made of prefabricated components ready for installation.

2.03 MATERIALS

A. Fabric: High density polyethylene (HDPE) structural mesh.
   1. Base Fabric: High density polyethylene.
   2. Warp and Weft Filaments: 100 percent round mono-filament.
   3. Stretch Properties: Dimensionally stable in warp and weft.
   4. Flame Retardancy: Passing NFPA 701.
   5. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84, Class A.
   6. Seams: Sufficient strength to develop 90 percent of full strength of fabric at 140 degrees F in direct tension across seam.
      a. Acceptable Seams and Edges: Overlock stitched into a polyethylene rope of appropriate stretch and durability characteristics or other approved material.

b. Prohibited Seams and Edges: French-hem seam and edge details around a steel cable are unacceptable due to wear characteristics.
c. Prevent fabric from coming into contact with steel support members other than through polyethylene edge rope or other corner terminations. Stretched fabric over steel support frame is unacceptable due to wear characteristics.

7. Expected Service Life: 10 to 12 years.
8. Color: White.
9. Products:
   a. Duraweave II.
   b. Substitutions: See Section 01 6000 - Product Requirements.

B. Supporting Steel Members: As specified in Section 05 1200, unless otherwise specified in this section; all steel members hot-dipped galvanized after fabrication.

C. Paint for Structural Steel Members, Tensioning Nuts, and Fabric Plates:
   1. Coat all anchor plates, bolts, tensioning nuts to the precast concrete walls with Black Max. Overcoat onto adjacent precast walls a minumum of 12" around the metal anchor system and 12" up on metal structure support.

D. Cables and End Fittings: Provide structural cables of same type having same modulus of elasticity.
   1. Cables: Stainless steel, Type 304 or 316.
   2. Cables in Contact with Fabric: PVC sleeved.
   3. Cable Length Tolerance: As indicated on the drawings.
   4. Swaged and Speltered Fittings: Design and install to develop full breaking strength of cable.
   5. Thimble End Fittings: Design and install to develop a minimum of 90 percent of breaking strength of cable.
   6. Swaged End Fittings, Pins, Nuts, and Washers: Stainless steel.
   7. Tensioning Nuts and Fabric Plates: Galvanized steel, finished with 2 coats of epoxy paint.

E. Shackles, Rigging Screws, Clamps, and Tensioning Hardware: Stainless steel architectural finished material only.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine area to receive structure. Notify Architect if area is not acceptable. Do not begin installation until unacceptable conditions have been corrected.

B. Examine foundations and anchor bolts for location and elevation. Notify Architect of inaccuracies. Do not begin installation until unacceptable conditions have been corrected.

3.02 PREPARATION

A. Prepare an erection plan for all structural and fabric installation activity, including a detailed sequence of the work.

B. Prepare a clear, flat, smooth, and clean layout area on ground of sufficient size for assembly of fabric panels. Prepare area adjacent to location of structure installation.

C. Check contact surfaces to remove sharp objects, dirt, grease, oil, and other causes for rips, scratching, or other damage to fabric panels during installation.

D. Use temporary ground sheets where fabric panels are to be dragged across a surface. Prevent chaffing or other damage to fabric panel surface.

3.03 INSTALLATION

A. Conform to pre-established erection plan.

B. Do not undertake erection of fabric during inclement weather conditions. The installer has sole responsibility to determine when conditions are safe for erection.

C. Install structure in accordance with manufacturer's instructions at location indicated on the drawings.

D. Concrete Foundations:
   1. Install concrete foundations and anchor bolts as specified in Section 03 3000 and as indicated on the drawings.
   2. Ensure exposed concrete surfaces are smooth, uniform, and clean, with no "bug holes," air voids, or other surface blemishes.
   3. Ensure concrete has obtained specified minimum compressive strength before erection of support steel.

E. Support Steel:
   1. Erect support steel as specified in Section 05 1200 and as indicated on the drawings.
   2. Erect support steel plumb, level, and square, to correct location and elevation.
   3. Do not perform field welding without approval of Architect. Use experienced welders.

F. Install structure in the necessary sequence and with sufficient bracing to ensure stability at all times.

G. Architect will inspect installed concrete foundations, support steel, cables, and fittings before installation of fabric only to ensure compliance with data submittals.

H. Install and tension fabric in accordance with manufacturer's instructions.
   1. Use care in installation of fabric to avoid damage to base material, coating, and surface treatment.
   2. Ensure surfaces of fabric are smooth, uniform, and clean, with even curved edges and interfaces, and with no cuts, scratches, abrasions, stains, marks, blemishes, or welding irregularities.

I. Repair or replace defective or damaged materials, coatings, and finishes as directed by Architect.

3.04 ADJUSTING

A. Make final adjustments to structure as required for structural integrity, geometric shape, and free from objectionable wrinkles when viewed from the normally occupied space.

3.05 CLEANING

A. Clean structure in accordance with fabric manufacturer's instructions.

END OF SECTION

SECTION 14 6000
TROLLEY HOISTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead frame rails, electric hoists and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 4100 - Precast Structural Concrete

B. Section 05 1200 - Structural Steel: Overhead trolley and traveler beams

C. Section 09 9000 - Painting and Coatings

D. Section 26 0519 - Low Voltage Electrical Power Conductors and Cables (600V and Less)

E. Section 26 0526 - Grounding and Bonding for Electrical Systems

F. Section 26 0529 - Hangers and Supports for Electrical Systems

G. Section 26 0534 - Conduit

H. Section 26 0535 - Surface Raceways

I. Section 26 0537 - Boxes

J. Section 26 2717 - Equipment Wiring

K. Section 26 2726 - Wiring Devices

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:
   1. ASME - Safety Code for Overhead Hoists
   2. ASME - Inspectors Manual for Overhead Hoists

B. ASTM International:
   1. ASTM A36/A36M - Standard specification for Carbon Structural steel
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanneled) by the hot dipped process.
   3. ASTM 666 - Standard Specification for Austenitic Stainless Steel, trip, late and Flat Bar.
   4. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy with Improved Formability

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel

D. SSPC: The Society for Protective Coatings:
   1. SSPC - Steel Structures Painting Manual

1.04 SYSTEM DESCRIPTION

A. Overhead Rail System: Structural steel shapes arranged as a dual-rail track suspended from pre-cast concrete roof panels with a traverse mounted traveling beam on ball bearing rollers.

B. Electric Overhead Trolley Hoist System: Electric powered hoist, geared type.

C. Characterictics of each hoist are as follows:
   1. Rated Net Capacity: 4,000 lbs.
   2. Rated power: 1 HP motor.

1.05 DESIGN REQUIREMENTS FOR HOIST

A. Plain trolley mount.

B. Double chain

C. Mechanical Load brake

D. Multiple Disk Motor Brake.

E. Helical Gears

F. Overload Clutch

G. Chain Container

H. Operation:
   1. Push button controls on pendant.
   2. Adjustable limit switches.
   3. Solid State motor starter.

1.06 PERFORMANCE REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwritters Labatories, Inc. as suitable for purpose specified and indicated.

1.07 SUBMITTALS

A. Section 01 3300 - Submittal Procedures: Submittal Requirements.

B. Shop drawings: Indicate the following information:
   1. Hoisting Machine, controller, motor starter, gearing, braking and chain sheave.
   2. Trolley and Hoist Beam sizes.
   3. Trolley drawings, attachment wheels.
   4. Support Hangers, including: size, configuration, spacing and maximum loads imposed on support rails requiring load transfer to building structure.
   5. Individual weight of principal components: load reaction at points of support.
   6. Loads on hoisting and trolley beams.
   7. Clearances and over-all size of trolley hoist machinery.
   8. Locations and spacing of traveling cables and connections for power.
   9. Electrical Characteristics and connection requirements.

C. Product Data: Submit data on the following items:
   1. Manufacturer's name, model number and hoisting capacity.
   2. Operating controls.
   3. Beam and attachment requirements.
   4. Electrical and electrical rough-in requirements.
   5. Service and maintenance requirements.

1.08 CLOSEOUT SUBMITTALS

A. Section 01 7000 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data:
   1. Include parts catalog with complete list of equipment replacement parts: identify each entry with equipment description and identifying code.
   2. Include technical information for servicing operating equipment.
   3. Include legible schematic wiring diagrams of installled electrical equipment and changes made in the Work.
   4. Include one copy of master schematic and one copy of lubrication chart.

1.09 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM A17.1, AWS D1.1, AISC S335 and as supplemented in this section.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of three years experience.

B. Installer: Company specializing in performing Work of the section and approved by the equipment manufacturer.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 SCHEDULING

A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

1.13 WARRANTY

A. Section 01 7000 - Execution Requirements: Product warranties and product bonds.

B. Furnish manufacturer's warranty for hoist equipment and devices.

1.14 MAINTENANCE SERVICE

A. Section 01 7000 - Execution Requirements: Maintenance Service

B. Perform maintenance work using competent and qualified personnel.

1.15 EXTRA MATERIALS

A. Section 01 7000 - Execution requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.01 SUPPORT RAILS, TROLLEY BEAMS, HANGERS

A. Support Rail Components:
   1. Rolled Steel Sections, Shapes: ASTM A36/A36M.
   2. Adjustable clevis-type hangers and bolts.
   3. Shop and Touch-up Primer: SSPC 15, Type 1, red oxide.
   4. Finish Paint (for metal surfaces): Alkyd enamel, semi-gloss, color as selected. Do not paint wheel track surfaces.

B. Lubrication:
   1. Grease Fittings: For lubricating bearings requiring periodic lubrication.
   2. Lubrication Points: Visible and easily accessible.

C. Trolley Beam Fabrication:
   1. Frame: Welded steel, rolled steel sections, rigid and braced.
   2. Paint: Same as above for rails.

D. Trolley Beam Hangers:
   1. See Standard Detail 5G-11B

2.02 ELECTRIC TROLLEY HOISTS

A. Manufacturers:
   1. Coffing Hoists: Model ECT 4008-1-20
   2. Substitutions: Section 01 6000 - Product Requirements

B. Accessories:
   1. Chain Container: Coffing 927JG-20

C. Electrical characteristics and components:
   1. 208 Volts
   2. Disconnect Switch: Factory mounted disconnect switch on equipment.
   3. Emergency Disconnect Switch: Wall mounted emergency push button switch that disconnects all power to the motor when activated.
      a. Electrical components shall be compatible with circuit characteristics.
      b. Conduit, box, switch and conuctors shall be furnished and installed by contractor.
   4. Boxes, Conduit, Wiring and devices: See related sections.
   5. Fittings: Steel compression type for electrical metallic tubing (EMT). Fittings with set screws are not acceptable.
   6. Do not use armored flexible metal conduit as grounding conductor.

2.03 ELECTRIC DISTRIBUTION SYSTEM

A. Bar System:
   1. 2 Bar system with insulated cover and brackets.
   2. Connect to electrical per drawings.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify location of steel reinforcing in precast concrete tee's.
   1. Bore holes in or sleeve Precast Structural Concrete for hanger bolts.

3.02 EXAMINATION

A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate location of support rails, hangers and electrical connections with locations of other ceiling and roof mounted installations such as fans and lights.

C. Verify pre-cast concrete structural members are ready for work of this section.

D. Verify electrical power is available and of correct characteristics.

3.03 INSTALLATION

A. Install in accordance with ASTE A17.1

B. Install system components. Connect equipment to building utilities.

C. Install conduit boxes, wiring and accessories.

D. Securely fasten to building supports. Prevent lateral displacement.

E. Accomodate equipment equipment in space indicated.

F. Install support rails using clevis hangers and through-bolts.

G. Accurately align support rails. Form smooth joints with machined splice plates.

H. Adjust hangers to support an equal portion of the load.

I. Bolt hangers directly to structural precast concrete tee's.

J. Rails, hangers and traveler beam shall be painted. Do not paint, wheels, bearings or wheel tracks on rails.

K. Touch up paint on equipment to match original color.

L. Adjust equipment for smooth, quiet operation.

3.04 ERECTION TOLERANCES

A. Section 01 4000 - Quality requirements: Testing and Inspection services

B. Support rail Alignment: Level and parallel to each other within 1/8 inch.

C. Hanger loading differential: adjust loading so maximum variation in loading shall be no greater than 10% among all hangers on one support rail.

D. Trolley Movement on Aligned Support Rails: Smooth movement, with no objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Testing and Inspection Services.

3.06 MANUFACTURERS FIELD SERVICES

A. Section 01 4000 - Quality Requirements: Manufacturers field services.

3.07 ADJUSTING

A. Section 01 7000 - Execution Requirements: Testing, adjusting and balancing.

B. Adjust for movement of trolley by hand.

3.08 CLEANING

A. Section 01 7000 - Execution Requirements: Final Cleaning

B. Clean surfaces and components ready for inspection.

3.09 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Demonstrate proper operation of equipment to Iowa Department of Transportation's designated representative.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 7000 - Execution requirements: Protecting installed construction.

B. Position all chains and pendents out of traffic areas.

C. Do not allow other trades to operate hoists.

3.11 SCHEDULE

ROOM NUMBER:	ROOM NAME:	
110	STORAGE BAYS	(2 in storage bay)
111	MECHANICS BAYS	

END OF SECTION

SECTION 21 0000

PROJECT TITLE PAGE - MECHANICAL, ELECTRICAL, PLUMBING

MUSCATINE MAINTENANCE FACILITY

PROJECT NUMBER: BG-2M31(000)--80-70

3001 GRANDVIEW AVENUE
MUSCATINE , IOWA 52761

PROJECT MANUAL - PART II MECHANICAL, ELECTRICAL, PLUMBING
DATE: 10/31/2016

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pipe and connections for sprinkler systems.
   2. Valves and Appurtenances.
   3. Fire Department Connections.
   4. Control Switches.
   5. Sprinkler Heads.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler and standpipe systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and professional engineer.

B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

C. Welding certificates.

D. Fire-hydrant flow test report.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.8 SYSTEM DESCRIPTION

A. Contractor shall make connection at new water service entrance upstream of fire protection double check valve assembly.

B. "Hazard Classification", including items, systems, and subsystems not shown on drawings:
1. Light Hazard Occupancy:
a. Hydraulically calculated per NFPA to provide a density of 0.10 gpm per square foot for remote Class I hose stream. The system is to utilize 165 degree F rated standard coverage or extended coverage heads with spacing commensurate with the hazard of the room and as required to obtain the density specified.
b. Applicability: As indicated on Drawings.
2. Ordinary Hazard Occupancy (Group 1):
a. Hydraulically calculated per NFPA to provide a density of 0.15 gpm per square foot for the most remote 1500 square feet of floor area while allowing 500 gpm for the

most remote Class I hose stream. The system is to utilize 165 degree F rated standard coverage or extended coverage heads with spacing commensurate with the hazard of the room and as required to obtain the density specified. Heads spaced at 130 square feet maximum per head for standard coverage heads and 400 square foot per head for extended coverage heads.

b. Applicability: Areas where indicated.

3. Ordinary Hazard Occupancy (Group 2):

a. Hydraulically calculated per NFPA to provide a density of 0.20 fpm per square foot for the most remote 1500 square feet of floor area while allowing 500 gpm for the most remote Class I hose stream. The system is to utilize 165 degree F rated standard or extended coverage heads with spacing commensurate with the hazard of the room and as required to obtain the density specified. Heads spaced at 130 square feet per head for standard coverage heads and 400 square foot per head for extended coverage heads."

b. Applicability: As indicated on Drawings.

1.9 WATER SUPPLY TEST INFORMATION

A. Perform test at the nearest hydrant, coordinating fully with the City of Muscatine. Note the following:

1. Hydrant number and location.
2. Static Pressure.
3. Residual Pressure.
4. Calculated Flow.
5. Flow at 20 psi.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.

2.2 ABOVE GROUND PIPING

A. Black Steel Pipe: 175 psi working pressure, each length marked with applicable standard.

1. Thoroughly cleaned and protected with suitable coating.
2. Schedule 40; ASTM A53 or A120; hydraulically tested at mill per ASTM standards.
3. Schedule 10 piping may be used in sizes 2-1/2" and larger.

B. Pipe Joints:

1. Thoroughly cleaned and protected with suitable coating.
2. Schedule 40:

a. Screwed: ANSI B2.1.

b. Welded; ANSI B31.1.0, B31.1.0a, and B31.1.0b.

c. Mechanical Coupling: Rolled or cut groove type, UL and FM approved combination of couplings, gaskets, and grooves; pipe end preparation in accordance with manufacturer's instructions.

C. Screwed Fittings:

1. Cast Iron: ANSI B16.4; black, 125 lb class.

a. Maximum working pressure for 1" through 2": 300 psi.

b. Maximum working pressure for 2-1/2" through 12": 175 psi.

2. Malleable Iron: ANSI B16.3; black, 150 lb class.

a. Maximum working pressure: 300 psi.

D. Flanged Fittings:
1. Cast Iron, short body, class 125, Black, ANSI B16.1.
2. Gaskets: Full face, minimum 1/8 inch thick, red sheet rubber, ANSI B16.24.
3. Bolts and nuts: Bolt length to allow not less than 1/8 inch exposed thread beyond nut, ANSI B18.2.1, 18.2.2.

E. Grooved Couplings: ASTM A47; malleable iron, 175 psi working pressure.
1. Gaskets: Butyl rubber.
2. Tested and listed by UL and FM.
3. Acceptable Manufacturers:
a. Grinnell Gruvlok 7001.
b. Tyler/Gustin-Bacon
c. Victaulic.

F. Grooved Fittings: ASTM A47, malleable iron, 175 psi working pressure.
1. Gaskets: Butyl rubber.
2. Tested and listed by UYL and FM.
3. Acceptable Manufacturers:
a. Grinnell.
b. Tyler/Gustin-Bacon
c. Victaulic.

G. Drain Termination: Terminations inside building: indirect waste over floor drain or receiver.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Malleable iron, adjustable swivel, split ring or adjustable band hanger.

B. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis or band hanger.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches (80 mm): Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.4 VALVES AND APPURTENANCES

A. Double Check Assembly Backflow Preventer:
1. Manufacturers: Watts, Febco.
2. Two outside screw and yoke gate valves.
3. Two check valves with bolted cover plate.

4. Tested and Listed by UL and FM.
5. With supervisory switches at valves.

B. Outside Screw and Yoke (OS&Y) Gate Valve:
1. Basis of Design: Mueller.
2. Flanged, iron body, bronze mounted.
3. 175 psi working pressure.
4. Handwheel, open counter-clockwise.
5. Tested and listed by UL and FM.
6. With supervisory switch.

C. Indicating Butterfly Valve:
1. Basis of Design: Stockham.
2. Cast iron body, lug type, gear operated.
3. Indicating flag mounted on top to show valve open or valve closed.
4. 175 psi working pressure.
5. Tested and listed by UL and FM.
6. With supervisory switch.

D. Check Valve - Swing Type:
1. Basis of Design: Mueller.
2. Flanged, iron body, bronze seat ring and disc ring.
3. 175 psi working pressure.
4. Tested and listed by UL and FM.

E. Butterfly Valve (for use as zone control valve and isolation valve):
1. Basis of Design: Mueller.
2. 175 psi working pressure.
3. Bubble tight shut-off to 350 psig.
4. Grooved or wafer body.
5. Tested and listed by UL and FM.
6. With supervisory switch.

F. Auxiliary Drain and Inspector's Test Valve:
1. One inch globe type, bronze body, screwed.
2. Integral sight glass and labeled plate showing test drain positions.
3. Test orifice for flow of one head.
4. 200 psi working pressure.
5. Renewable composition soft disc.

G. Pressure Gauges:
1. 3-1/2" dial marked in five pound increments.
2. 1/2 inch NPT.
3. 175 psig working pressure.

2.5 FIRE DEPARTMENT CONNECTION

A. Wall Mounted Type:
1. Basis of Design: Potter Roemer.
2. Other manufacturers: Elkhart, Seco.
3. Flush mounted style with two- 2-1/2" inlets, angle outlet body, as applicable to specific building.
4. Individual drop clapper valves, plugs, and chains.
5. Polished chrome escutcheon lettered "AUTO SPKR.”.

6. Inlet hose thread: Comply with local fire department thread specifications.
7. Material: Brass with polished chromium plate finish on exposed parts.
8. Tested and listed by UL and FM.

2.6 CONTROL SWITCHES

A. Wet-pipe System Flow Detector Switch:
1. Vane operated electric flow alarm switch.
2. Capable of indicating a flow of water equal to discharge from one sprinkler head.
3. Two DPDT 24 VDC switches.
4. 20 second (adjustable 0-60 seconds) time delay.
5. Tamper resistant construction.
6. For horizontal or vertical pipe mounting.

B. Supervisory Switches:
1. For zone valves, and other valves where indicated.
2. Activatory arm and mounting device as required for valve type.
3. Two DPDT 24 VDC switches.
4. Tamper resistant construction.
5. Waterproof for exposed locations.

2.7 ELECTRIC ALARM BELLS

A. Provided and installed as part of the fire alarm system by Division 28.

2.8 SPRINKLER HEADS

A. Manufacturers: Reliable, Automatic Sprinkler Corp of America, Tyco, Star, Viking

B. For Wet Systems:
1. Activator: Fusible link unless otherwise scheduled.
2. Discharge from heads at ceilings: horizontal unless otherwise scheduled.

C. Select temperature ratings of each head for the maximum ambient temperature of the space in which the head is installed; comply with NFPA 13.

D. Coverage: standard or extended coverage.

E. Escutcheons: Steel or brass, two piece, adjustable height.

F. Sprinkler Head Styles :
1. Concealed pendant sprinklers, to be installed in all finished ceiling areas. Cover plate finish shall be white except where installed in wood ceilings, where color shall be as selected by Architect. Submit color options for review.
2. Upright style, with manufacturer’s standard non-corrosive finish.
3. In rooms devoted primarily to mechanical and electrical equipment, storage rooms, and concealed spaces, and where noted: Upright style, with manufacturer's standard non-corrosive finish.

G. Heads shall be tested and listed by UL and FM.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Sleeve pipes passing through partitions, walls, and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 m).
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

I. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
   2. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   3. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

J. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

K. Install flushing connections at ends of cross mains; capped nipple same diameter as pipe, but not larger than 2 inches.

L. Extend drain valve and test valve discharges to floor drain, mop basin or outside on splash block where indicated; terminate so discharge is visible. Drain size not less than 3/4 inch. Provide nipple and cap or brass plug for systems or partial systems of 5 gallons or less. Provide valve and plug for systems or partial systems of more than 5 gallons.

M. Provide auxiliary drain valves where required.

N. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 099000.

O. Do not penetrate building structural members unless indicated.

P. Provide sleeves when penetrating floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

Q. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

R. Provide gate valves for shut-off or isolating service.

S. Provide drain valves at main shut-off valves, low points of piping and apparatus.

T. Install each wet sprinkler system zone control assembly complete with:
1. Butterfly valve with supervisory switch.
2. Water flow switch.
3. 1-1/4 inch drain valve.
4. One inch globe type inspector's test valve.
5. One inch sight glass.
6. One inch auxiliary drain valve.
7. Required interconnecting piping.

U. Sprinkler Heads:
1. Lay out in accordance with design requirements and as indicated.
2. Install head guards on all heads exposed to or subject to mechanical damage.
3. Install sprinklers in fittings after piping is in place.
4. Install ceiling mounted sprinklers in the centers of ceiling tiles unless directed otherwise.
5. Install escutcheons and covers flush with ceiling.

3.3 FIELD QUALITY CONTROL

A. Conduct tests prior to covering or concealing joints in portion of system to be tested.

B. Test new piping. Invite Architect/Engineer, Owner's Representative, and Authority having jurisdiction to witness tests.

C. Close control valves of existing systems during testing of new systems.

D. Flush all new system piping thoroughly.

E. Hydrostatic Test:
1. Required for all new piping and equipment.
2. Fill portion of system to be tested a minimum of 24 hours prior to testing; remove all air.
3. Maintain 50 psig above maximum static pressure, 200 psig minimum, for 2 hours.

F. Pneumatic Test:
   1. Interim test required for new piping and equipment exposed to freezing conditions.
   2. Maintain 40 psig for 24 hours.
   3. Retest hydrostatically when weather permits.

G. Operating Test:
   1. Required for resettable working equipment.
   2. Test under normal maximum pressures and flow rates.
   3. Pressure test control valves by opening to full flow to for minutes, then closing against full pressure to test for tightness.

H. Adjustment, Repair, Retest:
   1. Adjust, repair, and alter systems as required to attain specified test results.
   2. Replace defective parts with new material.
   3. Caulking of screwed joints or peening of welds not permitted.
   4. Retest, after correction of defects, until satisfactory test results are attained.

I. Contractor's Material and Test Certificate: Submit completed certificate to authority having jurisdiction, with copies to Architect/Engineer, Owner's Representative, and Project Record Documents.

J. Be responsible for damage to the Work, to property and materials of others, and to building, caused by leaks in fire protection equipment, unplugged or disconnected pipes or fittings. Repair or replace work or items so damaged during installation and testing of work specified under this Section.

END OF SECTION

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 1000 m (3300 feet) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers:

1. Basis of Design: Smith, Jay R. Mfg. Co.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers:

1. Advance Products & Systems, Inc.

2. Metraflex Company (The).

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: HPDE interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 34.5-MPa (5000-psi), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 25-mm (1-inch) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 50 mm (2 inches) above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 6.4-mm (1/4-inch) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 6.4-mm (1/4-inch) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 50 mm (2 inches) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than DN 150 (NPS 6): Cast-iron wall sleeves, Galvanized-steel wall sleeves, Galvanized-steel-pipe sleeves.

2. Concrete Slabs-on-Grade:

a. Piping Smaller Than DN 150 (NPS 6): Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 25-mm (1-inch) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

a. Piping Smaller than DN 150 (NPS 6)Galvanized-steel-pipe sleeves, PVC-pipe sleeves,Stack-sleeve fittings.

4. Interior Partitions:

a. Piping Smaller Than DN 150 (NPS 6): Galvanized-steel-pipe sleeves, PVC-pipe sleeves.

END OF SECTION

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   d. Bare Piping at Wall Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass] type with [polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

   1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Dial-type pressure gages.
3. Gage attachments.
4. Test plugs.
5. Test-plug kits.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E 1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.

1. Size: 5 inch (125 mm) diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.
5. Support Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
6. Dial range shall be at least minus 18 to plus 104 deg C (0 to 220 deg F).

2.2 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: type(s);; 114-mm (4-1/2-inch) nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with DN 8 or DN 15 (NPS 1/4 or NPS 1/2), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.

6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
11. Dial range shall be at least 0 to 1380 kPa (0 to 200 psig).

2.3 GAGE ATTACHMENTS

A. Valves: Brass or stainless-steel needle, with DN 8 or DN 15 (NPS 1/4 or NPS 1/2), ASME B1.20.1 pipe threads.

2.4 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: DN 8 (NPS 1/4) or DN 15 (NPS 1/2), ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 125 psig.

E. Core Inserts: EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

J. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

SECTION 22 05 23.12

BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

1.3 SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.

4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Handlever: For quarter-turn valves smaller than DN 100 (NPS 4)

H. Valves in Insulated Piping:

1. Include 50-mm (2-inch) stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Two-Piece, Brass Ball Valves with Regular Port and Brass Trim:

1. Manufacturers:

a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 4140 kPa (600 psig).
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Regular.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, DN 50 (NPS 2) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe DN 50 (NPS 2) and Smaller:

1. Two-piece, brass ball valves with regular port and brass trim.

END OF SECTION

SECTION 22 05 23.13

BUTTERFLY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Iron, single-flange butterfly valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.3 SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set butterfly valves closed or slightly open.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B31.9 for building service piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Handlever: For valves DN 150 (NPS 6) and smaller.

H. Valves in Insulated Piping: With 50-mm (2-inch) stem extensions.

2.2 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. Iron, Single-Flange Butterfly Valves with Ductile-Iron Disc:

1. Manufacturers:

a. Hammond Valve.
b. Jenkins Valves; Crane Energy Flow Solutions.
c. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 1380 kPa (200 psig).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated ductile iron.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine mating flange faces for damage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

D. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe DN 65 (NPS 2-1/2) and Larger:

1. Two-piece, brass ball valves with regular port and brass trim.

END OF SECTION

SECTION 22 05 23.14

CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Iron swing check valves with closure control.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.3 SUBMITTALS

A. Product Data: For each type of valve.

   1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers:
   a. Crane; Crane Energy Flow Solutions.
   b. Hammond Valve.
   c. Milwaukee Valve Company.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 1380 kPa (200 psig).
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged or threaded. See valve schedule articles.
   f. Trim: Bronze.
   g. Gasket: Asbestos free.
   h. Closure Control: Factory-installed exterior lever and weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Check Valves: In horizontal or vertical position, between flanges.
2. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, DN 50 (NPS 2) and Smaller: Threaded or soldered.
2. For Copper Tubing, DN 65 to DN 100 (NPS 2-1/2 to NPS 4): Flanged or threaded.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe DN 50 (NPS 2) and Smaller: Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125, bronze disc.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASME B31.9.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 34.5-MPa (5000-psi), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 100 mm (4 inches) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [DN 65 (NPS 2-

1/2)] and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe DN 100 (NPS 4) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe DN 100 (NPS 4) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. DN 8 to DN 90 (NPS 1/4 to NPS 3-1/2): 305 mm (12 inches) long and 1.22 mm (0.048 inch) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 40 mm (1-1/2 inches).

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 0.05 mm (2.0 mils).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes DN 15 to DN 100 (NPS 1/2 to NPS 4).
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes DN 20 to DN 100 (NPS 3/4 to NPS 4), requiring clamp flexibility and up to 100 mm (4 inches) of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes DN 15 to DN 100 (NPS 1/2 to NPS 4) if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes DN 15 to DN 100 (NPS 1/2 to NPS 4), to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes DN 20 to DN 200 (NPS 3/4 to NPS 8).
6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes DN 15 to DN 200 (NPS 1/2 to NPS 8).
7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes DN 15 to DN 200 (NPS 1/2 to NPS 8).

8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes DN 15 to DN 200 (NPS 1/2 to NPS 8).
9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes DN 10 to DN 200 (NPS 3/8 to NPS 8).
10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes DN 10 to DN 80 (NPS 3/8 to NPS 3).
11. U-Bolts (MSS Type 24): For support of heavy pipes DN 15 to DN 100 (NPS 1/2 to NPS 4).
12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
13. Pipe Saddle Supports (MSS Type 36): For support of pipes DN 100 to DN 900 (NPS 4 to NPS 36), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
14. Single-Pipe Rolls (MSS Type 41): For suspension of pipes DN 25 to DN 100 (NPS 1 to NPS 4), from two rods if longitudinal movement caused by expansion and contraction might occur.
15. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes DN 65 to DN 100 (NPS 2-1/2 to NPS 4), from single rod if horizontal movement caused by expansion and contraction might occur.
16. Complete Pipe Rolls (MSS Type 44): For support of pipes DN 50 to DN 100 (NPS 2 to NPS 4) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers DN 24 to DN 100 (NPS 3/4 to NPS 4).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers DN 20 to DN 100 (NPS 3/4 to NPS 4) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 150 mm (6 inches) for heavy loads.
2. Steel Clevises (MSS Type 14): For 49 to 232 deg C (120 to 450 deg F) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 49 to 232 deg C (120 to 450 deg F) piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 340 kg (750 lb).
    b. Medium (MSS Type 32): 680 kg (1500 lb).
    c. Heavy (MSS Type 33): 1360 kg (3000 lb).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 32 mm (1-1/4 inches).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include

auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fastener or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe labels.
2. Valve tags.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PIPE LABELS

A. Manufacturers:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Champion America.
4. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping at least 13 mm (1/2 inch) for viewing distances up to 1830 mm (72 inches) and proportionately larger lettering for greater viewing distances.

2.2 VALVE TAGS

A. Manufacturers:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Champion America.
4. Seton Identification Products.

B. Valve Tags: 1-1/2” diameter brass tags, stamped or engraved with 6.4-mm (1/4-inch) letters for piping system abbreviation.

1. Tag Material: Brass, 0.8-mm (0.032-inch) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting."

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 15 m (50 feet) along each run. Reduce intervals to 7.6 m (25 feet) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:

1. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

2. Storm Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

3. Sanitary Waste and Vent Piping:

   a. Background Color: Safety black,
   b. Letter Color: White

4. Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 38 mm (1-1/2 inches), round.
   b. Hot Water: 38 mm (1-1/2 inches), round.
   c. Low-Pressure Compressed Air: 38 mm (1-1/2 inches), round.

2. Valve-Tag Colors:

   a. Cold Water: Safety green.
   b. Hot Water: Safety green.
   c. Low-Pressure Compressed Air: Safety blue.

3. Letter Colors:

   a. Cold Water: White.
   b. Hot Water: White.
   c. Low-Pressure Compressed Air: White.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Roof drains and rainwater leaders.
6. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.4 COORDINATION

A. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.5 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturer:

a. Knauf Insulation: www.knaufusa.com.
b. Johns Manville Corporation: www.jm.com.
c. Owens Corning Corp: www.owenscorning.com.
d. CertainTeed Corporation: www.certainteed.com.

2. Type I, 454 Deg C (850 Deg F) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Undersink Pipe Covers:

1. Manufacturer:

a. Basis of Design: Truebro.

2. ADA Complaint.
3. Material: Molded vinyl.
4. Wall thickness: 1/8”.
5. UV Protection.
6. Color: White.
7. Paintable.
8. ASTM D-635
9. ASTM G21 and G22.
10. Coverage:

a. One P-trap cover, two angle valves and covers.
b. One 5” offset tailpiece wheelchair strainer assembly.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.03 metric perm (0.05 perm) at 0.9-mm (35-mil) dry film thickness.
2. Service Temperature Range: Minus 18 to plus 82 deg C (0 to 180 deg F).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.5 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 75 mm (3 inches).
2. Thickness: 0.29 mm (11.5 mils).
3. Adhesion: 1.0 N/mm (90 ounces force/inch) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 7.2 N/mm (40 lbf/inch) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 75-mm- (3-inch-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 100 mm (4 inches) o.c.
   3. Overlap jacket longitudinal seams at least 38 mm (1-1/2 inches). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 50 mm (2 inches) o.c.

      a. For below-ambient services, apply vapor-barrier mastic over staples.

   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 100 mm (4 inches) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 50 mm (2 inches) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 50 mm (2 inches).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 50 mm (2 inches) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 150 mm (6 inches) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 25 mm (1 inch), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. DN 25 (NPS 1) and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 13 mm (1/2 inch) thick.

2. DN 32 (NPS 1-1/4) and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 25 mm (1 inch) thick.

B. Domestic Hot and Recirculated Hot Water:

1. DN 40 (NPS 1-1/2) and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 25 mm (1 inch) thick.

2. DN 50 (NPS 2) and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 38 mm (1-1/2 inch) thick.

C. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 25 mm (1 inch) thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:
a. Pipe Cover.

END OF SECTION

SECTION 22 11 13

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components for the building water service.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NSF Compliance:

1. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.6 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88M, Type B (ASTM B 88, Type L), water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:

a. DN 50 (NPS 2) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
b. DN 65 to DN 100 (NPS 2-1/2 to NPS 4): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Flanges: ASME 16.1, Class 125, cast iron.

2.3 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, BCuP Series.

2.4 PIPING SPECIALTIES

A. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

   a. Description:

      1) Standard: ASSE 1079.
      2) Pressure Rating: 860 kPa (125 psig) minimum at 82 deg C (180 deg F).
      3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

   a. Description:

      1) Standard: ASSE 1079.
      2) Factory-fabricated, bolted, companion-flange assembly.
      3) Pressure Rating: 860 kPa (125 psig) minimum at 82 deg C (180 deg F).
      4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

   a. Description:

      1) Nonconducting materials for field assembly of companion flanges.
      2) Pressure Rating: 1035 kPa (150 psig).
      3) Gasket: Neoprene or phenolic.
      4) Bolt Sleeves: Phenolic or polyethylene.
      5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

   a. Description:

      1) Standard: IAPMO PS 66
      2) Electroplated steel nipple. complying with ASTM F 1545.
      3) Pressure Rating: 2070 kPa (300 psig) at 107 deg C (225 deg F).
      4) End Connections: Male threaded or grooved.

5) Lining: Inert and noncorrosive, propylene.

2.5 BUTTERFLY VALVES

A. AWWA Butterfly Valves:

1. Manufacturers: Hammand Vlave, Crane Co., Milwaukee Valuve, Victaulic.

2. Description: Rubber seated.

a. Standard: AWWA C504.
b. Body: Cast or ductile iron.
c. Body Type: Wafer or flanged.
d. Pressure Rating: 1035 kPa (150 psig).

2.6 CURB VALVES

A. Manufacturers:

B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 75 mm (3 inches) in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.7 WATER METERS

A. Water meters will be furnished by utility company.

2.8 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers:

a. Basis of Design: Watts 957OSY.

b. Other Manufacturers: Conbraco, Febco, Wilkins.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 83 kPa (12 psig) at 500 gpm.
5. Size: 4-inch.
6. Design Flow Rate: 500 gpm.
7. Selected Unit Flow Range Limits: 750 gpm maximum.
8. Housing and Sleeve: 304 (Schedule 40) Stainless Steel.
9. Elastomers: EPDM, Silicone and Buna-N.
10. Torsion Spring Checks: Stainless Steel.
11. Check Discs: Reversible Silicone or EPDM

12. Test Cocks: Bronzze Body Nickel Plated.
13. Pins and Fastners: 300 Series Stainless Steel.
14. Springs: Stainless Steel.
15. End Connections: Flanged for DN 65 (NPS 2-1/2) and larger.
16. Configuration: Designed for horizontal, straight through flow.
17. Accessories:

    a. OS&Y gate type with flanged ends on inlet and outlet of DN 65 (NPS 2-1/2) and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

    1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

    1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

    1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

    2. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

3.2 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. 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.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade,

3.3 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping DN 20 to DN 80 (NPS 3/4 to NPS 3) shall be the following:

1. Ductile Iron Pipe: AWWA C151/A21.51.

F. Aboveground Water-Service Piping DN 20 to DN 80 (NPS 3/4 to NPS 3) shall be the following:

1. Hard copper tube, ASTM B 88M, Type B (ASTM B 88, Type L); wrought-copper, solder-joint fittings; and brazed joints.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 33 05 00 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than DN 50 (NPS 2) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.

2. Install tapping sleeve on pipe to be tapped.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections DN 50 (NPS 2) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

F. Bury piping with depth of cover over top at least 750 mm (30 inches), with top at least 300 mm (12 inches) below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 910 mm (36 inches) cover over top.

G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

I. Sleeves are specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

K. See Section 22 11 16 "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.

3.8 VALVE INSTALLATION

A. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

B. MSS Valves: Install as component of connected piping system.

3.9 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support DN 65 (NPS 2-1/2) and larger backflow preventers, valves, and piping near floor.

3.10 CONNECTIONS

A. Connect water-distribution piping to utility water main.

B. Connect water-distribution piping to interior domestic water piping.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 350-kPa (50-psig) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 kPa (0 psig). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 1.89 L (2 quarts) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.12 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 33 05 00 "Common Work Results for Utilities" for identifying devices.

3.13 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. System purging and disinfecting activities report.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88M, Type B (ASTM B 88, Type L) water tube, drawn temper.

B. Fittings for piping 2” and smaller: Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Joints for piping 2” and smaller: ASTM B 32, alloy SN95 solder.

D. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

E. Fittings for piping 2-1/2” inches and larger: Cast bronze, grooved ends, ASTM B584-87, or wrough copper, groved ends ASTM B-75.

F. Joints for piping 2-1/2” inches and larger: Bolted clamps type couple with grooved end lock, ASTM A-536. Victaulic or equal.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

B. Flux: ASTM B 813, water flushable.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: [860 kPa (125 psig) minimum at 82 deg C (180 deg F)]. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: [860 kPa (125 psig) minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install shutoff valve immediately upstream of each dielectric fitting.

C. Install domestic water level and plumb.

D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping to permit valve servicing.

H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100: Use dielectric flanges.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least one day 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

   c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. 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 a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   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 it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
   f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) 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 three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping, NPS 2 (DN 50) and smaller shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and soldered joints.

E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100 shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast bronze, grooved ends, or wrough copper, groved ends. Bolted clamps type couple with grooved end lock.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temperature Actuated, water mixing valves.
2. Strainers.
3. Hose stations.
4. Hose bibbs.
5. Wall hydrants.
6. Water-hammer arresters.
7. Air vents.
8. Flexible connectors.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 860 kPa (125 psig) unless otherwise indicated.

2.3 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

1. Basis of Design: Power LFe480.

2. Standard: ASSE 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 860 kPa (125 psig) minimum unless otherwise indicated.
4. Body: Lead free bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

8. Minimum Flow Rate: 0.5 gpm.
9. Maximum Flow Rate: 5.2 gpm.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Size 1-1/2 inch (40 mm) to 4 inch (100 mm):

1. Class 125, flanged iron body, Y pattern with 1/16 inch (1.6 mm) stainless steel perforated screen.
   a.

2.5 HOSE BIBBS

A. Hose Bibbs HB-1:

1. Manufacturer:

   a. Basis of Design: Chicago.
   b. Other Manufacturers: Jay R. Smith Manufacturing, Watts Regulator Company, Zurn Industries.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Finish: Chrome plated.
5. Seat: Bronze, replaceable.
6. Sill fittings.
7. 2-1/4” Tee Handle
8. Slow Compression Operating Cartridge
9. Supply Connections: DN 20 (NPS 3/4) threaded inlet.
10. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
11. Pressure Rating: 860 kPa (125 psig).
12. Temperature Rating; 140 F.
13. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.
16. Warranty:

    a. Lifetime Limited Faucet Waranty.
    b. 5-Year Limited Cartridge Warranty.
    c. 1-Year Limited Finish Warranty.

B. Hose Bibb HB-2

1. Manufacturer:

   a. Basis of Design: Chicago.
   b. Other Manufacturers: Jay R. Smith Manufacturing, Watts Regulator Company, Zurn Industries.

2. Standard: ASME A112.18.1, ASSE 1001, ADA ANSI A117.1.
3. 3-3/8” Fixed Centers
4. 2-3/8” Rigid Atmospheric Vacuum Breaker Spout with ¾” Hose Thread.
5. 2-3/8” Vandal Proof Level Handle

6. Quantum Compression Operating Cartridge
7. Less Inlet Supply Arms
8. Atmospheric Vacuum Breaker.
9. Rated Operating Pressure: 860 kPa (125 psig).
10. Temperature Rating; 140 F.
11. Warranty:

    a. Lifetime Limited Faucet Waranty.
    b. 5-Year Limited Cartridge Warranty.
    c. 1-Year Limited Finish Warranty.

2.6 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturer:

    a. Basis of Design: Woodford B67.
    b. Other Manufacturers: Chicago, Jay R. Smith Manufacturing, Watts Regulator Company, Zurn Industries.

2. Standard: ASSE 1052 concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 860 kPa (125 psig).
4. Maximum Temperating: 120 F
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: DN 20 (NPS 3/4).
8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Box: Deep, flush mounted with cover.
10. Box and Cover Finish: Chrome plated.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.
13. 3/8” solid brass operating rod.
14. Hardened Stainless Steel operating steam.
15. Two imdependent check valves.
16. Drains automatically when hose is removed.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Basis of Design: Sioux Chief 650/660.
2. Standard: ASSE 1010 .
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F.

2.8 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.

2. Pressure Rating and Temperature: 860-kPa (125-psig) minimum pressure rating at 60 deg C (140 deg F).
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: DN 10 (NPS 3/8) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 1035-kPa (150-psig) minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: DN 10 (NPS 3/8) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.9 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 1380 kPa (200 psig).
2. End Connections DN 50 (NPS 2) and Smaller: Threaded copper pipe or plain-end copper tube.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 1380 kPa (200 psig).
2. End Connections DN 50 (NPS 2) and Smaller: Threaded steel-pipe nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

B. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

C. Install air vents at high points of water piping.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 11 23

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.2 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers:

1. Basis of Design: Taco 112.

2. Other manufacturers: Armstrong, Bell and Gossett, Grundfos.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Pump Construction:

1. Casing: Radially split with threaded companion-flange connections for pumps with DN 50 (NPS 2) pipe connections and flanged connections for pumps with DN 65 (NPS 2-1/2) pipe connections.
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
5. Bearings: Oil-lubricated; bronze-journal or ball type.
6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

E. Capacities and Characteristics: As shown on the drawings.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft(s) horizontal.

C. Install continuous-thread hanger rods and spring hangers of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 22 05 48.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

    a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
    b. Comply with requirements for flexible connectors specified in Section 22 11 16 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.
8. Adjust temperature settings on thermostats.
9. Adjust timer settings.

3.6 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 30 kPa(10-foot head of water).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:

1. Manufacturers:

   a. ANACO-Husky.
   b. MIFAB, Inc.
   c. Mission Rubber Company, LLC; a division of MCP Industries.

2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers:

   a. Basis of Design: Charlotte.

2. Standard: ASTM C 1277.

3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET (1500 mm) OF BUILDING

A. PVC Pipe: ASTM D3034 SDR 35.

1. Fittings: PVC.
2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

B. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.5 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

B. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.

1. Fittings: PVC.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88M, Type B and Type C (ASTM B 88, Type L and Type M), water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88M, Type B (ASTM B 88, Type L), water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 3.2-mm (1/8-inch) maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Unshielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1173.
b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

4. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

5. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 860 kPa (125 psig) minimum at 82 deg C (180 deg F).
3) End Connections: Solder-joint copper alloy and threaded ferrous.

6. Dielectric Nipples:

a. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 2070 kPa (300 psig) at 225 deg F (107 deg C.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

2. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

3.2 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. 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.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade,

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping DN 80 (NPS 3) and smaller; 1 percent downward in direction of flow for piping DN 100 (NPS 4) and larger.

2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. 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."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install steel piping according to applicable plumbing code.

O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

P. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

Q. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections DN 65 (NPS 2-1/2) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping DN 50 (NPS 2) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping DN 65 (NPS 2-1/2) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 30 kPa (10-foot head of water). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 250 Pa (1-inch wg). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

7. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

8. Cap and subject piping to static-water pressure of 345 kPa (50 psig) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

9. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

10. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping DN 100 (NPS 4) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

3. Copper DWV tube, copper drainage fittings, and soldered joints.

C. Aboveground, vent piping DN 100 (NPS 4) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

3. Copper DWV tube, copper drainage fittings, and soldered joints.

a. Option for Vent Piping, DN 65 and DN 90 (NPS 2-1/2 and NPS 3-1/2): Hard copper tube, Type C (Type M); copper pressure fittings; and soldered joints.

D. Underground, soil, waste, and vent piping DN 100 (NPS 4) and smaller shall be any of the following:

1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.

E. Underground Site PVC pipe and fittings.

1. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

2. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

F. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

END OF SECTION

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Sand/Oil Trap Catch Basin.

1.2 SUBMITTALS

A. Product Data: For each type of interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers:

1) Josam Company.
2) Smith, Jay R. Mfg. Co.
3) Wade

4) Zurn Industires Inc.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk\brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers:

1) Josam Company.
2) Smith, Jay R. Mfg. Co.
3) Wade
4) Zurn Industires Inc.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Closure: Brass plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron.
8. Top Loading Classification: Heavy Duty.
9. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers:

a. Josam Company.
b. Smith, Jay R. Mfg. Co.
c. Wade
d. Zurn Industires Inc.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers:

a. Josam Company.

b. Smith, Jay R. Mfg. Co.
c. Wade
d. Watts
e. Zurn Industires Inc.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Anchor Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Top or Strainer Material: Nickel bronze.
9. Top of Body and Strainer Finish: Polished bronze.
10. Top Shape: Round.
11. Trap Material: Cast iron.
12. Trap Pattern: Standard P-trap.

2.3 SAND/OIL TRAP CATCH BASIN

A. Custom precast concrete catch basin.

1. Manufacturer:

a. Basis of Design: Lister Industries.

2. Standard: Concrete to comply with ASTM C 913
3. Walls: 3-1/2” thick.
4. Floor: 3-1/2” thick.
5. Frame and Lid:

a. Basis of Design: Detter Foundary: #2230 Heavy Duty Frame and Lid
b. Description: 26”x26”x1-1/2” 234 with square inches of open area.

6. Capacities and Characteristics: Refer to Architectural Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to DN 100 (NPS 4). Use DN 100 (NPS 4) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 15 m (50 feet) for piping DN 100 (NPS 4) and smaller and 30 m (100 feet) for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 750 mm (30 Inches) or Less: Equivalent to 1 percent slope, but not less than 6.35-mm (1/4-inch) total depression.
   b. Radius, 750 to 1500 mm (30 to 60 Inches): Equivalent to 1 percent slope.
   c. Radius, 1500 mm (60 Inches) or Larger: Equivalent to 1 percent slope, but not greater than 25-mm (1-inch) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

F. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 25-mm (1-inch) clearance between vent pipe and roof substrate.

G. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

H. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 25-mm (1-inch) clearance between vent pipe and roof substrate.

I. Install wood-blocking reinforcement for wall-mounting-type specialties.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 13 23

SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Oil interceptors.

1.2 SUBMITTALS

A. Product Data: For each type of interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

C. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:

1. Interceptors.
2. Piping connections. Include size, location, and elevation of each.
3. Interface with underground structures and utility services.

PART 2 - PRODUCTS

2.1 WATER INTERCEPTORS

A. Precast concrete to comply with ASTM C 913.

1. Manufacturer:

a. Basis of Design: Lister Industries, Iowa Department of Transportation design.

2. Concrete: 4000 psi 28 day compressive strength.
3. Reinforcement: See Detail 1 on drawing sheet SP-7.
4. Casting delivered loose and to be poured into finished slab on grade.
5. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
6. Access Extension: Reinforced-concrete pipe, length as necessary to extend to slab on grade, to match diameter of manhole frame and cover.
7. Manhole Frames and Covers: Two Ferrous; 610-mm (24-inch) ID by 175- to 225-mm (7- to 9-inch) riser with 100-mm- (4-inch-) minimum width flange and 660-mm- (26-inch-) diameter cover. See detail 1 on drawing sheet SP-7

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
c. Include indented top design with lettering cast into cover, using wording equivalent to "OIL INTERCEPTOR."

B. Capacities and Characteristics:

1. Capacity: 1000 gallon.
2. Overall Dimensions: See details 1 and 2 on drawing sheet SP-7.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements.

D. Set tops of grating frames and grates flush with finished surface.

E. Set interceptors level and plumb.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 22 13 16 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION

SECTION 22 14 13

FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Miscellaneous Storm Drainage Piping Specialties.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 30 kPa (10-foot head of water).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.01 STORM SEWER PIPING, BURIED BEYOND 5 FEET (1500 mm) OF BUILDING

A. PVC Pipe: ASTM D3034 SDR 35.

1. Fittings: PVC.
2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

B. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.02 STORM SEWER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

B. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.

1. Fittings: PVC.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Downspout Adaptors:

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

2. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

3.2 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. 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.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade,

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 2 percent downward in direction of flow for piping DN 80 (NPS 3) and smaller; 2 percent downward in direction of flow for piping DN 100 (NPS 4) and larger.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

M. 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."

N. Install steel piping according to applicable plumbing code.

O. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 22 14 23 "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 14 23 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 14 23 "Storm Drainage Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

3.5 INSTALLATION OF MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

B. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

C. Set cleanout frames and covers in earth in cast-in-place concrete block, 450 by 450 by 300 mm (18 by 18 by 12 inches) deep. Set with tops 25 mm (1 inch) above surrounding earth grade.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 30 kPa (10-foot

head of water). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Underground Site PVC pipe and fittings.

1. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

2. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

END OF SECTION

SECTION 22 15 13

GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 1035 kPa (150 psig) or less.

1.2 DEFINITIONS

A. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 1035 kPa (150 psig) or less.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Pipes, fittings, and valves.
2. Dielectric fittings.
3. Flexible pipe connectors.
4. Safety valves.
5. Pressure regulators. Include rated capacities and operating characteristics.
6. Quick couplings.
7. Hose assemblies.
8. Pressure gauges.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.

1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

C. Blue extruded aluminum 6063 T5: Made of ASTM B241

1. Manufacturer: Parker Transair
2. Thermal powder coating
3. Maximum working pressure: 188 psi from -4 degrees F to 140 degrees F.
4. ISO 9001.
5. Conforms to EN 775.2, EN 755.8 and EN 573.3 standards.
6. Fittings & Connectors:

   a. Pipe-to-pipe connectors are push-connect, using a gripping ring technology with a single-turn release collar mechanism.

      1) Interchangeable and reusable.
      2) UL 94-HB.

   b. Engineering grade plastic (PA 6.6 +30% fiber glass reinforced and heat stabilized) with gripping teeth manufactured in stainless steel Z10 CN 17-7E2 with NBR HD70 buna-N,nitrile seals
   c. Quick Assembly Drop Connectors: Reducing brackets, or quick assembly brackets, are patented quick-to-install pipe connections. By drilling into the pipe and closing the bracket around the outer diameter, an air tight connection is made that incorporates a compact swan neck condensate management system which gives a 46 mm center to center outlet required by the pipe. They are manufactured in engineering grade plastic (PA 6.6 +30% fiber glass reinforced and heat stabilized).
   d. Flexible Hose: Flexible hoses consist of a nitrile inner tube and textile coated exterior. All flexible hoses conform to ISO 8030 Norm (for compressed air applications), and EN 12115 for Vacuum applications. Conforms to Worldwide & European Fire Resistance Standards ISO 8030 (Compressed Air) and EN 12.115 (Vacuum). It is compatible with all compressor oils and is available in the following diameters:
   e. 2-port 45-degree wall brackets:

      1) ½” Brass plugs
      2) ¼” drain outlet.

D. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

2.2 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.3 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 150 psig (1035 kPa).
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.4 VALVES

A. Steel Piping: Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:

1. Manufacturers:

a. Basis of Design: Nibco T-585-70-SV
b. Alternates: Conbraco Industries, Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig (4140 kPa).
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

B. Aluminum Piping: Quick connection, double female vented.
1. Manufacturer: Parker Transair.

2.5 FLEXIBLE PIPE CONNECTORS

A. Flexible hoses consist of a nitrile inner tube and textile coated exterior. All flexible hoses conform to ISO 8030 Norm (for compressed air applications), and EN 12115 for Vacuum applications. Conforms to Worldwide & European Fire Resistance Standards ISO 8030 (Compressed Air) and EN 12.115 (Vacuum). It is compatible with all compressor oils and is available in the following diameters: Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
2. End Connections, NPS 2 (DN 50) and Smaller: Threaded steel pipe nipple.

2.6 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Line Pressure Regulators: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig (1380-kPa) minimum inlet pressure, unless otherwise indicated.

2.7 QUICK COUPLINGS

A. Manufacturer:

1. Parker Transair.

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

1. Composite automatic safety coupler:

a. Female (1) NPT 3/8” and (1) 1/4” at each drop.
b. ISO 4414 compliant.
c. Maximum working pressure: 232 psi.
d. Features:

1) Clockwise Turn: Vent.
2) Counterclockwise Turn: Release.

2.8 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300 psig (1035 kPa) minimum working pressure, unless otherwise indicated. Auto rewind hose, with heavy gauge steel base, brass NPT swivel inlet machined 1 inch solid steel axle with 1 inch lubricated precision bearings, multi-positon lock ratchet, non-corrosive stainless steel spring.

1. Manufacturer:

a. Basis of Design: Coxreel EZ-SH series, as dictated by required hose length, for wall or overhead mounting as noted on Drawings.

2. Hose: Reinforced single- or double-wire-braid, CR-covered hose for compressed-air service.
3. Hose Clamps: Stainless-steel clamps or bands.
4. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.

2.9 PRESSURE GAGES

A. Manufacturers:

1. Basis of Design:

a. Weksler BA14 or BY14.

2. Other Manufacturers:

a. Weiss Instruments, Inc.
b. Winters Instruments.
c. Trerice.

B. Pressure Gages: ASME B40.100, drawn stainless steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. 4-1/2 inch dial, cast aluminum case, direct mounting.
2. Brass globe needle valve.
3. Liquid filled with snubber for pump discharge gages.

C. Gauge Range to be 1.5 times the normal operating pressures.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use one of the following piping materials for each size range:

1. Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.

2. Blue extruded aluminum with push-to-connect fittings.

B. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:

1. Blue extruded aluminum with push-to-connect fittings.

C. Drain Piping: Use the following piping materials:

1. NPS 2 (DN 50) and Smaller: Type L or K copper tube; wrought-copper fittings; and soldered joints.

3.2 VALVE APPLICATIONS

A. Provide valves that are compatible with piping. Do not use plastic valves between air compressors and receivers.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

H. Flanged joints may be used instead of specified joint for any piping or tubing system.

I. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install pressure gage on discharge piping from each air compressor and on each receiver.

L. Install piping to permit valve servicing.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

F. Pipe clips for aluminum piping: manufactured in nylon 6.6 and in sizes suitable for the pipe. Center to center dimension to the wall shall be 46 mm (for 16.5 mm, 25 mm and 40 mm) and 90 mm (for 63 mm).

3.5 VALVE INSTALLATION

A. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

B. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install stainless-steel-hose flexible pipe connectors at air compressor.

3.8 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment.

D. Install quick couplings at piping terminals for hose connections.

E. Install hose assemblies at hose connections.

3.9 CONNECTIONS

A. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

3.10 HANGER AND SUPPORT INSTALLATION

A. For steel piping, comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Install hangers for blue aluminum piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 30 inches (760 mm) with 3/8-inch (10-mm) rod.
2. NPS 3/4 (DN 20): 38 inches (975 mm) with 3/8-inch (10-mm) rod.
3. NPS 1 (DN 25): 40 inches (1015 mm) with 3/8-inch (10-mm) rod.
4. NPS 1-1/4 (DN 32): 45 inches (1140 mm) with 3/8-inch (10-mm) rod.
5. NPS 1-1/2 (DN 40): 52 inches (1330 mm) with 3/8-inch (10-mm) rod.
6. NPS 2 (DN 50): 58 inches (1470 mm) with 3/8-inch (10-mm) rod.

C. Install supports for vertical blue aluminum piping every 48 inches (1220 mm).

3.11 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.12 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not more than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Piping Leak Tests for aluminum Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen, at temperature of 110 deg F (43 deg C) or less, to pressure of 40 psig (275 kPa)- above system operating pressure, but not more than 120 psig (825 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
3. Repair leaks and retest until no leaks exist.
4. Inspect filters and pressure regulators for proper operation.

C. Prepare test reports.

END OF SECTION

SECTION 22 15 19

GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reciprocating air compressors.
2. Refrigerant compressed-air dryers.
3. Filters.
4. Electronic demand condensate drain traps.
5. Oil/Water Separators.

1.2 DEFINITIONS

A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in actual L/s (acfm).

B. Standard Air: Free air at 20 deg C (68 deg F) and 29.92 in. Hg (1 atmosphere) before compression or expansion and measured in standard L/s (scfm).

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressed-air equipment to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One for each belt-driven compressor.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

2.2 RECIPROCATING AIR COMPRESSORS

A. Basis of Design: FSCurtis CA7.5, vertical simplex unit.

B. Other manufacturers: Kaeser, Ingersoll.

C. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.

D. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.

1. Submerged gear-type oil pump.
2. Oil filter.
3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
4. Belt guard totally enclosing pulleys and belts.

E. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.

1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
3. Control Voltage: 120-V ac or less, using integral control power transformer.
4. Motor Overload Protection: Overload relay in each phase.
5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
6. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.

F. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
2. Interior Finish: Corrosion-resistant coating.

G. Accessories:
1. Factory fill of oil.
2. UL approved pressure switch.
3. ASME approved discharge valve

4. ASME approved safety valve.
5. Metal intake filter/silencers.
6. Air-cooled aftercooler.
7. Low level oil shutdown
8. Automatic tank drain.
9. Tank isolator pads.

2.3 REFRIGERANT COMPRESSED-AIR DRYERS

A. Manufacturer:

1. Basis of Design: FS Curtis RNP25.

2. Other manufacturers: Kaeser, Ingersoll, Classic, Champion.

B. Description: Noncycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 2 deg C (35 deg F), 690-kPa (100-psig) air at dew point.

1. Copper tube-on-tube heat exchanger.
2. Maximum Pressure: 250 psig.
3. Maximum Entering-Air Temperature: 120 deg F.
4. ISO 8573.1 Air Quality Class: Moisture – 4-5.
5. Refrigerant: R-134a.

2.4 FILTERS

A. Moisture Filter: Equal to FSCurtis CF filter.
1. Construction: weatherproof housing with replaceable, moisture separating element.
2. Solid particle removal: 10 micron.
3. Pressure drop: wet – 0.8 psig; dry - 0.8 psig.

B. Particulate Filter: Equal to FSCurtis CF filter
1. Construction: weatherproof housing with replaceable dry particulate filter.
2. Solid particle removal: 1 micron.
3. Pressure drop: dry – 1 psig.

2.5 ELECTRONIC DEMAND CONDENSATE DRAIN TRAPS

A. Manufacturer: FS Curtis, Kaeser, Ingersoll, Classic, Champion.

B. Description: Unit with a solenoid valve, diaphragm valve, and collection chamber that automatically discharges condensate from filters, dryers, and tanks without releases of air pressure. Rated for 1380-kPa (200-psig) minimum working pressure.

2.6 OIL/WATER SEPARATORS

A. Manufacturer:

1. Basis of Design: FS Curtis Clean Pro-65.

2. Other manufacturers: Kaeser, Ingersoll, Classic, Champion.

B. Description: Unit that separates and permanently absorbs oil and removes it from condensate created by the compressed air system.
   1. Maximum operating pressures: 232 psig.
   2. Operating Temperature 41-140 deg. F.
   3. Disposable Filter.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Equipment Mounting:

   1. Install air compressors and air dryers on cast-in-place concrete equipment base(s).

B. Install compressed-air equipment anchored to substrate.

C. Arrange equipment so controls and devices are accessible for servicing.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Install the following devices on compressed-air equipment:

   1. Pressure Gauge and Safety Valve: Install on each compressed-air receiver.
   2. Pressure Regulators: Install downstream from air compressors and dryers.
   3. Condensate Drain Trap: Install on filters, receivers, and dryers. Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 15 13 "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to machine, allow space for service and maintenance.

3.3 IDENTIFICATION

A. Identify general-service air compressors and components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Check for lubricating oil in lubricated-type equipment.
   3. Check belt drives for proper tension.
   4. Verify that air-compressor inlet filters and piping are clear.
   5. Check for equipment vibration-control supports and flexible pipe connectors, and verify that equipment is properly attached to substrate.

6. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure, but not higher than rating of system components.
7. Drain receiver tanks.
8. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
9. Test and adjust controls and safeties.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air compressors and air dryers.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pumps.
   1. Sump Pumps.

1.02 SUBMITTALS

A. See Section 01 1400 - General Requirements, for Administrative Requirements for submittals procedures.

B. Product Data:
   1. Indicate pump type, capacity, power requirements.
   2. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   3. Provide electrical characteristics and connection requirements.

C. Project Record Documents: Record actual locations of components.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Iowa Department of Transportation's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 1400 - General Requirements, for additional provisions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.04 WARRANTY

A. See Section 01 1400 - General Requirements, for Closeout Submittals for additional warranty requirements.

B. Provide three year manufacturer warranty for sump pumps.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:
   1. Armstrong Pumps Inc: www.armstrongpumps.com.
   2. Hydromatic Pumps: www.hydromatic.com.
   3. Zoeller Pump Company: www.zoeller.com.
   4. Type: Completely submersible, vertical, centrifugal.

B. Casing: Cast iron volute with radial clearance around impeller, inlet strainer, slide away cou-

plings.

C. Impeller: Thermoplastic.

D. Drive: Flexible coupling to vertical, solid 416 stainless steel shaft, ball bearing electric motor.

E. Sump Basin: Topp Industries Inc., 48" diameter by 108" deep fiberglass with access cover as described on drawings.

F. Rail Pump Lift System: Topp Industries Inc., Freeflo Base Elbow Rail System. Stainless steel or galvanized upper guide rail brackets, replacement pull-out flanges. stainless steel chains, ball check valves, gate valves, valve extension handles, unions.

G. Controls (Duplex): Four control floats (pump off, pump 1 on, pump 2 on, high level alarm). Type 304 stainless steel float bracket with control grips. Topp Industires, Ic, "Freeflo" pump rail system with lift chains. Internal schedule 80 PVC discharge piping including ball check valve, union, gate valve, and discharge coupling.

H. Control Panel: SJE Rhombus model 123-1-W-1-2-4-H-5A-6A-9A-10E-10F-10K-12C-17C (4)-19U, Type NEMA 4X duplex lift station control panel. 230 volt single phase, single point power connection. IEC motor contactors, grounding lug, incoming power terminal block, float status lights (on ciruit board), alarm package with red alarm beacon, alarm horn, alarm test/normal/silence switch. Alternating pump control, thermal cutout/heat sensor auto reset, auxiliary alarm contact (form C), run time meters, pump overload protection, locakable latch, lightning arrestor, anti-condensation heater, motor start components, four sensor floats (internally weighted), run light for each pump on door, hand/off/ automatic switches.

I. Performance: As scheduled on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:
   1. Ensure shaft length allows sump pumps to be located minimum 24 inches (600 mm) below lowest invert into sump pit and minimum 6 inches (150 mm) clearance from bottom of sump pit.
   2. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
   3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 22 3100

DOMESTIC WATER SOFTENERS
(NOT IN CONTRACT)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Commercial water softeners.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.

C. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

D. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Salt for Brine Tanks: Furnish in same form as and at least four times original load, but not less than 1000 lb (453.6 kg). Deliver on pallets according to the following:
      a. 99.8% soluble Pellet Salt: In 40- or 50-lb (18.1- or 22.7-kg) packages.
   2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

1.6 QUALITY ASSURANCE

A. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

B. ASME Compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, where indicated.

C. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures of mineral and brine tanks.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
      d. Attrition loss of resin exceeding 3 percent per year.
      e. Mineral washed out of system during service run or backwashing period.
      f. Effluent turbidity greater and color darker than incoming water.
      g. Fouling of underdrain system, gravel, and resin with turbidity or by dirt, rust, or scale from water softener or soft water, while operating according to manufacturer's written operating instructions.
   2. Commercial Water Softeners, Warranty Period: From date of Substantial Completion.
      a. Parts: 4 years.
      b. Labor 2 years.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of water softener Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper water softener operation at rated capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 COMMERCIAL WATER SOFTENERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Culligan International Company.
   2. Kinetico Incorporated. (Basis of Design)
   3. Marlo Incorporated.

B. Description: Factory-assembled, pressure-type water softener.
   1. Standard: Comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."
   2. Configuration: Modular configuration with each module comprised of a dual unit and single brine tank.
   3. Mounting: On concrete housekeeping pad.
   4. Wetted Components: Suitable for water temperatures from 40 to at least 120 deg F (5 to at least 49 deg C).
   5. Mineral Tanks: Polyethylene and fiberglass wrapping, pressure-vessel quality.

a. Construction: Fabricated and stamped to comply with ASME Boiler and Pressure Vessel Code: Section X, "Fiber-Reinforced Plastic Pressure Vessels."
b. Pressure Rating: 125 psig (860 kPa) minimum.
c. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
d. Support Legs or Skirt: Integral with tank.
e. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
f. Liner: PE or other material suitable for potable water.

6. Controls: Automatic; non-electric factory mounted on unit.
   a. Metered regeneration based on water usage.
   b. Sequence of Operation: Non-electric use metered flow regeneration.
   c. Pointer on pilot-control valve shall indicate cycle of operation.
   d. Includes means of manual operation of pilot-control valve if power fails.
7. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:
   a. Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
   b. Valve for single mineral-tank unit with internal automatic bypass of raw water during regeneration.
   c. Sampling cocks for soft water.
   d. Special tools are not required for service.
8. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.
9. Brine Tank: Combination measuring and wet-salt storing system.
   a. Tank and Cover Material: HDPE.
   b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawal and freshwater refill.
   c. Size: Large enough for at least four regenerations at full salting.
10. Factory-Installed Accessories:
    a. Piping, valves, tubing, and drains.
    b. Sampling cocks.
    c. Main-operating-valve position indicators.
    d. Water meters.

11. Field-Installed Accessories:
    a. Inlet Filter: In-line style, capable of 50 gpm, with plastic housing and stainless steel replaceable media, cleanable by flushing without removing from pipe line. Hydrostatically tested to 1-1/2 times pressure rating. Provide one filter for each softener module.

C. Capacities and Characteristics:
1. Water Analysis:
   a. Hardness: 240 ppm.
   b. Inlet Water Pressure: 75 psig .
   c. Water Temperature: 40 deg F.

2. Peak Service Flow Rate: 125 gpm at 25-psig pressure drop.
3. Manifold Pipe Size: 3” NPS.
4. Backwash-to-Drain Pipe Size: ¾” NPS.
5. Number of Mineral Tanks: Two per module.
6. Resultant hardness: <1 grain/gallon
7. Electrical Characteristics:
   a. No electrical connections in basis of design.
8. Salt Capacity: 500 lb. per module.

9. Regenerations volume/time (each of 6 units): 160 gallons/90 minutes.
10. System Floor Area Required: 60 sq. ft. (sq. m)>.
11. Height Required: 72 inches.

2.2 CHEMICALS

A. Mineral: High-capacity, non-solvent, high capacity cation resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.
   1. Exchange Capacity: 68.6 grams/liter when generated with 0.53 pounds of salt per liter of resin .
   2. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material.
   3. Form: Processed, 99.8% soluble.

2.3 WATER-TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

2.4 SOURCE QUALITY CONTROL

A. Hydrostatically test mineral tanks before shipment to a minimum of one and one-half times the pressure rating.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WATER SOFTENER INSTALLATION

A. Equipment Mounting:
   1. Install commercial water softeners on cast-in-place concrete equipment base(s).

B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.

C. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

D. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to equipment, allow space for service and maintenance of equipment.

C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank**,** and on inlet and outlet headers.
   1. Metal general-duty valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping,"
   2. Exception: Water softeners with factory-installed shutoff valves at locations indicated.

D. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Section 220519 "Meters and Gages for Plumbing Piping."
   1. Exception: Water softeners with factory-installed pressure gages at locations indicated.

E. Install drains as indirect wastes to spill over floor drains.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Water softeners will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

B. Add water to brine tanks and fill with the following form of salt:
   1. Commercial Water Softeners: Processed, 99.8% soluble salt pellets.

C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:
   1. ASTM D 859, "Test Method for Silica in Water."
   2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
   3. ASTM D 1068, "Test Methods for Iron in Water."
   4. ASTM D 1126, "Test Method for Hardness in Water."
   5. ASTM D 1129, "Terminology Relating to Water."
   6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits.

3.6 **DEMONSTRATION**

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water softeners.

END OF SECTION 223100

SECTION 22 33 00

ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Electric, domestic-water heaters.
   2. Domestic-water heater accessories.

1.2 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Operation and Maintenance Data: For electric domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:
   1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.4 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures including storage tank and supports.
    b. Faulty operation of controls.
    c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Periods: From date of Substantial Completion.
    a. Electric, Domestic-Water Heaters:
        1) Tank: Ten years limited.
        2) Parts: One year

PART 2 - PRODUCTS

2.1 ELECTRIC, STORAGE, DOMESTIC-WATER HEATERS

A. Residential, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Manufacturer:
    a. Basis of Design: Rheem.
2. Standard: ANSI Z21.10.1/CSA 4.1.
3. Storage-Tank Construction: Non-metallic, lightweight composite tank – no anode rod required
    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 1035 kPa (150 psig).
    c. .
4. Factory-Installed Storage-Tank Appurtenances:
    a. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    b. Drain Valve: ASSE 1005.
    c. Insulation: Comply with ASHRAE/IESNA 90.1. Tank insulated with 2-1/2: polyurethane foam.
    d. High density polyethylene jacket Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    e. Four titanium elements.
    f. Thermal efficiency: 98%.
    a. Temperature Control: Adjustable thermostat.
    b. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    c. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
    d. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4-M. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
    e. Power circuits use two surface mounted thermostats and operate in two stages:
        1) Lower control is for the lower two elements for normal demand.
        2) Upper control is for the lower two elements for high demand.

B. Capacity and Characteristics: As shown on the drawings.

C. Minimum Vent Diameter: 2-inch.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

B. Heat-Trap Fittings: ASHRAE 90.2.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.
   1. Maintain manufacturer's recommended clearances.
   2. Arrange units so controls and devices that require servicing are accessible.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
   5. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains.

E. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

F. Fill domestic-water heaters with water.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION

SECTION 22 42 13.13

COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets (WC-1, WC-2): Floor mounted, bottom outlet, top spud.

1. Manufacturers:

a. Basis of Design: Kohler.

b. Other Manufacturers: American Standard, Gerber, Zurn, Crane.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Refer to drawings.
f. Rim Contour: Elongated.
g. Water Consumption: 4.8 L (1.28 gal.) per flush.
h. Spud Size and Location: DN 40 (NPS 1-1/2); top.
i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.

2.2 FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:

1. Manufacturers:

   a. Basis of Design: Sloan Valve Company.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 860 kPa (125 psig).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 6 L (1.6 gal.) per flush.
12. Minimum Inlet: DN 25 (NPS 1).
13. Minimum Outlet: DN 32 (NPS 1-1/4).

2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers:

   a. Basis of Design: Kohler.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial.
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install actuators in locations that are easy for people with disabilities to reach.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 13.16

COMMERCIAL URINALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals (UR-1): Wall hung, back outlet, washout.

1. Manufacturers:

a. American Standard America.
b. Crane Plumbing, L.L.C.
c. Kohler Co.

2. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Washout with extended shields.
d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
e. Water Consumption: Water saving.
f. Spud Size and Location: DN 20 (NPS 3/4), top.
g. Outlet Size and Location: DN 50 (NPS 2), back.
h. Color: White.

3. Flushometer Valve: Sloan 8186.
4. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: DN 50 (NPS 2).

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.2 URINAL FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:

1. Manufacturers:

a. Sloan Valve Company.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 860 kPa (125 psig).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Concealed.
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: 1.0 gal. (3.8 L per flush).
12. Minimum Inlet: DN 20 (NPS 3/4).
13. Minimum Outlet: DN 20 (NPS 3/4).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:
1. Use off-floor carriers with waste fitting and seal for back-outlet urinals.

2. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.13

COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED LAVATORIES

A. Lavatory: Solid surface, wall mounted, with back wall hanging support frame.

1. Manufacturers:

a. Basis of Design: Kohler.
b. Other manufacturers: American Standard Inc., Gerber Plumbing, Eljer, Inc.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: 21 by 18
d. Color: To be determined by Architect.
e. Mounting Material: Heavy gauge stainless steel support frame.
f. Single piece dual bowl with 4” centers less soap dispenser hole.
g. Drilled for concealed arm carrier.

3. Faucet: 2 handle lever faucets with aerator and grid strainer.

2.2 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.

2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-(0.83-mm-) thick brass tube to wall; and chrome-plated, brass or steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.16

COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service basins.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.

2. Include rated capacities, operating characteristics and furnished specialties and accessories.

B. Maintenance Data: For sinks to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL FAUCET REQUIREMENTS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

2.2 SERVICE BASINS

A. Service Basins (MB-1): Terrazzo, floor mounted.

1. Manufacturers:
   a. Acorn Engineering Company.
   b. Fiat
   c. Crane Plumbing, L.L.C.

2. Fixture:

   a. Standard: IAPMO PS 99.
   b. Shape: Rectangular.
   c. Nominal Size: 24 by 24 inches (610 by 610 mm.
   d. Height: 12 inches (305 mm.
   e. Rim Guard: On front and sided top surfaces.
   f. Color: To be determined by Architect.
   g. Drain: Grid with DN 80 (NPS 3) outlet.

3. Mounting: On floor and flush to wall.

4. Faucet:

a. Commercial, Solid-Brass Faucets.

1) Manufacturers:

a) American Standard America.
b) Chicago Faucets; Geberit Company.
c) Delta Faucet Company.
d) Fiat.

b. Standard: ASME A112.18.1/CSA B125.1.
c. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies; coordinate outlet with spout and sink receptor.
d. Body Type: Widespread.
e. Body Material: Commercial, solid brass.
f. Finish: Chrome plated.
g. Handle(s): Cross, four arm.
h. Mounting Type: Back/wall, exposed.
i. Spout Type: Rigid, solid brass with wall brace.
j. Vacuum Breaker: Required for hose outlet.
k. Spout Outlet: Hose thread according to ASME B1.20.7.
l. Wall mount with vacuum breaker, wall support and pail hook.
m. Manual type, two-lever-handle mixing valve.

2.3 UTILITY SINKS

A. Service Sinks (US-1): , Sheet Molded Compound, floor mounted.

1. Manufacturer:

a. Basis of Design: Fiat FL-1.

b. Other manufacturers: Stern-Williams.

2. Fixture:

a. Single Compartment Laundry Tub with white baked enamel angle legs.
b. CSA Approved.
c. Faucet:

1) Manufacturer:

a) Basis of Design: Kohler K-15271.
b) Other Manufacturers: American Standard, Delta.
c) ASME A112.18.1/CSA B125.1
d) Reversible quarter-turn washerless ceramic disc valves.
e) 6-inch threaded swing spout reach.
f) Metal construction.

2.4 COUNTER SINKS

A. Utility Sinks (S-1): Stainless steel, counter mounted.

1. Manufacturer:

   a. Basis of Design: Elkay LARDQ1918.

   b. Other manufacturers: American Standard, Just, Eljer, Kohler.

2. Fixture:

   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Construction: #18 gauge, type 304 nickel bearing stainless steel, self-rimming.
   c. Underside: Fully undercoated to dampen sound and prevent condensation.
   d. Drain Opening: 3-1/2”
   e. Number of Compartments: One.

3. Faucet(s):

   a. Manufacturer:

      1) Basis of Design: Elkay LK3000.

      2) Other manufacturers: American Standard, Just, Eljer, Kohler.

   b. Holes Required: Two 1-3/8” diameter faucet openings.
   c. Mounting: On ledge.
   d. Removable ceramic disc cartridge.
   e. 1.5 gpm flow regulator.
   f. 360-degree spout rotation.
   g. Chrome finish.
   h. Lifetime warranty.
   i. Standards: ADA, ANSI/NSF61, ASME A112.18/CSA B125.1

4. Supply Fittings:

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

      1) Operation: Loose key.

      2) Risers: DN 15 (NPS 1/2), ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

5. Waste Fittings:

   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap(s):

      1) Size: DN 40 (NPS 1-1/2).

      2) Material: Stainless-steel, two-piece trap and swivel elbow with 0.30-mm-(0.012-inch-) thick stainless-steel tube to wall; and stainless-steel wall flange.

6. Mounting: On counter with sealant.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

2.6 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 34.5-MPa (5000-psi), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Set floor-mounted sinks in leveling bed of cement grout.

C. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

D. Seal joints between sinks, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 33

WASH FOUNTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Semicircular wash fountains.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wash fountains.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of wash fountain.

1. Include diagrams for power, signal, and control wiring.

C. Operation and Maintenance Data: For wash fountains and components to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PRECAST-TERRAZZO, SEMICIRCULAR WASH FOUNTAINS

A. Wash Fountains (WF-1): On-floor, precast-terrazzo, semicircular receptor.

1. Manufacturers:

a. Basis of Design: Bradley WF2604.

b. Other Manufacturers: Haws, Acorn, Speakman.

2. Standard: IAPMO IGC 156.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Receptor:

a. Standard: IAPMO PS 99 for precast-terrazzo receptor.
b. Nominal Diameter: 1372 mm (54 inches).
c. Height to Rim: 737 mm (29 inches) above floor.
d. Drain: Grid with DN 50 (NPS 2) tailpiece.

5. Spray Head:

   a. Material: Stainless steel or integral part of receptor back.
   b. Spray Nozzles: Chrome-plated brass or stainless steel complying with NSF 61 Annex G and ASME A112.18.1/CSA B125.1.
   c. Control: Collective, foot-rail actuation with manual mixing valve complying with ASSE 1016 and having check stops; comply with NSF 61 Annex G.

6. Liquid-Soap Dispensers: Manual, for each user station.
7. Supply Fittings:

   a. Piping: DN 25 (NPS `1) copper tubing.
   b. Valves: Shutoff valve on each supply.
   c. Supply Piping: From top.

8. Waste Fittings:

   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap and Drain Piping: [DN 40 (NPS 1-1/2)] [DN 50 (NPS 2)].
   c. Vent Piping: DN 40 (NPS 1-1/2) to ceiling.

9. Shroud: Stainless steel of size to cover supply and vent piping.
10. On-Floor Mounting: Floor bracket and wall bracket attached to concrete or block wall.

    a. Supplies: DN 25 (NPS `1) copper tubing with ball valves.
    b. Drain Piping: DN 50 (NPS 2) P-trap, waste to wall, and wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply, sanitary drainage, and vent piping systems to verify actual locations of piping connections before wash-fountain installation.

B. Examine walls and floors for suitable conditions where wash fountains will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wash fountains level and plumb according to roughing-in drawings.

B. Install off-floor carrier supports, affixed to building substrate, for wall-mounted wash fountains.

C. Install water-supply piping with shutoff valve on each supply to each wash fountain to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

D. Install trap and waste piping on each drain outlet of each wash fountain to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect wash fountains with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with requirements for water piping specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with requirements for soil and waste drainage piping and vent piping specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Install protective-shielding pipe covers and enclosures on exposed supplies and waste piping of accessible wash fountains. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.4 ADJUSTING

A. Operate and adjust wash fountains and controls. Replace damaged and malfunctioning wash fountains, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After installing wash fountains, inspect and repair damaged finishes.

B. Clean wash fountains, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed wash fountains and fittings.

D. Do not allow use of wash fountains for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 45 00

EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Combination units.
2. Supplemental equipment.
3. Water-tempering equipment.

1.2 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.

D. Tepid: Moderately warm.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

C. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

C. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Standard, Plumbed Emergency Shower with Eyewash Combination Units, (ES-1):

1. Manufacturers:

   a. Basis of Design: Bradley S19314SS.

   b. Other Manufacturers: Guardian, Haws, Acorn, Speakmann.

2. Piping:

   a. Material: Galvanized steel, chrome-plated brass or stainless steel.
   b. Unit Supply: DN 32 (NPS 1-1/4) minimum.
   c. Unit Drain: Outlet at back or side near bottom.
   d. Backflow Prevention: Dual check backflow preventer with chrome nick plated brass body with atmospheric vent.

3. Shower:

   a. Capacity: Not less than 76 L/min. (20 gpm) for at least 15 minutes.
   b. Supply Piping: DN 25 (NPS 1) with flow regulator and stay-open control valve.
   c. Control-Valve Actuator: Pull rod.
   d. Shower Head: 200-mm- (8-inch-) minimum diameter, stainless steel.
   e. Mounting: Pedestal.

4. Eyewash Unit:

   a. Capacity: Not less than 1.5 L/min. (0.4 gpm) for at least 15 minutes.
   b. Supply Piping: DN 15 (NPS 1/2) with flow regulator and stay-open control valve.
   c. Control-Valve Actuator: Paddle.
   d. Spray-Head Assembly: Two receptor-mounted spray heads.
   e. Receptor: Stainless Steel bowl.
   f. Mounting: Attached shower pedestal.

2.2 WATER-TEMPERING EQUIPMENT

A. Hot- and Cold-Water, Water-Tempering Equipment,(TMV-1):

1. Description: Factory-fabricated equipment with thermostatic mixing valve.

   a. Thermostatic Mixing Valve: Designed to provide 29 deg C (85 deg F) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 3 deg C (5 deg F) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
   b. Supply Connections: For hot and cold water.

2.3 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

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

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 11 16 "Domestic Water Piping."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

J. Fill self-contained fixtures with flushing fluid.

3.3 CONNECTIONS

A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with

requirements for hot- and cold-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION

SECTION 22 47 13

DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes drinking fountains and related components.

1.2 SUBMITTALS

A. Product Data: For each type of drinking fountain.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include operating characteristics, and furnished specialties and accessories.

B. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains EWC-1:

1. Manufacturers:

   a. Basis of Design: Elkay LVRCGRNTL8FC.
   b. Other manufacturers: Haws, Kohler, Delta.

2. Self-contained, bi-level, wall hung, electric, refrigerant, water cooler.
3. ADA Compliant.
4. Capacity: 8.8 gallons per hour of 50F drinking water at 80F inlet and 90F ambient.
5. Filter/Glass Filler.
6. No Lead Design.
7. Strainer with cleanable screen.
8. Temperature Control: Enclosed adjustable thermostat is factory preset.
9. Frame: Galvanized steel.
10. Fountain Top: One piece stainless polished to bright luster finish.
11. Basin with bubbler pad.
12. Safety bubbler: Pliable polyester elastomer, abrasion resistant, anti-sweat.
13. Color: Stainless Steel.
14. Standards: A.R.I. 1010, NSF/ANSI 61 and 372.
15. Refrigerant: HFC-134a.
16. Cooling Unit: Tube-tank type.

    a. Tube: Continuous coil of cooper tubing.
    b. Fully insulated with EPS foam.
    c. Condenser: Fan cooled, copper tube with aluminum fines.
    d. Compressor: Hermetically sealed, reciprocating type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains on floor.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation.

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings.

F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture.

D. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 1000 m (3300 feet) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 17

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 34.5-MPa (5000-psi), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 25-mm (1-inch) annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 50 mm (2 inches) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than DN 150 (NPS 6): Galvanized-steel wall sleeves with grout.

2. Concrete Slabs-on-Grade:

   a. Piping Smaller Than DN 150 (NPS 6): Galvanized-steel wall sleeves with grout.

END OF SECTION

SECTION 23 05 19

METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Pressure gages and pressure gage taps.
2. Thermometers and thermometer wells.

1.2 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers.

B. ASTM E1 - Standard Specification for ASTM Thermometers.

1.3 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers:

1. Basis of Design:
   a. Weksler BA14 or BY14.

2. Other Manufacturers:
   a. Weiss Instruments, Inc.
   b. Winters Instruments.
   c. Trerice.

B. Pressure Gages: ASME B40.100, drawn stainless steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. 4-1/2 inch dial, cast aluminum case, direct mounting.
2. Brass globe needle valve.
3. Liquid filled with snubber for pump discharge gages.

C. Gauge Range to be 1.5 times the normal operating pressures.

PRESSURE GAGE TAPPINGS

D. Gage Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).

E. Needle Valve: Brass, 1/4 inch (6 mm) NPT for minimum 150 psi (1034 kPa).

F. Pulsation Damper: Pressure snubber, brass with 1/4 inch (6 mm) connections.

2.2 DIAL THERMOMETERS

A. Manufacturers:

1. Basis of Design:
   a. Weksler Glass Thermometer Corp; Model 5A, 5S, 5L or 5R.

2. Other Manufacturers:
   a. Weiss Instruments, Inc; Model 5VBM.
   b. Trerice.

B. Thermometer: ASTM E 1, stainless steel case, with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.

1. Size: 5 inch (125 mm) diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.
5. Temperature Range:

   a. 0 to 200 degrees F for loop pipes and boiler piping.

2.3 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.4 TEST PLUGS

A. Manufacturers:

1. Basis of Design: Peterson; Model Pete's Plug 110.

B. Test Plug: 1/4 inch (6 mm) or 1/2 inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F (176 degrees C).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

E. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

G. Locate test plugs where shown and where required for hydronic balancing.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment Supports.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.

4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Coating: Zinc or paint.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. 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.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads and at changes in direction of piping.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

E. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

F. Use thermal-hanger shield inserts for insulated piping and tubing.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
5. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 48

MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Vibration isolators.

1.2 REFERENCES

A. SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

B. ASHRAE - Handbook and Product Directory: Systems, HVAC and Applications.

C. Standards of The Expansion Joint Manufacturers Association (EJMA).

1.3 VIBRATION ISOLATOR DESIGN REQUIREMENTS

A. Spring vibration isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified. This determines that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided.

B. Isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 60 percent above the design deflection.

C. Ratio of lateral to vertical stiffness for spring isolators shall not be less than 1.0 or greater than 1.3.

D. Vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ by more than +/- 10 percent.

E. Wave motion through the isolator shall be reduced to the following extent: Isolation above the primary vertical system resonance frequency shall follow the theoretically predicted isolation curve for single degree of freedom systems within 10% up to 50 dB or greater at all frequencies above 150 Hz.

F. All neoprene mountings shall have a Shore-A hardness of 30 to 50, after minimum aging of 20 days or corresponding oven-aging.

G. For "packaged" air handling units which are available with internal isolation; the internal isolation supplied by the air handling unit manufacturer shall comply with one of the following:

1. If the internal isolators are neoprene mounts, the mounts must be of 30 to 60 durometer neoprene. The static deflection shall be no greater than 0.25 times the external isolation static deflections scheduled herein for the entire packaged air handling unit. Internal

neoprene isolators alone, in lieu of the specified vibration isolators and equipment frames scheduled herein, are unacceptable.

2. If the internal isolators are spring mounts, the springs must comply with all requirements and specifications set forth and scheduled herein for external isolators.

H. Ensure products furnished under this Section do not cause 'Average Noise Criteria Curves', outlined in ASHRAE Guide, to be exceeded.

1.4 SUBMITTALS

A. Product Data:

1. Catalog cuts and data sheets on specific vibration isolators to be utilized showing compliance with the specifications and schedules herein. Include load versus deflection curves.
2. An itemized list showing the items of equipment, ductwork, piping, etc., to be isolated, the isolator type and model number selected, isolator loading, deflection and spring diameter.
3. Written instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices, including hangers and bases; alternatively the equipment may be installed by the vibration isolation manufacturer.
4. An itemized list of all items of equipment to be fitted with flexible piping and/or duct connections. Flexible piping and/or duct submittals shall contain all information and calculations to demonstrate conformance and suitability for the equipment operating conditions including but not limited to pressure, temperature, capacity, mounting, maintenance, etc.

B. Shop Drawings:

1. Drawings showing methods for suspensions, support, guides, etc., for piping and ductwork, etc.
2. Details of flexible piping and duct connections for all typical conditions listed in the schedule provided above.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Type HS - Spring Pipe and Duct Hanger:

1. Manufacturers: Mason 30N, Vibrex HXA, Peabody SRH, Vibration Mountings and Controls, Vibro-Acoustics.
2. Spring element in series with nominal 1 inch thick neoprene element with integral grommet.
3. Designed so hanger rod may be misaligned 15 degrees relative to the vertical without touching integral grommet inset in hanger box frame.

B. Type HW - Spring Pipe and Duct Hanger:

1. Manufacturers: Amber/Booth Model BS, Peabody Model SH, Vibration Mountings and Controls, Vibro-Acoustics.

2. Suspension hanger with a free-standing laterally stable steel spring and elastomer washer.

3. Minimum additional travel to solid spring condition of 50% of rated deflection.
4. Provide with eye bolts for the attachment of wire or duct straps.
5. Designed to permit misalignment of the hanger rod 15 degrees relative to the vertical without touching the hanger box frame.
6. Provide up to 50 percent overload capacity.

C. Type HN: Suspension hanger with neoprene element.

1. Minimum static deflection range of 0.25" to 0.5" designed to preclude contact of hanger rods with frame at up to 15 degrees misalignment.

D. Type IP: Rubber isolation pads.

1. Manufacturers: Mason W or Mason Super W.
2. Waffle type pads, nominally 50 durometer hardness.
3. For installation between air handler base and curb or rail.

E. Color code spring isolators. Furnish with 1/4 inch ribbed neoprene pads.

F. Verify force and load moments for each vibration isolation pipe hanger and for each equipment vibration set, taking into consideration operating weight of pipe, complete with contents, insulation, fittings, valves, and other in-line devices, plus forces imposed on piping and equipment due to the flexible connector. Ensure isolators are sized accordingly.

G. Preload isolators to ensure ductwork, piping, and equipment are properly and correctly supported under all conditions of operation.

2.2 VIBRATION ISOLATOR APPLICATION

A. The isolator type schedules shall be furnished and installed for the following components, loaded to yield the specified deflection per the schedule below.

B.

	Item	Isolation Type	Minimum Static Deflection
1.	Heat pumps & Exhaust fan EF-79	IP	1.0”
2.	Horizontal suspended pipe 2" and smaller Connected to vibrating equipment over 1/2 horsepower	HS	1.0"
3.	Supported vertical riser piping, larger than 1" Connected to vibrating equipment over 1/2 horsepower	HW	1.0"
4.	Pipe anchors for piping, any size, attached to vibrating Equipment over 1/2 horsepower, inline pumps	HN	----

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Installation or use of vibration isolators must not cause any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.

B. The Contractor shall not install any equipment, duct or piping which makes rigid contact with the "building" unless it is approved in this specification or by the Architect. "Building" includes, but is not limited to slabs, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.

C. Prior to installation, the Contractor shall bring to the Architect's attention any conflicts between trades which will result in unavoidable rigid contact at equipment, piping or ducts due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

D. The contractor shall correct, at no additional cost to the Owner, all installations which are deemed defective in workmanship or materials by the Architect.

3.2 PIPING AND DUCT SUSPENSION

A. All piping is included under this Section except the following: compressed air piping, fire standpipe and sprinkler piping, and natural gas lines.

B. Pipes and ducts connected to vibrating equipment shall be resiliently supported or suspended for a distance of 50 feet from such equipment. All connections to equipment to include flexible connections.

C. Suspension isolators shall be installed with the isolator hanger box as close as possible to the structure above. Suspend isolators from substantial structural members, not from slab diaphragms unless specifically approved.

D. Install isolation of sheet metal ducts, housings, plenums, dampers, and related accessories in accordance with SMACNA Manual. Variances from Manual will be considered when submitted to Architect/Engineer for review.

E. Provide isolators for all ductwork hangers above suspended ceilings over occupied spaces immediately below mechanical equipment rooms.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Operation and Maintenance Manual: Valve schedule with location and numbering scheme.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Brady Corporation.

B. Seton Identification Products.

C. Brimar.

D. Marking Services Inc.

2.2 OWNER'S REQUIREMENTS FOR IDENTIFICATION

A. All systems and components shall be identified with equipment codes.

B. Nomenclature shall be coordinated with Owner's existing system.

2.3 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content:

1. If adding equipment to an existing space, use existing Field ID Number format and do not duplicate existing Field ID Numbers.

    a. Consult with Owner's Representative to obtain Field ID number sequences available for use.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.5 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Items concealed by insulation (strainers, balancing dampers, valves, unions, etc) shall be clearly marked on outside of insulation covering.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:

1. Loop Supply and Return Piping and Heating Water Piping: White letters on a safety-green background.
2. Natural Gas Piping: Black letters on a safety-yellow background.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

1.2 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association.

1.3 SUBMITTALS

A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:

      a. List of all air flow and water flows to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      e. Final test report forms to be used.
      f. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Diffuser proportioning.

2) Branch/submain proportioning.
3) Total flow calculations.
4) Rechecking.

g. Details of how TOTAL flow will be determined; for example:

1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

h. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
i. Confirmation of understanding of the outside air ventilation criteria under all conditions.
j. Methods for making coil capacity measurements, if specified.
k. Time schedule for TAB work to be done in phases (by floor, etc.).
l. Exhaust fan balancing and capacity verifications,
m. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
n. Procedures for formal deficiency reports, including scope, frequency and distribution.

1.4 PROGRESS REPORTS

A. Final Report: Indicate deficiencies in systems that prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Units of Measure: Report data in I-P (inch-pound) units only.
7. Include the following on the title page of each report:

a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

B. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   2. SMACNA HVAC Systems Testing, Adjusting, and Balancing.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:

      a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
      b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Proper thermal overload protection is in place for electrical equipment.
   3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Volume dampers are in place and open.
   7. Air coil fins are cleaned and combed.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Duct system leakage is minimized.
   11. Hydronic systems are flushed, filled, and vented.
   12. Pumps are rotating correctly.
   13. Proper strainer baskets are clean and in place.
   14. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.8 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps
   2. Boilers.
   3. Heat Pumps.
   4. Fans
   5. Air Inlets and Outlets.

3.9 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. Pumps:
   1. Identification/number
   2. Manufacturer
   3. Size/model
   4. Impeller
   5. Service

6. Design flow rate, pressure drop, BHP
7. Actual flow rate, pressure drop, BHP
8. Discharge pressure
9. Suction pressure
10. Total operating head pressure
11. Shut off, discharge and suction pressures
12. Shut off, total head pressure

C. Boilers:
1. Identification/number
2. Manufacturer
3. Model Number
4. Serial Number
5. Primary water entering temperature, design and actual
6. Primary water leaving temperature, design and actual
7. Primary water flow, design and actual
8. Primary water pressure drop, design and actual

D. Air Moving Equipment (Heat Pumps):
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM
15. Design flow rate, pressure drop, BHP
16. Actual flow rate, pressure drop, BHP
17. Discharge pressure
18. Suction pressure
19. Total operating head pressure

E. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

F. Fans (not included in Air Moving Equipment above):
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Air flow, specified and actual
   6. Total static pressure (total external), specified and actual
   7. Inlet pressure
   8. Discharge pressure
   9. Sheave Make/Size/Bore
   10. Number of Belts/Make/Size
   11. Fan RPM

G. Duct Traverses:
   1. System zone/branch
   2. Duct size
   3. Area
   4. Design velocity
   5. Design air flow
   6. Test velocity
   7. Test air flow
   8. Duct static pressure
   9. Air temperature
   10. Air correction factor
   11. Test air flow

H. Air Distribution Tests:
   1. Air terminal number
   2. Room number/location
   3. Terminal type
   4. Terminal size
   5. Area factor
   6. Design velocity
   7. Design air flow
   8. Test (final) velocity
   9. Test (final) air flow
   10. Percent of design air flow

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

1.2 REFERENCE STANDARDS

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

B. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2008.

C. ASTM C 612 - Standard Specification for Mineral ` Block and Board Thermal Insulation; 2009.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

E. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

F. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84.

GLASS FIBER, FLEXIBLE

B. Manufacturers:

1. Basis of Design:

a. Knauf Insulation; Model Friendly Feel: www.knaufusa.com

2. Other Manufacturers:

a. Johns Manville Corporation: www.jm.com.
b. Owens Corning Corp: www.owenscorning.com.
c. CertainTeed Corporation; : www.certainteed.com.

C. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: 0.27 at 75 degrees F (0.039 at 24 degrees C), when tested in accordance with ASTM C 518.
2. Density: 1.0 lbs/cu. ft.
3. Maximum Service Temperature - Faced: 250 degrees F (120 degress C) (450 degrees F (232 degrees C).
4. Maximum Water Vapor Sorption: 5.0 percent by weight.

D. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

2.2 GLASS FIBER, RIGID

A. Manufacturers:

1. Basis of Design:

a. Knauf Insulation; Model Insulation Board: www.knaufusa.com.

2. Other Manufacturers:

a. Johns Manville Corporation: www.jm.com.
b. Owens Corning Corp: www.owenscorning.com.
c. CertainTeed Corporation; : www.certainteed.com.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' ('Ksi') value: 0.23 at 75 degrees F (0.033 at 24 degrees C), when tested in accordance with ASTM C518.
2. Density: 3.0 lbs/cu. ft.
3. Maximum service temperature: 450 degrees F (232 degrees C).
4. Maximum Water Vapor Sorption: 5.0 percent.
5. Vapor Barrier Jacket:

a. Kraft paper with glass fiber yarn and bonded to aluminized film.
b. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E 96/E 96M.

C. Secure with pressure sensitive tape.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.03 metric perm (0.05 perm) at 0.9-mm (35-mil) dry film thickness.
2. Service Temperature Range: Minus 18 to plus 82 deg C (0 to 180 deg F).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

2.4 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 75 mm (3 inches).
2. Thickness: 0.16 mm (6.5 mils).
3. Adhesion: 1.0 N/mm (90 ounces force/inch) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 7.2 N/mm (40 lbf/inch) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 75-mm- (3-inch-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 100 mm (4 inches) o.c.
3. Overlap jacket longitudinal seams at least 38 mm (1-1/2 inches). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [50 mm (2 inches)] [100 mm (4 inches)] o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 100 mm (4 inches) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 50 mm (2 inches) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant.
3. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 450 mm (18 inches) and smaller, place pins along longitudinal centerline of duct. Space 75 mm (3 inches) maximum from insulation end joints, and 400 mm (16 inches) o.c.
    b. On duct sides with dimensions larger than 450 mm (18 inches), place pins 400 mm (16 inches) o.c. each way, and 75 mm (3 inches) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 50 mm (2 inches) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 13-mm (1/2-inch) outward-clinching staples, 25 mm (1 inch) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 10 deg C (50 deg F) at 5.5-m (18-foot) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 75 mm (3 inches).

5. Overlap unfaced blankets a minimum of 50 mm (2 inches) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 450 mm (18 inches) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 150-mm- (6-inch-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 150 mm (6 inches) o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 450 mm (18 inches) and smaller, place pins along longitudinal centerline of duct. Space 75 mm (3 inches) maximum from insulation end joints, and 400 mm (16 inches) o.c.
    b. On duct sides with dimensions larger than 450 mm (18 inches), space pins 400 mm (16 inches) o.c. each way, and 75 mm (3 inches) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 50 mm (2 inches) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 13-mm (1/2-inch) outward-

clinching staples, 25 mm (1 inch) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 10 deg C (50 deg F) at 5.5-m (18-foot) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 75 mm (3 inches).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 150-mm- (6-inch-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 150 mm (6 inches) o.c.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Exhaust Ducts and Plenums Within 10 ft (3 m) of Exterior Openings, except for the brine building: 1 inch Glass Fiber, Rigid.

B. Outside Air Intake Ducts and Plenums: 2 inches Glass Fiber, Rigid.

C. Supply Ducts: 1-1/2" Glass Fiber, Rigid, or 2" Glass Fiber, Flexible.

END OF SECTION

SECTION 23 07 16

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:
   1. Expansion/compression tanks.
   2. Air separators.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Equipment Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.1 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.2 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install multiple layers of insulation with longitudinal and end seams staggered.

E. Keep insulation materials dry during application and finishing.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with least number of joints practical.

H. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

I. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

J. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints 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, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) 4 inches (100 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

N. For above ambient services, do not install insulation to the following:
1. Testing agency labels and stamps.
2. Nameplates and data plates.
3. Manholes.
4. Handholes.
5. Cleanouts.

3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. Do not overcompress insulation during installation.
    d. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    e. Impale insulation over anchor pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Stagger joints between insulation layers at least 3 inches (75 mm).
7. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
8. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
9. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3.5 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Heating-hot-water and loop water expansion tank insulation shall be the following:
   1. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.

C. Loop water air-separator insulation shall be the following:
   1. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.

D. Heating-hot-water air-separator insulation shall be the following:
   1. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Heating water piping, indoors.
   2. Loop water piping, indoors.
   3. Condensate water piping, indoors.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Indoor Piping Insulation Schedule" and articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Johns Manville; a Berkshire Hathaway company.

   b. Knauf Insulation.

   c. Owens Corning

   d. CertainTeed

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Conductivity: 0.25-0.29 BTU-in/(h-ft^2-F) at 125F.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.4 SEALANTS

A. ASJ Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Keep insulation materials dry during application and finishing.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with least number of joints practical.

H. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
3. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

I. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

J. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

L. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, and seal patches similar to butt joints.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
2. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.5 INDOOR PIPING INSULATION SCHEDULE

A. Heating Water piping above floor, and Loop Water (Interior):

1. ½" to 2": Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-inch thick.

2. Over 2": Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.5 inches thick.

B. Condensate:

1. All Pipe Sizes: Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.0 inches thick.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping and tubing joining materials.
3. Valves.
4. Meters.
5. Pressure Regulators.
6. Dielectric Fittings.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

1.3 PERFORMANCE REQUIREMENTS

A. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

1.4 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

B. Operation and Maintenance Data: For motorized gas valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Mechanical Couplings:

    a. Steel flanges and tube with epoxy finish.
    b. Buna-nitrile seals.
    c. Stainless-steel bolts, washers, and nuts.
    d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.

B. Bronze Plug Valves: MSS SP-78.

1. Basis of Design: SMG Key Port Series 400.
2. Body: Bronze.
3. Plug: Bronze.
4. Ends: Threaded.
5. Operator: Square head.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service.

C. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Flanged
6. Operator: Square head or lug type.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.5 PRESSURE REGULATORS

A. Equipment Regulators:
   1. Basis of Design: Fisher Company.
   2. Spring loaded regulator with low pressure shutoff assembly and internal relief valve.
   3. Cast iron body, aluminum spring case.
   4. Single stage and suitable for natural gas.
   5. Steel jacket and corrosion-resistant components.
   6. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
   7. Springs: interchangeable.
   8. Atmospheric vent with stainless steel screen.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

   1. Body and Diaphragm Case: Cast iron.
   2. Springs: Zinc-plated steel; interchangeable.
   3. Diaphragm Plate: Zinc-plated steel.
   4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
   5. Orifice: Aluminum; interchangeable.
   6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
   7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
   8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
   9. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
   10. Maximum Inlet Pressure: 100 psig (690 kPa).

2.6 GAS METER

A. Meter furnished by utility, installed by contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

3.3 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Locate valves for easy access.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Verify final equipment locations for roughing-in.

J. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

K. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

L. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

M. Concealed Location Installations:

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

2. Prohibited Locations:

a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
b. Do not install natural-gas piping in solid walls or partitions.

N. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

O. Connect branch piping from top or side of horizontal piping.

P. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

Q. Do not use natural-gas piping as grounding electrode.

R. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
4. Sleeves: Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

3.4 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.

B. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

2. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

3.6 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. 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.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

   a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade.

3.7 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

3.8 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
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.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

3.10 LABELING AND IDENTIFYING

A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Exposed aboveground, distribution piping shall be the following:

1. Steel pipe with malleable iron fittings and threaded joints.

B. Underground, below building, piping shall be the following:
1. Steel pipe with wrought-steel fittings, welded joints, and a PE coating.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be the following:

1. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Bronze plug valve.

C. Valves in branch piping for single appliance shall be the following:

1. Cast iron plug valve.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heating and Geothermal Loop piping, above ground.
2. Condensate drain piping, above ground.
3. Transition fittings.
4. Dielectric fittings.

PART 2 - PRODUCTS

2.1 HEATING AND GEOTHERMAL LOOP WATER PIPE AND FITTINGS

A. 2-1/2" and Above:
   1. Steel Pipe: ASTM A53, Schedule 40, black.
      a. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1 welded.
      b. Flanges: 2-1/2" and over: Forged steel welding neck or slip-on, 150 psi, ANSI B16.5.
      c. Fittings: ANSK B16.9 butt weld schedule 40 steel fittings.
   2. Steel Pipe: ASTM A135 or A53.
      a. Joints: Bolted clamp type coupling with grooved end lock – Victaulic or equal.
      b. Fittings: Black malleable iron, grooved ends, ASTM A47.

B. 2" and Under:
   1. Copper Tube: Type L hard temper copper, ASTM B88.
      a. Fittings: ASME B16.22, solder wrought copper.
      b. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
         1) Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
      c. Wrought-Copper Unions: ASME B16.22.

2.2 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; solder joint.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:
1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions: fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.

2.6 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

K. 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.

L. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

M. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

N. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

O. Install shutoff valve immediately upstream of each dielectric fitting.

P. Install escutcheons for piping penetrations of walls, ceilings, and floors in the office area.

1. Escutcheons: One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

Q. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
4. Sleeves: Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.7 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

2.8 HANGERS AND SUPPORTS

A. Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

2.9 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

2.10 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

2.11 CHEMICAL TREATMENT

A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with glycol and inhibitor solution as indicated.

2.12 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

4. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

END OF SECTION

SECTION 23 21 16

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Ball Valves.
2. Butterfly Valves.
3. Swing Check Valves.
4. Spring Loaded Check Valves.
5. Flow Controls.
6. Strainers.
7. Pressure Reducing Valves.
8. Air Control Devices.
9. Relief Valves.
10. Combination Air and Dirt Separators.
11. Expansion Tanks.
12. Propylene Glycol Solution.
13. Bypass Chemical Feeder.

1.2 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels.

1.3 SUBMITTALS

A. Product Data: For each type of the following:
a. Valves.
b. Check valves.
c. Flow Control Valves.
d. Strainers.
e. Pressure Reducing Vavles.
f. Air Control Devices.
g. Relief Valves.
h. Combination Air and Dirt Separators.
i. Expansion Tanks.
j. Propylene Glycol Solution
k. Bypass Chemical Feeder.

PART 2 - PRODUCTS

2.1 BALL VALVES

A. Manufacturers:
1. Conbraco Industries.
2. Nibco, Inc.
3. Milwaukee Valve Company.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches (50 mm):
   1. Ductile iron body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, grooved ends or flanged, rated to 800 psi (5515 kPa).
   2. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.2 BUTTERFLY VALVES

A. Manufacturers:
   1. Hammond Valve.
   2. Crane Co.
   3. Milwaukee Valve Company.
   4. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, grooved, or flanged ends, extended neck.
   5. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM enscapsulation or Buna-N enscapsulation.
   6. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck
   7. Disc: Aluminum bronze. Bubble tight shutoff to 175 psig.
   8. Operator: 10 position lever handle.
   9. For Grooved piping, Butterfly valves shall be equal to Victaulic Style 300 for 2-1/2" through 12" sizes.

2.3 SWING CHECK VALVES

A. Manufacturers:
   1. Hammond Valve.
   2. Nibco, Inc.
   3. Milwaukee Valve Company.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, threaded ends with screw x solder adapter for copper tube.

C. Over 2 Inches (50 mm):
   1. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.
   2. For Grooved piping, Check valves shall be equal to Victaulic Series 716 for sizes 2-1/2" and 3"; Victaulic series 779 for sizes 4" through 12".

2.4 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Hammond Valve.
   2. Crane Co.
   3. Milwaukee Valve Company.
   4. Nibco, Inc.
   5. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.5 FLOW CONTROLS

A. Automatic Balancing Valve

1. Manufacturers:

   a. Griswold, Flow Design, Inc.
   b. HCI Terminator, Pro-Hydronic

2. Description: Factory assembled, pressure compensating flow control valve, preset to control flow rate within 5 percent of tagged rating over an operating pressure differential of at least 10 times minimum required for full flow conditions; stainless steel internal components.

   a. Ball valve: Brass body, stainless steel trim; internal parts replaceable without removing valve body from pipe; full port design; extended neck where used on insulated pipe.
   b. Strainer: Brass and stainless steel; 510 micron mesh screen; with back-flush/drain valve.
   c. Unions: Ground joint seal or rubber O rings.
   d. FC-1, 2" and smaller: Flow control, ball valve, union, dual temperature and pressure test ports.
   e. End connections as applicable to piping system.

B. Manual Venturi Balance Valve Manufacturers
   1. Griswold, Flow Design, Inc.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
   3. FC-3: 2" and Smaller: Bronze and brass construction, manual venturi balance valve, union, dual temperature and pressure test ports.
      a. Factory assembled.
      b. Venturi: precision formed throat, with stated catalog accuracy of 3%.
      c. Ball Valve: Brass body, stainless steel trim; internal parts replaceable without removing valve body from pipe; full port design; extended neck where used on insulated pipe.
      d. Unions: Ground joint seal or rubber O rings.
      e. Rated for 400 psig and 250F.
      f. Memory stop to allow shutoff and return to preset balance position.
   4. FC-3: 2-1/2" and Larger: Steel construction, venturi, butterfly valve, dual pressure and temperature test ports.
      a. Factory assembled.
      b. Venturi: low loss, piezo ring throat, with stated catalog accuracy of 3%.
      c. Rated for 240 psig and 250F.
      d. Memory stop to allow shutoff and return to preset balance position.
   5. Provide portable meter kit complete with diaphragm gauge with over-range protection, ten foot hoses with P/T adapters, transparent gauge faces for reading gpm. Provide gauge ranges as required.

2.6 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig (860 kPa).

2.7 PRESSURE REDUCING VALVES

A. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Low inlet-pressure check valve.
7. Valve Seat and Stem: Noncorrosive.
8. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.8 AIR-CONTROL DEVICES

A. Manual Air Vents:
1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/8 (DN 6).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:
1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/4 (DN 8).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

2.9 RELIEF VALVES

A. Manufacturers:

1. Basis of Design: ITT Bell & Gossett Model 790.
2. Other manufacturers:

   a. Armstrong International, Inc.
   b. Conbraco Industries, Inc.
   c. Taco Inc.

3. Description: Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 COMBINATION AIR & DIRT SEPARATORS

A. Description:

1. Steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi (860 kPa) operating pressure, with integral strainer, blow down connections, and air venting assembly. Provide access to all internal parts for inspection and replacement.
2. Features:

   a. Internal stainless steel coalescing medium with 3/16" (4.8mm) perforations and 51% open area to remove entrained air and suspended sediment.
   b. Blowdown valve at bottom of unit.
   c. Air vent at top of unit.

2.11 EXPANSION TANKS

A. Bladder-Type Expansion Tanks:
1. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

B. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psi (83 kPa).

2.12 PROPYLENE GLYCOL SOLUTION

A. Glycol: Inhibited Propylene Glycol as manufactured under the trade name of DowFrost.

B. Water:
1. Good quality water with the following maximum levels:
   a. Chloride Ions – 25 ppm.
   b. Sulfate (SO4) ions – 25 ppm.
   c. Total hardness ions – 100 ppm.
2. Other acceptable processed waters:
   a. Distilled.
   b. Deionized.

C. Concentration: Geothermal loop and underfloor radiant systems shall be mixed to 40% solution by volume.

2.13 CLOSED LOOP HYDRONIC HEATING SYSTEM INHIBITOR

A. Heavy duty inhibitor for reducing limescale and corrosion, with pH neutral formation.
1. Sentinal Performance Solutions, Inc. - X100 Inhibitor.
2. Concentration: 1% of system volume.

2.14 AUTOMATIC CHEMICAL-FEED EQUIPMENT

A. Description: Storage tank with pressure pump, including fuse protection. Unit features include: storage mixing tank, in level gauge, fill/access opening, pump with inlet strainer, inlet check valve, discharge check valve, low fluid level pump cut out float switch, pressure switch, pressure gauge, 60 psi pressure relief valve.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shut off-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

3.3 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install specialties in accordance with manufacturer's instructions.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blow down connection. Pipe to nearest floor drain.

F. Provide relief valves on pressure tanks, low pressure side of reducing valves and expansion tanks.

G. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

H. Pipe relief valve outlet to nearest floor drain.

I. Clean and flush systems per Section 23 21 13; refill system with glycol and inhibitor solution as indicated.

J. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

K. Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

SECTION 23 21 23

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Wet-rotor pumps.

1.2 SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Operation and Maintenance Data including installation manual, replacement parts list, and exploded view assembly.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers:
   1. Basis of Design:
      a. Taco, Inc.
   2. Other Manufacturers:
      a. Wilo.
      b. Armstrong Pumps Inc.
      c. ITT Bell & Gossett.

B. Description: Horizontal shaft, single stage, direct connected, end suction for 175 psi maximum working pressure, designed for installation with pump and motor shafts mounted horizontally.y or vertically.

C. Pump Construction:

1. Casing: cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
2. Impeller: Bronze, fully enclosed, keyed to shaft.
3. Bearings: Oil lubricated roller or ball bearings.
4. Shaft: Stainless steel shaft with bronze sleeve or steel shaft and stainless steel sleeves.
5. Pump Shaft: Alloy steel with stainless steel or bonze sleeve, integral thrust collar.
6. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.
7. Drive: Flexible coupling with coupling guard.
8. Baseplate: Cast iron or fabricated steel with integral drain rim.
9. Performance: As scheduled on Drawings.
10. Efficiency: Not less than 60 percent at operating condition.

D. Motor: Single speed and rigidly mounted to pump casing with integral pump support.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

2.3 WET-ROTOR PUMPS (for underfloor heating distribution)

A. Manufacturers:
1. Basis of Design:
   a. Taco, Inc.
2. Other Manufacturers:
   a. Wilo Stratos.
   b. Armstrong Pumps Inc.
   c. ITT Bell & Gossett.

B. Description: Factory-assembled and -tested, wet-rotor pump.
1. Pump shall be water lubricated, direct drive, requiring no seals, couplers or bearing assembly Pump shall be equipped with integral spring loaded flow check valve and rated for 200 psi working pressure and 220F fluid temperature.
   a. Casing: Cast iron or bronze.
   b. Cartridge: Stainless steel.
   c. Impeller: Non-metallic
   d. Shaft: Ceramic.
   e. Bearings: Carbon.
   f. O-ring and Gaskets: EPDM. Shaft.
   g. Performance: As scheduled on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

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

3.2 PUMP INSTALLATION

A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

C. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers of size required to support weight of in-line pumps.

1. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Mechanical Sound and Vibration Control."
2. Comply with requirements for hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install check valve and throttling valve with memory stop on discharge side of pumps where indicated.

E. Install Y-type strainer and shutoff valve on suction side of pumps where indicated.

F. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

G. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Duct Liner.
4. Sealants.
5. Hangers and supports.

1.2 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
7. Hangers and supports, including methods for duct and building attachment and vibration isolation.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet.

2.3 INSULATED FLEXIBLE DUCTS

A. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
2. Maximum Velocity: 4000 fpm (20.3 m/sec).
3. Temperature Range: -20 degrees F to 210 degrees F (-28 degrees C to 99 degrees C).

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity:

   a. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Solvent or water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. For duct velocities of less than 2500 fpm, secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.

8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 FLEXIBLE DUCTWORK CONNECTORS

A. Comply with recommendations set forth in SMACNA manual. Coordinate with 23 31 00.

B. Flexible connectors: Non-combustible water-proof, airtight glass fabric, one side coated with neoprene, weight 20 ounce per square yard. For ducts operating at over 100F and for acid resistant applications, flexible fabric shall be 30 ounce neoprene coated glass fabric.

2.6 SEALANT

A. General Sealant: Surface-burning characteristics for sealants shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Duct Sealant: UL listed, oil, water, and mold resistant synthetic rubber compound which dries to a flexible seal, aluminum in color.

1. Application Method: Brush on.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: ASTM 36/A 36M; steel, galvanized, threaded both ends, threaded one end, or continuously threaded.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.8 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Manufacturers:

1. Basis of Design: Lindab.

C. Materials:

1. Galvanized steel conforming to ASTM standards A653 and A924 conforming to the latest SMACNA HVAC Duct Construction Standards.

2. EPDM sealing gasket to conform to ASTM E84-91A and NFPA 90A flame spread and smoke developed ratings of 25/50.

D. Construction:

1. Spiral lock-seam construction with a mechanically formed seam locking indentation evenly spaced along the spiral seam. All spiral duct greater than 7 inch diameter incorporates multiple corrugations between the spiral seams.

E. Fittings:

1. All fitting ends shall come factory equipped with a double lipped, U-profile, EPDM rubber gasket.

2. The gasket is to be mechanically attached to the fitting using a spot welded stainless steel metal band located in a groove at the end of the fitting.

3. All fitting ends shall have rolled over edges for added strength and rigidity.

4. All elbows from 3" to 12" diameter shall be 2 pieces die stamped and continuously stitch welded.

5. All fittings that are of either spot-welded or button punched construction shall be internally sealed. When contract documents require divided flow fittings, only full body fittings will be accepted. The use of duct taps is unacceptable.

F. Volume and Balancing dampers:

1. Damper shall be fitting sized to slip into the spiral duct with a double lipped, U-profile, EPDM rubber gasket.

2. Locking quadrant with blade position indicator.

3. Integral shaft/blade assembly.

4. Shaft mounted, load bearing bushings.

5. Gasketed shaft penetrations to minimize leakage.

G. Performance:

1. Ducts designed to operate at static pressure in excess of 3 inches water gauge (750 Pa) shall be leak tested in accordance with SMACNA HVAC Duct Leakage Test Manual with the rate of air leakage less than or equal to 6.0 as determined in accordance with Equation 4-5 of the International Energy Conservation Code 2012.

2. Provide documentation that all sections have been tested and meet the requirements above.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

J. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.

K. Increase duct sizes gradually, not exceeding 15 degrees divergence whenever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

D. Repair or replace damaged sections and finished work that does not comply with these requirements.

E. Prepare ductwork for painting as indicated on Architectural Drawings.

3.3 FLEXIBLE DUCTWORK CONNECTORS

A. Align sheet metal duct with fan or fan casing opening in all three dimensions prior to installation of flexible connection, so that the duct and fan openings nearly coincide and are almost equally spaced from one another all around. Do not install flexible connection until above requirements are met.

B. Fans or fan casings and ducts shall be able to move 1" in any direction relative to each other without metal to metal contact or stretching taut the flexible connection.

C. Install flexible duct connections in compliance with appropriate SMACNA manual at heat pumps and exhaust fans.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

F. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

G. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3.6 CONNECTIONS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet connections.

3.7 DUCT SCHEDULE

A. In areas other than the wash bay and brine building, fabricate ducts with galvanized sheet steel. In the wash bay and brine building, fabricate ducts with type 304 stainless steel.

B. Supply, Exhaust, Intake and Return Ducts:

1. Ducts connected to Heat Pump and all exhaust ductwork except as noted below:
   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
2. Ducts connected to welding and vehicle exhaust:
   a. Pressure Class: Negative 3-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. Type: Single wall spiral lock-seams and EPDM gasket fittings.

C. Liner:

1. Return Air Ducts within 10 feet of heat pumps: 1 inch (25 mm) thick.

D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

2. Round duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" Figure 3-4, "Round Duct Elbows".

E. Branch Configuration

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

   a. Rectangular Main to Rectangular Branch: 45-degree entry.

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible", Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Motorized control dampers.
3. Flange connectors.
4. Duct-mounted access doors.
5. Duct accessory hardware.

1.2 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.

B. NFPA 92A - Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences.

C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

D. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc..

E. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc..

1.3 SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 with Type 2 finish.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

1. Manual Volume Dampers - Stainless steel for wash bay and brine building. Galvanized steel for all other areas.

2. Standard leakage rating.

3. Suitable for horizontal or vertical applications.

4. Frames:

   a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flangeless frames for installing in ducts.

5. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized -steel, 0.064 inch thick, or stainless steel as indicated.

6. Blade Axles: Galvanized steel or stainless steel as indicated.

7. Bearings:

   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel or stainless steel as indicated.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel or stainless steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Basis of Design: Ruskin type CD35.
2. Alternate Manufacturers:

   a. Louvers & Dampers, Inc:
   b. Nailor Industries Inc
   c. Ruskin Company
   d. Pottorff

B. Construction:

1. Stainless steel for wash bay and brine building. Galvanized steel for all other areas.
2. Frame: Minimum 16 gauge; reinforced corners.
3. Blades: Minimum 16 gauge, opposed blade; non-metallic bearings, polyurethane seals.
4. Leakage Rate: Maximum 10 cfm/sq ft at 1.0 inch wg.
5. Jamb seals: Flexible metal compression type.

C. Actuator: 120 volt.

2.5 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Stainless steel for wash bay and brine building. Galvanized steel for all other areas.

C. Gage and Shape: Match connecting ductwork.

2.6 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

2.7 DUCT ACCESSORY HARDWARE

A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct test holes where indicated and required for testing and balancing purposes.

C. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Downstream from motorized dampers.
2. Exhaust and intake plenums.

G. Access Door Sizes:

1. Two-Hand Access: 12 by 6 inches.

H. Install duct test holes where required for testing and balancing purposes.

I. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Utility set fans.
2. Centrifugal roof ventilators.
3. Centrifugal wall ventilators.
4. In-line centrifugal fans.
5. Welding Exhaust Fans.
6. Vehicle Exhaust Accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan controllers.
8. Vehicle Exhaust Fans and Assemblies.
9. Welding Fans and Hood Assemblies

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

C. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Standards: Power ventilators shall comply with UL 705.

1.5 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

A. Manufacturers:

1. Greenheck, Loren Cook, PennBarry, ACME, Twin City Fan.

B. Housing: Fabricated of continuously welded galvanized steel. Finish color shall be industrial gray. Provide specialty finishes as noted on Schedule.

C. Fan Wheels:

1. Radial type.
2. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
3. Fan wheel shall be manufactured with continuously welded steel blades, keyed to shaft.

D. Fan Shaft: turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.

E. Fan bearings: Heavy-duty grease lubricated, self-aligning or roller pillow block type, with L50 life in excess of 200,000 hours at maximum speed.

F. Belts and Drives:
1. Factory mounted, with final alignment and belt adjustment made after installation.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories:

1. Either an OSHA compliant weatherhood, or a combination of an OSHA compliant belt guard and shaft guard shall be included to completely cover the motor pulley and belt(s).

H. Capacities and Characteristics: As shown on the drawings.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers:

1. Greenheck, Loren Cook, PennBarry, ACME, Twin City Fan.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone. Fan and motor isolated from exhaust airstream.
   1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belts and Drives:
   1. Belts: oil and heat resistant.
   2. Drives: precision machined cast iron.
   3. Sized for 150 percent of installed motor horsepower.

E. Shaft and Bearings:

   1. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating
   2. Regreaseable ball bearings or pillow block ball bearings
   3. Bearing shall be selected for a minimum L50 average life of 500,000 hours at maximum cataloged operating speed.

F. Accessories:

   1. NEMA 1 disconnect switch.
   2. Bird Screens: Removable, 13-mm (1/2-inch) mesh, aluminum or brass wire.
   3. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops, 120 volt.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 40-mm- (1-1/2-inch-) thick, rigid, fiberglass insulation adhered to inside walls; and 40-mm (1-1/2-inch) wood nailer. Size as required to suit roof opening and fan base.

   1. Overall Height: 450 mm (18 inches).

H. Capacities and Characteristics: As shown on the drawings.

I. Finishes: As shown on the drawings.

2.3 DIRECT DRIVE HOOD REVERSIBLE FOUR WAY PROPELLER FAN

A. Description: Roof mounted, four function: exhaust, supply,

B. Wheel:

1. Cast aluminum, airfoil, reversible design of the blades and hubs.

C. Motors:
1. Permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.

D. Drive Frame:
1. Galvanized steel.

E. Fan Hood:
1. Material type: Steel.
2. Hood panels are arched with interlocking seams for weather protection.
3. Supporting members are galvanized steel angles.

F. Birdscreen:
1. Constructed of ½ inch galvanized steel mesh.

G. Protective Guards:
1. Mounted to the bottom of the plenum to protect fan

H. Plenums:
1. Galvanized steel.
2. Supported at the roof curb by mounting channels.

I. Bases:
1. Material type: Steel.

J. Fan Panels:
1. Constructed of heavy gauge steel with formed flanges and a double Venturi.

K. Dampers:
1. Actuator controlled.
2. Low leakage control damper.
3. Constructed of galvanized steel frames and blades.

L. Options/Accessories:
1. Control Center:
   a. Operating Modes: Supply/exhaust, recirculate, and mix.
   b. Allows operator to manually change the modes of operation of the fan from a convenient remote location.
   c. Controls are based in a NEMA-1 cabinet constructed of steel.
   d. Mode selector switch shall be used to engage the fan functions: exhaust, supply, recirculate, and mix.
   e. Temperature control available with mix mode only to maintain preset temperature.
   f. Custom control: See fan schedule for more information.
2. Curb Seal:
   a. Rubber seal between the fan and the roof curb
3. Disconnect Switches:
   a. NEMA -1 rated: for indoor application, no water.
   b. Positive electrical shut-off.
4. Finishes:
   a. Types: Baked Enamel
5. Plenum Extension
   a. Extension: 20 inches
6. Roof Curbs:

a. Material: Galvanized
b. Insulation thickness: 1.5 inches
c. Coating Type: None

2.4 CENTRIFUGAL WALL VENTILATORS

A. Manufacturers:

1. Greenheck,: Loren Cook, PennBarry, ACME, Twin City Fan.

A. Housing: Removable, spun-aluminum, dome top and outlet baffle, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone. Fan and motor isolated from exhaust airstream.
1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

C. Belts and Drives:
1. Belts: oil and heat resistant.
2. Drives: precision machined cast iron.
3. Sized for 150 percent of installed motor horsepower.

D. Shaft and Bearings:

1. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating
2. Regreaseable ball bearings or pillow block ball bearings
3. Bearing shall be selected for a minimum L50 average life of 500,000 hours at maximum cataloged operating speed.

E. Accessories:

1. NEMA 4x disconnect switch.
2. Motorized Dampers: Stainless steel construction. Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops. Actuator shall have NEMA 4X housing and stainless steel drive shaft.
3. Line voltage thermostat and humidistat as shown on Drawings.

F. Capacities and Characteristics: As shown on the drawings.

G. Finishes: As shown on the drawings.

2.5 TUBE AXIAL FANS

A. Manufacturers:

1. Greenheck, Loren Cook, PennBarry, ACME, Twin City Fan.

B. Continuously welded steel housing with integral inlet and outlet flanges, with structural members for mounting of motor, shaft and bearings.

C. Propellers to be airfoil design, with blades welded to blade stem, statically and dynamically balanced. Shaft shall be precision ground and polished, sized so first critical speed is at least 25% over the maximum operating speed.

D. Bearings shall be cast iron pillow block type, grease lubricated (provide extended lubrication lines), self-aligning, with L10 service life exceeding 80,000 hours for horizontal application.

E. Motors bases shall be adjustable; motor shall be out of the airstream. Belts, bearings and drives shall be protected from the airstream.

F. Accessories:

1. NEMA 1 disconnect switch.
2. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops, 120 volt.
3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.6 WELDING EXHAUST FANS

A. Manufacturers:

1. Basis of Design: Monoxivent DMA.
2. Other manufacturers: Carmon, Plymovent.

B. Description:

1. Direct drive, centrifugal high pressure blower with corrosion resistant components.
2. UL Approved.

C. Construction Features:

1. Silicon aluminum alloy housing and radial-type wheel.
2. Resiliently mounted motor
3. 1/2" Mesh, 0.062 inch thick aluminum wire bird screen

D. Motor: Total Enclosed Fan Cooled.

E. Disconnect Switch: NEMA 1, factory wired, non-fusible, in housing for thermal overload protected motor

F. Accessories:
1. Capture hood for fume blower:
   a. Welding gas capture hood on 7-foot swivel boom with 14' x 6" flexible hose arm and wall bracket.
   b. Hood: Impact resistant, high temperature polycarbonate/PVC material with handle, damper and knock outs for optional switches.
   c. Hood Opening: 12-inch oval design with both vertical and horizontal movement.
   d. Internal support arm: Tubular aluminum with pivot points.
   e. Extraction hose: Fiberglass coated with flame retardant vinyl that has a vinyl coated spring steel support wire.
2. Fan wall-mounting bracket.
3. Furnish one lifting pole with system.

2.7 VEHICLE EXHAUST ACCESSORIES

A. Manufacturers:

1. Basis of Design: Monoxivent 4000 Series Hose and 9000 Series Hose Reel.

2. Other manufacturers: Carmon, Plymovent.

B. Spring-retractable hose reel for process utility blower.

1. Mounting: Overhead.
2. Hose Size: 6-inch round.
3. Hose Length: 24 Feet.

C. Hose:

1. Double ply hose with an inner liner ply of woven fiberglass coated silicone rubber.

a. Fiberglass Inner Ply Thickness: 0.015 inches.
b. Nomex Outer Ply Thickness: 0.025 inches.

2. A helically wound spring steel wire is imbedded between the inner liner ply and an exterior ply of woven Nomex coated with silicone rubber.
3. The assembly is double wound with a treated Nomex cord and heat vulcanized.
4. Each hose shall be fitted with a rubber stack boot with optional magnet, optional lifting sleeve, and an optional spring-actuated door flap that closes automatically.

2.8 ATTIC EXHAUST FAN

A. Manufacturers:
1. Basis of Design: Master Flow

B. Description:
1. Direct Drive Centrifugal Roof Exhaust Fan
2. Aluminum housing
3. Backward inclined wheel
4. Birdscreen
5. Ball bearing motor
6. Motor isolated using shock mounts
7. Corrosion resistant fasteners

C. Accessories
1. Roof Curb: 18 gauge galvanized steel, straight, 1 inch thick, insulation.
2. Adjustable Humidistat/Thermostat

D. Refer to drawings for performance data.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 25 mm (1 inch).

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Registers and Grilles.
   2. Diffusers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.3 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.4 WARRANTY

A. Provide twenty year manufacturer's warranty against distortion, metal degradation, and failure of connections.

   1. Finish: Include coverage against degradation of exterior finish.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES and DIFFUSERS

A. Manufacturers:

   a. Carnes Company.

   b. Krueger.

   c. Nailor Industries Inc.

   d. Price Industries.

   e. Titus.

B. Description: As scheduled on the drawings.

C. Dampers: Where indicated and where required for proper air balance; opposed blade types, operable through face.

D. Finish: As scheduled on Drawings.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION DIFFUSER, REGISTERS AND GRILLES

A. Install diffusers, registers, and grilles level and plumb.

B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING DIFFUSERS, REGISTERS AND GRILLES

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 37 23

HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gravity roof hoods.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

A. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

C. Fabricate supports, anchorages, and accessories required for complete assembly.

D. Perform shop welding by AWS-certified procedures and personnel.

2.2 ROOF HOODS

A. Manufacturers:

1. Greenheck, Loren Cook.

B. 18 gauge aluminum, bolted and welded construction, with 8 gauge aluminum support structure. Provide rain gutter to prevent rain infiltration, and continuously welded curb cap corners.

C. Provide ½” galvanized mesh birdscreen.

D. Roof Curbs: Galvanized-steel sheet; with continuously welded corners; 40-mm- (1-1/2-inch-) thick, rigid fiberglass insulation adhered to inside walls; and 40-mm (1-1/2-inch) wood nailer. Size as required to fit roof opening and ventilator base.

1. Overall Height: 400 mm (16 inches).

E. Capacities and Characteristics: As Scheduled on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install gravity ventilators with clearances for service and maintenance.

C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during installation.

E. Label gravity ventilators according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Section 23 31 13 "Metal Ducts" Drawings indicate general arrangement of ducts and duct accessories.

B. Where motorized dampers are indicated, refer to Section 23 33 00.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION

SECTION 23 51 23

GAS VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Listed building-heating-appliance chimneys.
2. Guying and bracing materials.
3. Vent dampers.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, structural failures caused by expansion and contraction.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LISTED BUILDING-HEATING-APPLIANCE CHIMNEYS

A. Description: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F continuously or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1-inch annular space.

C. Inner Shell: ASTM A 666, Type 316 stainless steel.

D. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
2. Vented Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.
3. Joints: Gas tight, flange to flange, or draw band connection.

2.2 GUYING AND BRACING MATERIALS

A. Cable: Three galvanized, stranded wires of the following thickness:

1. Minimum Size: 1/4 inch in diameter.
2. For ID Sizes 4 to 15 Inches: 5/16 inch.

2.3 VENT DAMPERS

A. Damper Construction: Stainless-steel damper blade, shaft, and vent pipe with metal, prelubricated bearings.

1. Electric motor sized to power damper open and closed in approximately 15 seconds in each direction. Power is off when damper is at rest.
2. Comply with ANSI Z21.66.

B. Controls:

1. Control transformer.
2. Keyed wiring harness.
3. Damper end switch to prove damper is open.
4. Interlock with pressure washer to permit burner operation when damper is open.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

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

3.2 APPLICATION

A. Listed Building-Heating-Appliance Chimneys: Dual-fuel boilers, oven vents, water heaters, exhaust for engines, fireplaces, and other solid-fuel-burning appliances.

3.3 INSTALLATION OF LISTED CHIMNEYS

A. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Lap joints in direction of flow.

3.4 INSTALLATION OF MOTORIZED VENT

A. Install listed components in a manner complying with the listing.

B. Locate motorized vent dampers as close to draft hood collar as possible.

C. Secure motorized vent dampers to chimneys with hardware compatible with connected materials.

3.5 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

B. Provide temporary closures at ends of chimneys and stacks that are not completed or connected to equipment.

END OF SECTION

SECTION 23 52 16

CONDENSING BOILERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Gas-fired, water-tube condensing boilers, trim, and accessories for generating hot water.

B. Condensate neutralizers.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for boilers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Water-Tube Condensing Boilers: 10 year for heat exchanger, 1-year parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code. Boilers shall bear the ASME H stamp and be listed by the National Board.

C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. UL Compliance: Test boilers for compliance with UL 795. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. Boilers shall be constructed in accordance with the Iowa State Boiler Code.

F. Boilers shall be a minimum 95.3% thermal efficient and a minimum combustion efficiency of 95.7%.

2.2 WATER-TUBE CONDENSING BOILERS

A. Manufacturers:

1. Basis of Design: Laars.

2. Other approved manfacturers:

a. Aerco.

b. Weil McLain

c. Thermal Solutions.

B. Description: Factory-fabricated, -assembled, and -tested, water-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water-heating service only with ASME H stamp.

C. Heat Exchanger: Stainless-steel water tube with a low water volume design, welded construction with no gaskets in the header. Heat exchanger is accessible for visual inspection and cleaning of all internal surfaces.

D. Combustion Chamber: Stainless steel, sealed.

E. Sealed combustion jacket: unitized shell finished with acrylic thermo-set paint baked at not less than 325°F (163°C). The frame shall be constructed of galvanized steel. Chamber shall include a sight glass for viewing flame. Removal of jacket panels shall not affect the combustion seal.

F. Burner: Natural gas, forced draft drawing from gas premixing valve. Modulation with 5:1 turndown.

G. Blower: Fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.

H. Gas Train:

1. CSD-1 compliant.
2. Pilot and main gas pressure regulator, including vent from pressure regulator to point above roof.
3. Leak test valves downstream of each gas valve.
4. High and low gas pressure switches.
5. Manual shutoff valve upstream of burner and downstream of last gas valve.

I. Ignition: Silicone carbide hot-surface ignition that includes flame safety supervision and 100 percent main-valve shutoff.

J. Capacities and Characteristics: Refer to drawings.

2.3 TRIM

A. Include devices sized to comply with ASME B31.9.

B. Aquastat Controllers: Operating and high limit.

C. Safety Relief Valve: ASME rated set at 125 psi.

D. Pressure and Temperature Gage: Minimum 89-mm- (3-1/2-inch-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges, so normal operating range is about 50 percent of full range.

E. Boiler Air Vent: Manual.

F. Drain Valve: Minimum DN 20 (NPS 3/4) hose-end gate valve.

G. Outdoor reset sensor.

H. Water flow switch.

I. Manual reset high limit.

J. Auto Reset High Limit.

K. Outdoor air temperature sensor.

2.4 CONTROLS

A. Boiler controls may be via separate control panel, or may be self-contained if boilers have on-board capability to control multiple boilers.

B. Boiler operating controls shall include the following devices and features:

1. Ability to control the boiler pump, with delay features.
2. Ability to cascade and lead-lag boilers.
3. Built-in outdoor reset feature with customizable reset curves, based on the outdoor temperature and desired system water temperature.
4. Ability to accept a 4-20mA or 0-10VDC input connection from an external control or building automation system, to modulate the flame.
5. Dry alarm contacts for ignition failure.
6. Ability to monitor flue gas temperature and shall stop the boiler from firing if temperature is excessive.
7. Control transformer.
8. Allow adjustment of the following:
   a. Lead-lag setup parameters.
   b. Boiler high limit.
   c. Boiler temperature setpoint.
   d. Boiler on/off differentials.
   e. Boiler stack temperature limit.

f. Pump delay
g. Outdoor reset selection and low and high reset temperatures.
h. Warm weather shutdown.
i. Anti-short-cycle adjustment.

9. Monitor the following:
   a. System setpoint.
   b. Operating temperatures.
   c. Outlet temperature.
   d. Inlet temperature.
   e. Outdoor temperature.
   f. Boiler temperature rise.
   g. Lead-lag operating temperature,
   h. Lead-lag setpoint.
   i. Fan speed.
   j. Flame signal.
   k. Firing rate.
   l. Stack temperature.

2.5 ELECTRICAL POWER

A. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

2.6 COMBUSTION AIR AND FLUE

A. Direct vent vertical or horizontal arrangement, as shown on Drawings. Exterior terminations of combustion air and flue piping shall be in accordance with manufacturer's instructions. Provide all piping and fittings as required for sealed and pressure tight combustion air intake and flue exhaust systems. Provide manufacturer’s standard terminations for combustion air intake and exhaust piping.

B. Combustion Air and Flue Piping: CPVC.

   1. Type IV Grade I, with a Cell Classification of 23447 as defined in ASTM D1785.
   2. Color: light gray in color.
   3. Standards: ASTM F441

2.7 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to 2010 ASME Boiler and Pressure Vessel Code.

C. Allow Owner access to source quality-control testing of boilers.

2.8 CONDENSATE NEUTRALIZERS

A. Basis of Design: G.M. Services and Manufacturing.

B. PVC construction, with refillable charge of calcium carbonite, 3/4" threaded inlet and 3/4" threaded outlet. Provide with mounting hardware for attaching to floor or concrete pad.

C. For installation at the condensate drains of each high efficiency boiler.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Equipment Mounting:

1. Install boilers on cast-in-place concrete equipment base(s).

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Section 23 21 16 "Hydronic Piping Specialties."

E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.

F. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

G. Install piping from safety relief valves to nearest floor drain.

H. Boiler Venting:

1. Install flue venting kit and combustion-air intake.
2. Connect full size to boiler connections.

I. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

   a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
   b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Boiler will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION

SECTION 23 55 23.13

LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes low-intensity, gas-fired, forced-draft radiant heaters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Include plans, elevations, sections, and mounting attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of high-intensity, gas-fired, radiant heaters, as well as procedures and diagrams.
4. Include diagrams for power and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired, radiant heaters to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Igniter: One hot-surface burner igniter(s) for each style of high-intensity, gas-fired, radiant heater furnished.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within 3 years of substantial completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FORCED-DRAFT HEATERS

A. Manufacturers:
   1. Basis of Design: Roberts Gordon

B. Other Approved Manufacturers:
   1. Re-Verber-Ray
   2. Ambirad

C. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.

D. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

E. Burner Assembly:
   1. Combustion-Air Inlet: Ducted horizontal to outdoors through sidewall with vent caps.
   2. Burner Control Housing:
      a. See Schedule for where Harsh Environment Model and Standard Models are used.
      b. Harsh Environment Model
         1) Moisture resistant with fully gasketed burner access doors.
         2) Coating: Chemical and corrosion-resistant: 2-3 mil. epoxy polyester powder coat.
      c. Standard Model
         1) Enclosed and sealed box design
         2) Finish: Epoxy polyester powder coat
      d. Totally enclosed with access cover.
      e. Sight glass for visual inspection of burner.

   3. Burner: Stainless steel.

4. Ignition System: Silicon carbide hot-surface igniter with flame rod sensing capabilities and self-diagnostic control module.
   Combustion Blower Fan: Dynamically balanced, direct-driven, forward-curved fan with aluminized-steel housing.
5. Motors: totally enclosed, permanently lubricated type with internal thermal protection.

F. Combustion Chamber: 4-inch- (100-mm-) diameter, 16-gage, aluminized-steel/titanium alloy tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Chambers shall be equipped with sight glass for burner and pilot flame observation.

G. Emitter Tube: 4” 16-gage, aluminized-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
   1. Exhaust Vent Termination: Horizontal through side wall with vent caps.

H. Reflector:
   1. See Schedule for where Harsh Environment Model and Standard Models are used.
   2. Harsh Environment Model:
      a. Polished stainless steel, with end caps.
   3. Standard Model:
      a. Aluminum with end caps.
   4. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.

I. Accessories:
   1. Stainless-steel flexible connector with manual valve for gas supply.
   2. Rigid mounting kits.
   3. Clearance warning plaque.
   4. Vent adapter and vent cap.
   5. Fresh air inlet vent cap.

2.3 CONTROLS AND SAFETIES

A. Gas Control Valve: Single -stage, regulated redundant 24-V ac gas valve that contains pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

B. Failure Safeguards: 100 percent shutoff of gas flow in the event of flame or power failure.

C. Prepurge of air control system prior to burner ignition.

D. Safety lockout of burner after three consecutive ignition failures.

E. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.

F. Control Panel Interlock: Stops burner if panel is open.

G. Thermostat: Single-stage, wall-mounted type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

   1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structures, substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance of the Work.

B. Examine roughing-in for fuel-gas piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.

B. Suspended Units: Mount to substrate using manufacturer's rigid mounting kits or custom fabricated brackets.
   1. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Maintain manufacturers' recommended clearances for combustibles.

3.3 CONNECTIONS

A. Gas Piping: Comply with Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service according to NFPA 54.

B. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.

C. Electrical Connections: Comply with applicable requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

   1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   2. Verify proper motor rotation.
   3. Test Reports: Prepare a written report to record the following:

a. Test procedures used.
b. Test results that comply with requirements.
c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial-temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired, radiant heaters.

END OF SECTION

SECTION 23 81 46.13

WATER-TO-AIR HEAT PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vertical water to air heat pumps.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, furnished specialties, and accessories for each model.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include diagrams for power, signal, and control wiring.

C. Operation and Maintenance Data: For water-to-air heat pumps to include in operation, and maintenance manuals.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. One set(s) of filters for each unit.

1.4 QUALITY ASSURANCE

A. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

B. Comply with NFPA 70.

C. Comply with safety requirements in UL 484 for assembly of free-delivery, water-source heat pumps.

D. Comply with safety requirements in UL 1995 for duct-system connections.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of water-source heat pumps that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, refrigeration components.

2. Compressor Warranty Period: Four years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VERTICAL WATER-SOURCE HEAT PUMPS

A. Manufacturers:
   1. Basis of Design: Climate Master.
   2. Other acceptable manufacturers: Florida/Bosch, Daikin, Waterfurnace, AAON.

B. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to ASHRAE/ARI/ISO-13256-1.

   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Cabinet and Chassis: Galvanized-steel casing with the following features:

   1. Access panel for access and maintenance of internal components.
   2. Knockouts for electrical and piping connections.
   3. Flanged duct connections.
   4. Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch (13 mm) thick, complying with UL 181, ASTM C 1071, and ASTM G 21.
   5. Insulated panel separating fan compartment from compressor.
   6. Units field convertible for various discharge configurations.
   7. Condensate Drainage: High-density polyethylene plastic or stainless-steel drain pan with condensate drain piping projecting through unit cabinet and complying with ASHRAE 62.1.

   8. Sound Attenuation Package: Provide one or more of the following:

      a. Minimum 0.5-inch (1.5-mm-) thick compressor enclosure and front panel.
      b. Sound attenuating blanket over compressor.
      c. Compressors mounted on spring vibration isolators to a heavy gauge mounting plate, which is also isolated from the cabinet base with rubber grommets.

D. Fan: Direct driven, centrifugal, with multispeed motor resiliently mounted in fan inlet and with inlet rings to allow wheel removal from one side without removing housing. Fan motor shall be isolated from the housing by rubber grommets.

   1. General requirements for motors are specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
   2. Motor: Multispeed, permanently lubricated, ECM motor with overload protection.

E. Water Circuit:

   1. Refrigerant-to-Water Heat Exchangers:

      a. Coaxial heat exchangers with copper water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig (3102 kPa) on refrigerant side and 500 psig (2758 kPa) on water side. Factory-mount heat exchanger in unit on resilient rubber vibration isolators.

F. Refrigerant-to-Air Coils: Copper tubes with aluminum fins, leak tested to 625 psig (3102 kPa).

G. Refrigerant Circuit Components:

1. Sealed Refrigerant Circuit: Charge with R-410A refrigerant.
2. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.
3. Charging Connections: Service fittings on suction and liquid for charging and testing on each circuit.
4. Reversing Valve: Four-way, solenoid-activated valve designed to be fail-safe in heating position with replaceable magnetic coil.
5. Compressor: Hermetic scroll, two-stage compressor installed on vibration isolators and housed in an acoustically treated enclosure with factory-installed safeties as follows:

    a. Antirecycle timer.
    b. High-pressure cutout.
    c. Low-pressure cutout or loss of charge switch.
    d. Internal thermal-overload protection.
    e. Freezestat to stop compressor if water-loop temperature falls below freeze limit for antifreeze mix.
    f. Condensate overflow switch to stop compressor with high condensate level in condensate drain pan.
    g. Water-coil, low-temperature switch.
    h. Air-coil, low-temperature switch.

6. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
7. Pipe Insulation: Refrigerant minimum 3/8-inch- (10-mm-) thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-developed indexes according to ASTM E 84.
8. Refrigerant Metering Device: Dual-port, thermal-expansion valve to allow specified operation with entering-water temperatures from 20 to 120 deg F (minus 4 to plus 52 deg C).

H. Provide closed cell insulation to internal water piping, refrigerant suction tubing and refrigerant to water heat exchanger.

I. Pump: Provide internal, factory mounted variable speed water circulating pump as noted on Schedule.

J. Electric Auxiliary Heating Coil: Helix-wound, nickel-chromium, wire-heating elements in ceramic insulators mounted on steel supports. Electric heat can mount internally or externally and is started via low voltage cable from internally wired control board. Capacities as scheduled on Drawings.

K. Filters: Disposable, 1 inch (25 mm) thick MERV 8 filters.

L. Electrical Connection: Single electrical connection.

M. Capacities and Characteristics: As shown on the drawings.

2.2 CONTROLS:

A. Provide Solid State Control System with the following features:
1. Anti-short cycle time delay for compressor operation.

2. Random start on power up mode.
3. Low voltage protection.
4. High voltage protection.
5. Unit shutdown on high or low refrigerant pressures.
6. Unit shutdown on low water temperature.
7. Condensate overflow electronic protection.
8. Option to reset unit at thermostat or disconnect.
9. Automatic intelligent reset 5 minutes after fault cleared. Lockout after 3 sequential faults.
10. LED indicating high pressure, low pressure, low voltage, high voltage, low water/air temperature cut-out, condensate overflow, and control voltage status.
11. Water coil low temperature sensing.
12. Air coil low temperature sensing.
13. Night setback.
14. Random start on return from night setback.
15. Override temperature control with 2 hour timer.
16. Auxiliary heat control.
17. Relay to start internal pump.
18. Control transformer.

B. Electronic Communicating Thermostat:
1. Three stages of heat, two stages of cool, with manual or automatic change-over operation. Unit shall be able to operate in standard or programmable mode.
2. Thermostat shall allow for configuration of heat pump cfm for each mode of operation.
3. Display system faults, system inputs, system outputs configuration settings, loop inlet and outlet temperatures, compressor discharge line temperature, liquid line temperature, and leaving air temperature.

2.3 HOSE KIT ASSEMBLIES

A. General: Hose kits shall be designed for minimum 400-psig (2758-kPa) working pressure and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.

B. Supply hose having "Y" strainer with blow-down valve, and ball valve with pressure temperature port; return hose having automatic flow regulator with PT ports, and ball valve.

C. Hose: Length 36 inches (900 mm) braided stainless steel, complete with adapters. Minimum diameter, equal to water-source, heat-pump connection size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electric installations for water-source heat pumps to verify actual locations of piping connections and electrical conduits before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install water-source heat pumps on cast-in-place concrete equipment base(s).

B. Install wall-mounted thermostats at heights to match lighting controls. Provide all interconnecting wiring between thermostats and heat pump unit controllers.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect supply and return hydronic piping to heat pump with hose kits.
2. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

B. Connect supply and return ducts to water-source heat pumps with flexible duct connectors specified in Section 23 31 13 “Metal Ducts."

C. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

D. Install piping adjacent to machine to allow service and maintenance.

E. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following field tests and inspections:

1. After installing water-source heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Heat pumps will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
9. Start unit according to manufacturer's written instructions.
10. Complete startup sheets and attach copy with Contractor's startup report.
11. Inspect and record performance of interlocks and protective devices; verify sequences.
12. Operate unit for an initial period as recommended or required by manufacturer.
13. Verify thermostat calibration.
14. Inspect controls for correct sequencing of heating, refrigeration, and pump.

3.6 CLEANING

A. Replace filters used during construction prior to air balance or Substantial Completion.

B. After completing installation of exposed, factory-finished, water-source heat pumps, inspect exposed finishes and repair damaged finishes.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water-source heat pumps.

END OF SECTION

SECTION 23 83 16

RADIANT-HEATING HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes radiant-heating piping, including pipes, fittings, and piping specialties.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include data for piping, fittings, manifolds, specialties, and controls; include pressure and temperature ratings, oxygen-barrier performance, fire-performance characteristics, and water-flow and pressure-drop characteristics.

B. Shop Drawings: Show piping layout and details drawn to scale, including valves, manifolds, controls, and support assemblies, and their attachments to building structure.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For radiant-heating piping valves and equipment to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PEX PIPE AND FITTINGS

A. Manufacturers:

1. Basis of Design: Uponor.

B. Pipe Material: Crosslinked polyethylene PEX-a Engel Method, with oxygen diffusion barrier covered by extruded polyethylene.

C. Thermal Conductivity: 0.22 Btu/h/ft/degF.

D. Pressure/Temperature Rating: 160 psi gauge pressure at 73.4 deg F and 80 psi gauge pressure at 200^0F temperature.

E. Fittings:

1. For system compatibility, use fittings offered by piping manufacturer.

2.2 DISTRIBUTION MANIFOLDS

A. Manifold Construction: 1-1/2” heavy walled, corrosion resistant brass with threaded ends for combining manifolds, mounting bracket and end caps with gaskets.

B. Manual Air Vents and Fill Drain Valve:

1. Body: Bronze.
2. Type: Ball

C. Isolation valves on supply manifold branches:

1. Body: Brass.
2. Type: Ball.
3. With temperature gauge.

D. Balancing Valves on return manifold branches:

1. Body: brass and glass.
2. Type: Globe cartridge type.
3. Visual Flow Indicator: Inline visual flow member with threaded fittings.

E. Mounting Brackets: Heavy duty galvanized steel with rubber isolation pads.

F. Manifold Cabinet:
1. Stainless steel, minimum 20 gauge, with welded corners. Cabinet shall enclose top, front and sides of manifold, with open bottom. Provide 1” flange on three sides for mounting to wall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive radiant-heating piping for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Ensure that surfaces and pipes in contact with radiant-heating piping are free of burrs and sharp protrusions.
2. Ensure that surfaces and substrates are level and plumb.

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

3.2 INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings or coordination drawings.

B. Install radiant-heating piping continuous from the manifold through the heated panel and back to the manifold without piping joints in heated panels.

C. Connect radiant piping to manifold in a reverse-return arrangement.

D. Do not bend pipes in radii smaller than manufacturer's minimum bend radius dimensions.

E. Install manifolds in accessible locations, or install access panels to provide maintenance access.

F. Comply with requirements in Section 23 21 13 "Hydronic Piping" and Section 23 21 16 Hydronic Piping Specialties" for pipes and connections to hydronic systems.

G. Piping in Level Fill Concrete Floors:

1. Secure piping in concrete floors by attaching pipes to rebar with wire ties.
2. Space ties in accordance with manufacturer's instructions.
3. Maintain 3-inch minimum cover.
4. Install a sleeve around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
5. Maintain minimum 40-psig (275-kPa) pressure in piping during the concrete pour and continue for 24 hours during curing.

H. Revise locations and elevations from those indicated as required to suit field conditions and ensure integrity of piping and as approved by Architect.

I. After system balancing has been completed, mark balancing valves to permanently indicate final position.

J. Perform the following adjustments before operating the system:

1. Open valves to fully open position.
2. Check operation of automatic valves.
3. Set temperature controls so all zones call for full flow.
4. Purge air from piping.

K. After concrete has cured as recommended by concrete supplier, operate radiant-heating system as follows:

1. Start system heating at a maximum of 10 deg F (6 deg C) above the ambient radiant-panel temperature and increase 10 deg F (6 deg C) each following day until design temperature is achieved.
2. For freeze protection, operate at a minimum of 60 deg F (16 deg C) supply-water temperature.

3.3 FIELD QUALITY CONTROL

A. Prepare radiant-heating piping for testing as follows:

1. Open all isolation valves and close bypass valves.
2. Open and verify operation of zone control valves.
3. Flush with clean water and clean strainers.

B. Perform the following tests and inspections:

1. Leak Test: After installation, charge system and test for leaks. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig (690 kPa). Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Radiant-heating piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports and submit to Engineer.

E. Protect hydronic piping system from damage during construction.

END OF SECTION

SECTION 26 05 11

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, panelboards, and other items and arrangements for the specified items are shown on drawings or schedules.

B. Electrical service entrance equipment (arrangements for temporary and permanent connections to the 15kV system) shall conform to NEC requirements. Coordinate fuses, circuit breakers and relays with the 15kV system, and obtain Owner approval for sizes and settings of these devices.

C. Wiring ampacities specified, scheduled, or shown on the drawings are based on copper conductors unless otherwise noted, with the conduit and raceways accordingly sized.

1.2 MINIMUM REQUIREMENTS

A. References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials 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. Listed: Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production

of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3. Certified: equipment or product which:

   a. 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 of equipment or product is periodically inspected by a nationally recognized testing laboratory.
   c. Bears a label, tag, or other record of certification.

4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 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: Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class or type 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.
   2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility 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 wiring shall be identified on the equipment being furnished and on all wiring diagrams.

1.6 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

   1. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power

systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, wiring devices, electronic equipment, and accessories.

2. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
3. Damaged equipment shall be, as determined by the Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
5. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.7 WORK PERFORMANCE

A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.

B. Contractor shall be responsible for all permits and inspections required to complete the work.

C. Job site safety and worker safety is the responsibility of the contractor.

D. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:

1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.
4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Owner.

E. For work on existing buildings, arrange, phase and perform work to assure electrical service for other buildings at all times.

F. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions. Existing installation conditions discovered or uncovered during the course of new work shall be reported to Construction Manager or Engineer as soon as practical and not later than the end of the day the condition is discovered.

G. Coordinate location of all equipment and conduit with other trades to minimize interferences.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces shall not be less than specified in the NEC for all voltages specified.

C. Inaccessible Equipment:

1. Where the Engineer determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
2. "Conveniently accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.9 EQUIPMENT AND PATHWAY IDENTIFICATION

A. As defined in Section 26 05 53 - Identification for Electrical Systems.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
   1. Section 26 05 23 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.

1.2 DEFINITIONS

A. VFC: Variable frequency controller.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Type THHN/THWN-2 and Type XHHW-2.

C. Minimum 90-degree C insulation rating.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. Wiring Connectors for Splices and Taps:

1. Where a circuit passes through an outlet box and is tapped, all leads are to be pigtailed to the wiring device, including the equipment ground, to prevent loss of neutral or ground during maintenance work.
2. Copper Conductors Sized #8 and larger: Use compression connectors.

C. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide connections insulated with heat-shrink tubing for motor connections #8 AWG or larger.

D. Do not use split bolt connectors or scotch lock type wire connectors.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CONDUCTOR MATERIAL APPLICATIONS

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller for lighting circuits and non-vibrating power utilization equipment; stranded for No. 8 AWG and larger. Provide stranded conductors, regardless of size, for connections to vibrating equipment such as motors and transformers.

D. Use stranded conductors for control circuits.

E. Use conductor not smaller than 12 AWG for power and lighting circuits.

F. Use conductor not smaller than 14 AWG for control circuits.

G. Use 10 AWG conductors for 20 amperes, 120-volt branch circuits longer than 75 feet (25 m).

3.3 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

H. Metal Clad Cable is not permitted for use.

I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

J. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.
      c. Switch legs: Pink with ends taped to match phase color.
      d. Travelers for 3-Way and 4-Way Switching: Violet with ends taped to match phase color.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables. All conductors and cables to be installed in conduit unless otherwise noted.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 150 mm (6 inches) of slack.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly

END OF SECTION

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. UTP cabling.
   2. RS-485 cabling.
   3. Low-voltage control cabling.
   4. Control-circuit conductors.
   5. Identification products.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

D. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.4 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.5 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2 in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway.

PART 3 - EXECUTION

3.1 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2. Flexible metal conduit shall not be used.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:
1. Cables may not be spliced.
2. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems".
4. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
5. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
6. Support: Do not allow cables to lay on removable ceiling tiles.
7. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

D. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.

2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches (305 mm).

3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches (1200 mm).
5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

   1. Class 1 remote-control and signal circuits; No 14 AWG.
   2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
   3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.5 FIRESTOPPING

A. Comply with TIA-569-B, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping" Chapter.

3.6 GROUNDING

A. For low-voltage control wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NFPA 70B .

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 41 mm (1-5/8 inches) wide and 1.6 mm (1/16 inch) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 4 by 12 x ¼ inches, with 7.14-mm (9/32-inch) holes spaced 28 mm (1-1/8 inches) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression -type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 19 mm by 3 m (3/4 inch by 10 feet).

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, size as indicated on Drawings.

1. Bury at least 600 mm (24 inches) below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.
5. When making ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 05 53 “Identification of Electrical Systems”.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized as indicated on drawings between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

B. Provide a grounding electrode conductor sized per NEC between all separately derived systems and main building electrode.

3.4 EQUIPMENT AND PATHWAY GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems shall contain an equipment grounding conductor, except non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

D. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

E. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 50 mm (2 inches) below final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 300 mm (12 inches) deep, with cover.

1. Test Wells: Install at least one test well at main building service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Ground Ring: As indicated on drawings.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring.
2. Bury ground ring not less than 600 mm (24 inches) from building's foundation.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 6.0 m (20 feet) long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Substations and Pad-Mounted Equipment: 5 ohms.
2. Brine and Pole Buildings: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer’s catalog data for fastening and support systems.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4
4. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 14-mm- (9/16-inch-) diameter holes at a maximum of 200 mm (8 inches) o.c., in at least 1 surface.

1. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
2. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
3. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 6 mm (1/4 inch) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.

D. Outdoors: PVC coated steel slotted system with stainless steel anchoring and attachment components.

E. Indoor, Dry Spaces: Galvanized steel slotted system with galvanized anchoring and attachment components. Locations include:

1. Mechanic Bays.
2. Office.
3. Mechanical Rooms.
4. Storage Bays.
5. Pole Building.

F. Indoor, Subject to Corrosive Environment: Non-Metallic slotted system with stainless steel anchoring and attachment components. Locations include:
1. Brine Building.

G. Spring-steel clamps designed for supporting single conduits without bolts may be used for 38-mm (1-1/2-inch) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 90 kg (200 lb).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 100 mm (4 inches) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 100 mm (4 inches) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 100 mm (4 inches) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 20.7-MPa (3000-psi), 28-day compressive-strength concrete. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 0.05 mm (2.0 mils).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Nonmetal wireways and auxiliary gutters.
   5. Surface raceways.
   6. Boxes, enclosures, and cabinets.
   7. Handholes and boxes for exterior underground cabling.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduit, surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, exterior handholes and boxes, fabric innerduct, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. IMC: Comply with ANSI C80.6 and UL 1242.

C. PVC-Coated Steel Conduit: PVC-coated RMC or IMC as indicated.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 1 mm (0.040 inch), minimum.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:

      a. Material: Steel.
      b. Type: Compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 1 mm (0.040 inch), with overlapping sleeves protecting threaded joints.

H. Joint Compound for IMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 23 kg (50 lb). Outlet boxes designed for attachment of luminaires weighing more than 23 kg (50 lb) shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Device Box Dimensions: 100 mm square by 60 mm deep (4 inches square by 2-1/8 inches deep).

I. Gangable boxes are prohibited.

J. Hinged-Cover Enclosures: Comply with UL 50 with continuous-hinge cover with flush latch unless otherwise indicated.
   1. NEMA 250, Type1: Steel, finished inside and out with manufacturer's standard enamel.
   2. NEMA 250, Type 4X: Corrosion resistant type 316 stainless steel with brushed finish. Seamless poured in-place gasketed cover for protection against dust and moisture.

K. Cabinets:
   1. NEMA 250, Type1: Steel, finished inside and out with manufacturer's standard enamel.
   2. NEMA 250, Type 4X: Corrosion resistant type 316 stainless steel with brushed finish. Seamless poured in-place gasketed cover for protection against dust and moisture.
   3. Hinged door in front cover with flush latch and concealed hinge.
   4. Key latch to match panelboards.
   5. Metal barriers to separate wiring of different systems and voltage.
   6. Accessory feet where required for freestanding equipment.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
   1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with a combination of steel and fiberglass.
   1. Standard: Comply with SCTE 77.
   2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded lettering, as identified.
   6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   7. Handhole dimensions as identified on drawings.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: PVC coated RMC.
   2. Underground Conduit: RNC.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC .
   4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R unless otherwise noted.

B. Indoors: Apply raceway products as specified in table below unless otherwise indicated on drawings. If a specific application is not defined in the table use the general application rules that follow.

Area	Location	Conduit Type
Office*	Concealed in Wall and Above Ceilings	EMT
Mechanical Room	Exposed	IMC
	Connection to Vibrating Equipment	LFMC
Mechanics Bays (Including Parts Room)	Exposed Below 4'-0" AFF	RNC
	Exposed Above 4'-0" AFF	EMT
	Connection to Vibrating Equipment	FMC
Storage Bays	Exposed Below 4'-0" AFF	RNC
	Exposed Above 4'-0" AFF	EMT
	Connection to Vibrating Equipment	LFMC
Brine Building	Exposed	RNC
	Connection to Vibrating Equipment	LFMC
Pole Building	Exposed Below 10'-0" AFF	IMC
	Exposed Above 10'-0" AFF	EMT
	Connection to Vibrating Equipment	FMC
**Office includes the following rooms located within the Main Building: Office 100, Vestibule 101, Corridor 102, Men 103, Women 104, IT/COM 105, Janitor 106, Conference 107, and Storage 108.*		

1. Exposed, Not Subject to Physical Damage or Corrosive Environment: EMT.
2. Exposed and Subject to Severe Physical Damage, Not Subject to Corrosive Environment: IMC.
3. Exposed and Subject to Severe Physical Damage and Corrosive Environment: Use PVC coated RMC up to 10 feet above finished floor. Use RNC where located higher than 10 feet above finished floor, unless noted otherwise.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment)
   a. Dry Locations: FMC
   b. Damp or Wet Locations: LFMC Locations including the following:
6. Boxes and Enclosures in Dry Spaces: NEMA 250, Type 1
7. Boxes and Enclosures Subject to Corrosive Environment: except use NEMA 250, Type 4X stainless steel. Locations include but are not limited to the following:
   a. Brine Building.

C. Minimum Raceway Size: 21-mm (3/4-inch) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 49 deg C (120 deg F).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 150 mm (6 inches) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 300 mm (12 inches) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 300 mm (12 inches) of enclosures to which attached.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 27-mm (1-inch) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 3-m (10-foot) intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 50 mm (2 inches) of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from RNC to the specified conduit for a location before rising above the floor.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 35mm (1-1/4-inch) trade size and insulated throat metal bushings on 41-mm (1-1/2-inch) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits and feeder conduits from the main distribution panelboard.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 53-mm (2-inch) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 90-kg (200-lb) tensile strength. Leave at least 300 mm (12 inches) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:
   1. Install surface raceway with a minimum 50-mm (2-inch) radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 1200 mm (48 inches) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of the office, mechanic bay, and storage spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 1830 mm (72 inches) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 26 05 41 “Underground Electrical Construction” for pipe less than 150 mm (6 inches) in nominal diameter.
   2. Install backfill as specified in Section 26 05 41 “Underground Electrical Construction.”
   3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 300 mm (12 inches) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 26 05 41 “Underground Electrical Construction.”
   4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

      a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 75 mm (3 inches) of concrete for a minimum of 300 mm (12 inches) on each side of the coupling.
      b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 1500 mm (60 inches) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 12.5-mm (1/2-inch) sieve to 4.75-mm (No. 4) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 25 mm (1 inch) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire rated floor and wall assemblies.

B. Firestop System installation must meet requirements of UL 1479 tested assemblies that provide fire/smoke rating equal to that of construction being penetrated. Utilize firestop products identified under Products in this section in assemblies. Provide additional products as required for complete assembly.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 41

UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing and installation of ducts to form a complete underground raceway system.

B. “Duct” and “conduit”, and “rigid metallic conduit” and “rigid steel conduit" are used interchangeably in this specification and have the same meaning.

1.2 SUBMITTALS

A. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

B. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Engineer:

1. Certification that the materials are in accordance with the drawings and specifications.
2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

PART 2 - PRODUCTS

2.1 DUCTS

A. Number and sizes shall be as shown on drawings.

B. Ducts (direct burial):

1. Plastic duct:
   a. NEMA TC2 and TC3
   b. UL 651, 651A and 651B, Schedule 80 PVC or HDPE.
   c. Duct shall be suitable for use with 75 degree C rated conductors.

2.2 WARNING TAPE

A. Standard 4-mil polyethylene 76 mm (3 inch) wide tape, detectable type, red with black letters, imprinted with “CAUTION BURIED ELECTRIC CABLE BELOW”.

PART 3 - EXECUTION

3.1 TRENCHING

A. Follow Iowa One Call Professional Excavators Manual to locate all existing underground utilities.

B. All existing utilities identified on drawings must be located by method of hand-digging to identify exact size, quantity, and depth at utility crossing. Provide As-Built documentation for each utility verified.

C. Prior to beginning any underground work perform site walkthough with Owner's representative to verify all know utilities are properly identified.

D. Cut the trenches neatly and uniformly.

E. Direct buried medium voltage cables shall be installed at minimum depth of 36" to top of cables.

F. Install continuous strip of Warning Tape at 12" above utility when backfilling.

G. Conduits to be installed under existing paved areas, roads, and railroad tracks that are not to be disturbed shall be jacked into place. Conduits shall be PVC-coated rigid metal.

H. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course.

3.2 DUCT INSTALLATION

A. General Requirements:

1. Ducts shall be in accordance with the NEC and IEEE C2, as shown on the drawings, and as specified.
2. Slope ducts to drain towards manholes and handholes, and away from building and equipment entrances. Pitch not less than 100 mm (4 inches) in 30 M (100 feet).
3. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be PVC-coated galvanized rigid steel, and shall extend a minimum of 1500 mm (5 feet) outside of building foundation.
4. Stub-ups, sweeps, and risers to equipment mounted on outdoor concrete slabs shall be PVC-coated galvanized rigid steel, and shall extend a minimum of 1500 mm (5 feet) away from edge of slab.
5. Install insulated grounding bushings on the terminations.
6. PVC-coated rigid steel conduits shall be coupled to the ducts with suitable adapters, and the whole encased with 75 mm (3 inches) of concrete.
7. PVC coated rigid steel conduit turns of direction for all duct lines shall have minimum 1200 mm (4 feet) radius in the horizontal and vertical directions. PVC conduit sweeps for all duct lines shall have a minimum 12000 mm (40 feet) radius in the horizontal and 1200 mm (4 feet) in the vertical directions. Where a 12000 mm (40 feet) radius is not possible, horizontal turns of direction shall be rigid steel.
8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 75 mm (3 inches) above bottom of trench during the concrete pour. Spacer spacing shall not exceed 1500 mm (5 feet).
9. Duct lines shall be installed no less than 300 mm (12 inches) from other utility systems, such as water, sewer, and chilled water.
10. Clearances between individual ducts:
    a. For like services, not less than 75 mm (3 inches).
    b. For power and signal services, not less than 150 mm (6 inches).
    c. Provide plastic spacers to maintain clearances.
    d. Provide nonferrous tie wires to prevent displacement of the ducts during pouring of concrete. Tie wires shall not act as substitute for spacers.
11. Couple the ducts with proper couplings. Stagger couplings in rows and layers to insure maximum strength and rigidity of the duct bank.

12. Keep ducts clean of earth, sand, or gravel during construction, and seal with tapered plugs upon completion of each portion of the work.

B. Direct Burial Duct and Conduits:

1. Install direct burial ducts and conduits only where shown on the drawings.
2. Join and terminate ducts and conduits with fittings recommended by conduit manufacturer.
3. Tops of ducts and conduits shall be:
   a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
   b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
4. Do not kink the ducts or conduits.

C. Spare Ducts and Conduits: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.

D. Duct and Conduit Cleaning:

1. Upon completion of the duct bank installation or installation of direct buried ducts, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the line. The mandrel shall be not less than 3600 mm (12 inches) long, and shall have a diameter not less than 13 mm (1/2 inch) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than the diameter of the duct.

E. Duct and Conduit Sealing: Seal the ducts and conduits at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.

3.3 BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of [subbase material] [satisfactory soil], free of particles larger than [1 inch (25 mm)] <Insert dimension> in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
2. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

C. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

A. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Roof Penetration Conduit Seal Device.

1.2 SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.6-mm (0.0239-inch) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Shall be modular, mechanical type.
2. Inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
3. Elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM:

    a. Coloration shall be throughout elastomer for positive field inspection.
    b. Each link shall have a permanent identification of the size and manufacturer's name molded into it.

4. Pressure Plates and Bolts: Stainless steel.

5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 ROOF PENETRATION CONDUIT SEAL DEVICE

A. Manufacturers: Roof Products and Systems Corporation

1. Roof Products and Systems Corporation

B. Pipe Portal System

1. Prefabricated roof curb
2. Laminated acrylic coated ABS plastic cover with pre-punched mounting holes and molded sealing ring on a collared opening.
3. EPDM compression molded rubber cap.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 34.5-MPa (5000-psi), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Size pipe sleeves to provide 6.4-mm (1/4-inch) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using mechanical sleeve seals. Select sleeve size to allow for 25-mm (1-inch) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Conduit markers.

E. Warning signs and labels.

1.2 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2007.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2007.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide catalog data for nameplates, labels, and markers.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

PART 2 - PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate, labels, and markers to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.2 NAMEPLATES

A. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering for normal power system unless noted otherwise.

B. Nameplates shall be laminated red phenolic resin with white core with engraved lettering for emergency power system.

C. Nameplates shall identify the following:

1. Equipment ID.
2. Voltage/Phase/# of Wires
3. Wire Size
4. Where the equipment is Fed From

D. Locations:

1. All motor starters, motor controls, motor control centers, push-button stations, control panels and time switches.
2. All disconnect switches, panelboards, switchboards.
3. All feeder breakers installed in switchboards and distribution panelboards.
4. Circuit breakers, contactors, and relays in separate enclosures.

E. Secure Nameplates with screws. Use stainless steel screws where installed on NEMA 4/4X equipment. Apply sealant to interior side of the cover where penetrations are made.

F. Letter Size:

1. Use 1/2 inch high letters.

2.3 CIRCUIT IDENTIFICATION LABELS

A. Labels shall identify panelboard and branch circuit breaker position for installed power wiring.

B. Locations:

1. Electrical outlet faceplates. Refer to Section 26 27 26.
2. Blank cover plates on gutters, pull boxes, and junction boxes.

C. Labels: Embossed adhesive tape, with 3/16 inch black letters on clear background.

2.4 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

G. Description: Vinyl cloth or Nylon type self-adhesive wire markers.

H. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

2.5 CONDUIT MARKERS

A. Minimum Size: 1/2 inch high letters.

B. Color: Black text on white background unless otherwise indicated.

C. Description: Vinyl cloth or Nylon type self-adhesive marker.

D. Location: Furnish markers for each conduit longer than 6 feet.

E. Spacing: 20 feet on center.

F. Legend:

1. 208 Volt System: 208V.
2. 120 Volt System: 120V.
3. Fire Alarm System: FA.
4. Physical Access Control System: SECURITY
5. Communications: TELECOM

2.6 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester, or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

D. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Interior Components: Legible from the point of access.
6. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

E. Install Nameplates, Labels, and Markers on all equipment, boxes, wire, conduit, and devices identified in Part 2 Products of this Section.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Photoelectric Switches.

C. Power Packs.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.3 SUBMITTALS

A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

C. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data: Include detailed information on device programming and setup.

PART 2 - PRODUCTS

2.1 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Provide conduit for all low voltage wiring.

2.2 OCCUPANCY SENSORS

A. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:

    a. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
    b. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Turn-Off Delay: Field adjustable, up to a maximum time delay of 30 minutes.
5. Compatibility: Suitable for controlling LED lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

B. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:

    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
    c. Finish: Color to be selected.

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

C. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:

    a. Description: Low profile occupancy sensors designed for ceiling installation.
    b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
    c. Finish: White unless otherwise indicated.

2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: As scheduled on drawings.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

A. Description: Solid state, with SPST dry contacts to operate a connected power pack, complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1 to 15 fc with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Rated for exterior installation.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.4 POWER PACKS

A. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.

B. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.

C. Input Supply Voltage:

1. Occupancy Sensors: Rated for dual voltage 120/277 V ac.
2. Photoelectric Controlled Circuits: Rated for 120 to 277 V ac.

D. Load Rating: As required to control the load indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

B. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

C. Verify that final surface finishes are complete, including painting.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

E. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes as required for installation of lighting control devices provided under this section.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

H. Occupancy Sensor Locations:

1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

3.3 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.4 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust all occupancy sensor settings to 20-minute delay.

C. Where indicated or as directed by Owner, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect and Owner's Representative. Correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

C. Use operation and maintenance manual as training reference, supplemented with additional training materials as required. Install Nameplates, Labels, and Markers on all equipment, boxes, wire, conduit, and devices identified in Part 2 Products of this Section.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. GFEP: Ground-fault equipment protection.

C. HID: High-intensity discharge.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.
   5. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Keys: Two spares for each type of panelboard cabinet lock.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 FIELD CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
      b. Altitude: Not exceeding 6600 feet (2000 m).

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period:12 months from date of Substantial Completion.

PART 2 - PRODUCTS

A. PANELBOARDS COMMON REQUIREMENTS

B. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

G. Enclosures: Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R.
      c. Brine Building: NEMA 250, Type 4X, stainless steel.
      d. Pole Building: NEMA 250, Type 12.
   2. Height: 84 inches (2.13 m) maximum.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
   4. Finishes:
      a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Same finish as panels and trim.

H. Incoming Mains:
   1. Location: Convertible between top and bottom.
   2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

I. Phase, Neutral, and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
      a. Plating shall run entire length of bus.
      b. Bus shall be fully rated the entire length.
   2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
   3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

J. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Terminations shall allow use of 75 deg C rated conductors without derating.
   3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
   4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
   5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
   6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

K. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.

L. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices as identified on schedules.

M. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Sector; Eaton Corporation.
   2. General Electric Company; GE Energy Management - Electrical Distribution.
   3. Siemens Energy.
   4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers:
   1. Square D
   2. Eaton Electric
   3. Siemens Energy
   4. General Electric

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As identified on schedules.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic Trip Circuit Breakers:
      a. Required for 400 amp and larger breakers.
      b. RMS sensing.
      c. Field-replaceable rating plug or electronic trip.

d. Digital display of settings, trip targets, and indicated metering displays.
e. Multi-button keypad to access programmable functions and monitored data.
f. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
g. Integral test jack for connection to portable test set or laptop computer.
h. Field-Adjustable Settings:
i. Instantaneous trip.
j. Long- and short-time pickup levels.
k. Long and short time adjustments.
l. Ground-fault pickup level, time delay, and I squared T response.

4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

B. MCCB Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Breaker handle indicates tripped status.
3. UL listed for reverse connection without restrictive line or load ratings.
4. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
5. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
6. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407 .

D. Equipment Mounting:
   1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 84 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount surface-mounted panelboards to steel slotted supports 5/8 inch (16 mm) in depth. Orient steel slotted supports vertically.

I. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.
   2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

K. Install filler plates in unused spaces.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

B. Panelboards will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Wall-switches.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hubbell Incorporated

B. Cooper Wiring Devices

C. Leviton Manufacturing, Inc.

D. Pass and Seymore

E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

2.5 SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A.

C. Toggle Type.

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact nylon.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for while-in-use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover. Rated for while-in-use with the cover closed.

C. Wet-Location, Subject to Corrosive Environment Weatherproof Cover Plates: NEMA 250, complying with Type 4X, weather-resistant, stainless steel with lockable cover. Rated for while-in-use with the cover closed.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Installation Height:

1. Outdoor:

   a. Receptacles: 24” above finished grade.

2. Indoor; finished areas:

   b. Receptacles: 16” above finished floor.
   c. Receptacles above countertops: 3” above backsplash or countertop surface if no backsplash is installed.
   d. Switches: 48” above finished floor.

3. Indoor; unfinished areas:

   e. Receptacles: 52” Above finished grade.
   f. Switches: 52” Above finished grade.

D. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    g. Cut back and pigtail, or replace all damaged conductors.
    h. Straighten conductors that remain and remove corrosion and foreign matter.
    i. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

E. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

F. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install separate non-feed-through-type GFCI receptacles at each GFCI outlet location identified on Drawings.

3.3 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on clear tape on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

   a. Enclosed controllers.
   b. Enclosed switches.

1.2 SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
   1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

      c. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
      d. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

   2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
   3. Current-limitation curves for fuses with current-limiting characteristics.
   4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.
   5. Coordination charts and tables and related data.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in include the following:
   1. Ambient temperature adjustment information.
   2. Current-limitation curves for fuses with current-limiting characteristics.
   3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
   4. Coordination charts and tables and related data.

1.4 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cooper Bussmann

B. Littelfuse, Inc.

C. Mersen USA

D. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
   1. Type RK-1: 250 600-V, zero- to 600-A rating, 200 kAIC, time delay.
   2. Type RK-5: 250 600-V, zero- to 600-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPST: Single pole, single throw.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D.

B. General Electric.

C. Siemens.

D. Eaton Electrical.

2.2 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.

5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Brine and Wash Bay Areas: NEMA 250, Type 4X, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:
   1. Motor Starter Switch.
   2. Full-voltage magnetic.

1.2 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
   1. Show tabulations of the following:
      a. Each installed unit's type and details.
      b. Factory-installed devices.
      c. Nameplate legends.
      d. Short-circuit current rating of integrated unit.
      e. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

C. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

B. Routine maintenance requirements for enclosed controllers and installed components.

C. Manufacturer's written instructions for setting field-adjustable overload relays.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.7 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and form-work requirements are specified with concrete.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Prepare test and inspection reports.

2.2 FULL-VOLTAGE CONTROLLERS

A. Acceptable Manufacturers:
   1. Square D.
   2. General Electric.
   3. Siemens.
   4. Eaton Electrical.

B. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

C. Motor-Starting Switches: "Quick-make, quick-break" toggle action; marked to show whether unit is off or on.
   1. Configuration: Nonreversing.
   2. Red pilot light.

D. Magnetic Controllers: Full voltage, across the line, electrically held.
   1. Configuration: Nonreversing.
   2. Contactor Coils: Pressure-encapsulated type.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
4. Control Circuits: Obtained from integral CPT, with primary and secondary fuses, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices. Coordinate control voltage requirements with Building Automation Vendor.
5. Solid-State Overload Relay:
6. Switch or dial selectable for motor running overload protection.
7. Sensors in each phase.
8. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
9. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
10. External overload reset push button.

E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Fusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class RK fuses.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
2. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.3 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1 .
2. Outdoor Locations: Type 3R Insert type.
3. Brine and Wash Bay Areas: Type 4X , stainless steel .

2.4 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy -duty, oiltight type.
   a. Push Buttons: Unguarded types; momentary as indicated.
   b. Pilot Lights: LED types; colors as indicated; push to test.
   c. Selector Switches: Rotary type.
2. Elapsed Time Meters: Heavy duty with digital readout in hours; resettable.
3. Reversible N.C./N.O. auxiliary contact(s).
4. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
5. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 05 29 "Hangers and Supports for Electrical Systems."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 26 28 13 "Fuses."

E. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

F. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

D. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.

E. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

B. Inspect controllers, wiring, components, connections, and equipment installation.

C. Test continuity of each circuit.

D. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).

E. Test each motor for proper phase rotation.

F. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

G. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

H. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

I. Enclosed controllers will be considered defective if they do not pass tests and inspections.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes packaged engine-generator sets for emergency power supply with the following features:

1. Dual Fuel Engine: Natural-gas and liquid propane.
2. Unit-mounted cooling system.
3. Unit-mounted control.
4. Unit-mounted and remote monitoring.
5. Performance requirements for sensitive loads.
6. Fuel system.
7. Outdoor enclosure.

B. Related Requirements:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. NG: Natural Gas

B. LP: Liquid Propane.

C. EPS: Emergency power supply.

D. EPSS: Emergency power supply system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in cubic feet per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.

5. Include generator efficiency at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to kw rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine-generator set and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Source quality-control reports, including, but not limited to the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions showing compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

C. Field quality-control reports.

D. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
b. Operating instructions laminated and mounted adjacent to generator location.
c. Training plan.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. ASME Compliance: Comply with ASME B15.1.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

C. UL Compliance: Comply with UL 2200.

D. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.

E. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 30 to plus 40 deg C. (Minus 22 to 104 deg F)
2. Altitude: Sea level to 1000 feet (300 m).

2.3 ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Governor: Adjustable isochronous, with speed sensing.

D. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

E. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

F. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not

less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 ENGINE

A. Fuel: Dual Fuel: Natural gas with automatic liquid propane standby.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

   a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Muffler/Silencer: Semicritical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 18 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be dBA or less.

H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
   a. Provide heaters or use different battery technologies to ensure generator starts in subzero temperatures defined in environmental operating conditions.
5. Battery Cable: Size as recommended by engine manufacturer. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

   a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
   e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 GASEOUS FUEL SYSTEM

A. Natural-Gas Piping: Comply with requirements in Section 231123 "Facility Natural-Gas Piping."

B. Gas Train: Comply with NFPA 37.

C. Engine Fuel System:

1. Dual Natural-Gas with Liquid Propane Backup:

    a. Carburetor.
    b. Secondary Gas Regulators: One for each fuel type, with atmospheric vents piped to building exterior.
    c. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
    d. Fuel Filters: One for each fuel type.
    e. Manual Fuel Shutoff Valves: One for each fuel type.
    f. Flexible Fuel Connectors: Minimum one for each fuel connection.
    g. LP-gas flow adjusting valve.
    h. Fuel change gas pressure switch.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

B. Automatic Fuel Switchover: Pressure sensor monitors the natural gas fuel source. When pressure drops below a level where the generator can continue to operate at full capacity the generator shall automatically switch to the liquid propane fuel source.

C. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine-generator set battery.

F. Indicating Devices : As required by NFPA 110 for Level 1 system, including the following:

    1. AC voltmeter.
    2. AC ammeter.
    3. AC frequency meter.
    4. EPS supplying load indicator.
    5. Ammeter and voltmeter phase-selector switches.
    6. DC voltmeter (alternator battery charging).
    7. Engine-coolant temperature gage.
    8. Engine lubricating-oil pressure gage.
    9. Running-time meter.
    10. Current and Potential Transformers: Instrument accuracy class.

G. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:

1. Start-stop switch.
2. Overcrank shutdown device.
3. Overspeed shutdown device.
4. Coolant high-temperature shutdown device.
5. Coolant low-level shutdown device.
6. Low lube oil pressure shutdown device.
7. Air shutdown damper shutdown device when used.
8. Overcrank alarm.
9. Overspeed alarm.
10. Coolant high-temperature alarm.
11. Coolant low-temperature alarm.
12. Coolant low-level alarm.
13. Low lube oil pressure alarm.
14. Air shutdown damper alarm when used.
15. Lamp test.
16. Contacts for local and remote common alarm.
17. Coolant high-temperature prealarm.
18. Generator-voltage adjusting rheostat.
19. Main fuel tank low-level alarm.

    a. Low fuel level alarm shall be initiated when the level falls below that required for operation for the duration required in "Fuel Tank Capacity" Paragraph in "Diesel Fuel-Oil System" Article.

20. Run-Off-Auto switch.
21. Control switch not in automatic position alarm.
22. Low-starting air pressure alarm.
23. Low-starting hydraulic pressure alarm.
24. Low cranking voltage alarm.
25. Battery-charger malfunction alarm.
26. Battery low-voltage alarm.
27. Battery high-voltage alarm.
28. Generator overcurrent protective device not closed alarm.

H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

I. Common Remote Panel with Common Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine-generator set battery.

J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Life Safety Feeding Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

C. Generator Main Circuit Breaker: Insulated-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six lead alternator.

E. Range: Provide broad range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 20 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 10 percent and stabilize at rated frequency within 5 seconds.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
1. Hinged Doors: With padlocking provisions.
2. Space Heater: Thermostatically controlled and sized to prevent condensation.
3. Lighting: Provide weather resistant LED lighting with 30 footcandles ((330 LUX)) average maintained.
4. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.

B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

C. Interior Lights with Switch: Factory-wired, vapor-proof fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.

D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene separated by steel shims.

B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

C. Comply with requirements in Section 232116 Hydronic Piping Specialties" for vibration isolation and flexible connectors materials for steel piping.

D. Comply with requirements in Section 233113 "Metal Ducts" for vibration isolation and flexible connector materials for exhaust shroud and ductwork.

E. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.
9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.

1. Install flexible connectors and steel piping materials according to requirements in Section 232116 Hydronic Piping Specialties."
2. Insulate muffler/silencer and exhaust system components according to requirements in Section 230719 "HVAC Piping Insulation."

E. Installation requirements for piping materials and flexible connectors are specified in Section 232116 "Hydronic Piping Specialties." Copper and galvanized steel shall not be used in the fuel-oil piping system.

F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel-system piping adjacent to packaged engine-generator to allow service and maintenance.

C. Connect fuel piping to engines with a gate valve and union and flexible connector.
   1. Natural-gas piping, valves, and specialties for gas distribution are specified in Section 231123 "Facility Natural-Gas Piping."
   2. Install manual shutoff valve in a remote location to isolate natural-gas and LP supplies to the generator enclosure.
   3. Vent gas pressure regulators outside building a minimum of 60 inches (1500 mm) from building openings.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.

3.4 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

   1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

      a. Visual and Mechanical Inspection

         1) Compare equipment nameplate data with drawings and specifications.
         2) Inspect physical and mechanical condition.
         3) Inspect anchorage, alignment, and grounding.
         4) Verify the unit is clean.

      b. Electrical and Mechanical Tests

         1) Test protective relay devices.
         2) Verify phase rotation, phasing, and synchronized operation as required by the application.
         3) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
         4) Conduct performance test in accordance with NFPA 110.

5) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION

SECTION 26 36 00

TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 110.

G. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches circuit breakers or insulated-case circuit-breaker components as the transfer mechanism are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 26 05 53 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

F. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

G. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

H. Service-Entrance Rated Transfer Switches:

1. Meets UL 1008 standards for service entrance applications.
2. UL-Listed electronic-trip overcurrent, short circuit, and disconnecting device on the main incoming utility source:

    a. Size as indicated on drawings.
    b. Field-replaceable rating plug or electronic trip.
    c. Digital display of settings, trip targets, and indicated metering displays.
    d. Multi-button keypad to access programmable functions and monitored data.
    e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    f. Integral test jack for connection to portable test set or laptop computer.
    g. Field-Adjustable Settings:

        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.

2.3 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identify components according to Section 26 05 53 "Identification for Electrical Systems."

B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 DEFINITIONS

A. I(nominal): Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, I(nominal) ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

E. SPD's shall be a self-contained unit located near the equipment it is protecting. SPD's integral to panelboards are not permitted.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 2.

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2

1. SPDs with the following features and accessories:

a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
b. Indicator light display for protection status.
c. Form-C contacts rated at 5 A and 250-V AC, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
d. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 240kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

F. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Line to Line: 1000 V.

G. SCCR: Equal or exceed 200 kA.

H. I(nominal) Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

C. Comply with UL 1283.

D. Protection modes and UL 1449 VPR for grounded wye circuits with, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 700 V for 208Y/120 V.
3. Neutral to Ground: 700 V for 208Y/120 V.
4. Line to Line: 1200 V for 208Y/120 V

E. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

F. SCCR: Equal or exceed 100 kA.

G. I(nominal) Rating: 20 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4X.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.2 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures.
2. Lighting fixture supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Driver.
3. Energy-efficiency data.
4. Life, output (lumens, CCT, and CRI).
5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Installation instructions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.7 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Factory-Applied Labels: Comply with UL 1598. Include recommended driver. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following LED and Driver characteristics:
   a. CCT and CRI for all luminaires.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 150 mm (6 inches) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 20-mm (3/4-inch) metal channels spanning and secured to ceiling tees.

C. Suspended Lighting Fixture Support:

1. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
2. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency power and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires.
2. Poles and accessories.

B. Related Sections:

1. Section 26 51 00 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Luminaire: Complete lighting fixture, including ballast housing if provided.

E. Pole: Luminaire support structure, including tower used for large area illumination.

F. Standard: Same definition as "Pole" above.

1.3 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Ice Load: Load of 145 Pa (3 lbf/sq. ft.), applied as stated in AASHTO LTS-4-M Ice Load Map.

C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 15 m (50 feet) high or less is 40 m/s (90 mph).

1.4 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.

2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Photoelectric relays.
7. Drivers, including rated life and energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 300 mm (12 inches) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 6 mm (1/4 inch) deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: As indicated on drawings.
2. Warranty Period for Metal Corrosion: As indicated on drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating and free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. CCT and CRI for all luminaires.
b. Input power.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 16 to 32 lx (1.5 to 3 fc) and off at 48 to 108 lx (4.5 to 10 fc) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 65 by 130 mm (2-1/2 by 5 inches), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-in-Place Concrete."

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.5 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 317 MPa (46,000 psig); one-piece construction up to 12 m (40 feet) in height with access handhole in pole wall.

1. Shape: Square, tapered.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 13-mm (1/2-inch) threaded lug, complying with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

2.6 FIBERGLASS POLES

A. Poles: Designed specifically for supporting luminaires, with factory-formed cable entrance and handhole. Not less than 65 percent fiberglass, with resin and pigment making up the remainder.

1. Resin Color: Dark bronze; provide uniform coloration throughout entire wall thickness.
2. Surface Finish: Pigmented polyurethane, with a minimum dry film thickness of 0.04 mm (1.5 mils). Polyurethane may be omitted if the surface layer of pole is inherently UV inhibited.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

C. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 1520 mm (60 inches).
2. Water, Gas, Electric, Communication, and Sewer Lines: 3 m (10 feet).
3. Trees: 5 m (15 feet) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

D. Raise and set poles using web fabric slings (not chain or cable).

3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top flush with finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 30 00 "Cast-in-Place Concrete."

3.4 GROUNDING

A. Ground metal poles and support structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
3. Ground metallic components of pole accessories and foundations.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Building entrance primary surge protectors.
5. Grounding labeling.

1.2 DEFINITIONS

A. BCT: Bonding conductor for telecommunications.

B. EMT: Electrical metallic tubing.

C. TGB: Telecommunications grounding busbar.

D. TMGB: Telecommunications main grounding busbar.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:

1. BCT, TMGB, TGBs, and routing of their bonding conductors.

B. Qualification Data: For Installer, installation supervisor, and field inspector.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Result of the ground-resistance test, measured at the point of BCT connection.

b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of ITS Installer 2, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as ITS Installer 2 to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

A. Comply with J-STD-607-A.

2.2 CONDUCTORS

A. Comply with UL 486A-486B.

B. Insulated Conductors: Stranded copper wire, green, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 14.2 sq. mm (28 kcmils), 14 strands of No. 17 AWG conductor, and 6.3 mm (1/4 inch) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 41 mm (1-5/8 inches) wide and 1.6 mm (1/16 inch) thick.

2.3 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

C. Busbar Connectors: Cast silicon bronze, solderless compession connector; with a long barrel and two holes spaced on 15.8- or 25.4-mm (5/8- or 1-inch) centers for a two-bolt connection to the busbar.

D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

A. TMGB: Predrilled rectangular bars of hard-drawn solid copper, 6.3 by 50 mm (1/4 by 2 inches) in cross section, 12” length or as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.

1. Predrilling shall be with holes for use with lugs specified in this Section. Minimum of 14 holes with pattern suitable for 2 hole lugs.
2. Mounting Hardware: Stand-off brackets that provide at least a 50-mm (2-inch) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

B. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.

1. Rack-Mounted Horizontal Busbar: Designed for mounting in 483- or 584-mm (19- or 23-inch) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.

2.5 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 10 mm (3/8 inch). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with J-STD-607-A.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 900 mm (36 inches).)

C. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 900-mm (36-inch) intervals.
4. Install grounding and bonding conductors in 21-mm (3/4-inch) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 27 05 28 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 3/0 AWG.

3.5 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 50 mm (2 inches) minimum from wall, 300 mm (12 inches) above finished floor unless otherwise indicated.

3.6 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

D. Primary Protector: Bond to the TMGB with insulated bonding conductor.

E. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

F. Raceway

1. Conduit: Use insulated 6 AWG (16 mm²) bonding jumpers to ground metallic conduit at each end and to bond at all intermediate metallic enclosures.
2. Wireway: use insulated 6 AWG (16 mm²) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.

G. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond TMGB to the ground bar of the panelboard.

3.7 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label TMGB(s) with "TMGB".
2. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

   a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways and boxes for containment of communication cables.

1.2 SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of pathway groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Product Description: As specified in Section 26 05 36 “Raceways and Boxes for Electrical Systems”.

2.2 J-HOOKS

A. Manufacturers:

1. Equal to B-Line BCH64H 4" hooks.

B. Product Description:

1. Open-top cable supports rated for use with Category 6A UTP cables.
2. Zinc plated for heavy duty use (100 lbs.)
3. With heavy duty support bar for multi-tier use.

2.3 OUTLET BOXES

A. Product Description: As specified in Section 26 05 33, except as noted below.

B. Outlet boxes double-gang (4"x4"), extra deep (3-1/2") wall outlet box unless otherwise noted on drawings.

C. Include single gang mud ring as required for faceplate installation.

2.4 FIRESTOPPING

A. Conduit Penetrations

1. Manufacturer: Wiremold Flamestopper or equal.

   a. Two box assembly to fit over standard 2" or 4" trade size EMT conduit.
   b. Boxes prefilled with intumescent firestopping material.
   c. Adjustable steel doors to accommodate cables.
   d. Ability to add or remove cables by adjusting doors without need to remove, add or adjust firestopping intumescent material.
   e. For use through walls or through floors.
   f. Rated for air handling plenums.
   g. Up to 4 hour F rating.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

A. Product Description: As specified in Section 26 05 36 “Raceways and Boxes for Electrical Systems”.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Minimum Pathway Size: 27-mm (1-inch) trade size.

B. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

C. Install surface pathways only where indicated on Drawings.

D. Do not install nonmetallic conduit where ambient temperature exceeds 49 deg C (120 deg F).

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 150 mm (6 inches) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab. Stub up minimum of 3 inches at telecom backboards.

F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 300 mm (12 inches) of changes in direction. Utilize long radius ells for all optical-fiber cables.

G. Provide pull boxes in conduit runs greater than 100 ft. (30 m).

H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

I. Support conduit within 300 mm (12 inches) of enclosures to which attached.

J. Maintain the following separation distances from possible sources of electromagnetic interference (EMI):

1. Open or nonmetal pathways near unshielded power lines or electrical equipment. Electrical power source - Minimum separation distance:

   a. Less than 2 kVA - 5 in. (127 mm)
   b. 2 to 5 kVA - 12 in. (305 mm)
   c. Greater than 5 kVA - 24 in. (610 mm)

2. Grounded enclosed metal pathway near unshielded power lines or electrical equipment. Electrical power source - Minimum separation distance:

   a. Less than 2 kVA - 2.5 in. (64 mm)
   b. 2 to 5 kVA - 6 in. (152 mm)
   c. Greater than 5 kVA - 12 in. (305 mm)

3. Grounded enclosed metal pathway near power lines or electrical equipment in grounded metal pathway. Electrical power source - Minimum separation distance:

   a. 2 to 5 kVA - 3 in. (76 mm)
   b. Greater than 5 kVA - 6 in. (152 mm)

4. Electrical motors and transformers: Maintain 48 in (1.22 m) minimum separation distance.

K. Install conduits and pull boxes with minimum 6 inches of clear vertical space to ensure accessibility. Install J-hooks with minimum 12” of clear vertical space.

L. Install J-Hooks at maximum of 4 ft. spacing supported directly to structure or with minimum ¼” all thread rod.

M. Pathways Embedded in Slabs:

1. Run conduit larger than 27-mm (1-inch) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 3-m (10-foot) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 50 mm (2 inches) of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC to IMC before rising above floor.

N. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

O. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

P. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

R. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

S. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

T. Cut conduit perpendicular to the length. For conduits of 53-mm (2-inch) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

U. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 90-kg (200-lb)tensile strength. Leave at least 300 mm (12 inches)of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

V. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 50-mm (2-inch) radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 1200 mm (48 inches) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

W. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

X. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

Y. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Z. Mount boxes at 18” above finished floor in finished areas and 52” above finished floor in unfinished areas. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Comply with requirements in Section 26 05 36 “Raceways and Boxes for Electrical Systems”.

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire rated floor and wall assemblies.

B. Firestop System installation must meet requirements of UL 1479 tested assemblies that provide fire/smoke rating equal to that of construction being penetrated. Utilize firestop products identified under Products in this section in assemblies. Provide additional products as required for complete assembly.

C. Provide formed sheet metal barrier around opening to protect wall from physical damage and prevent intumescent material from falling into wall cavity at cable tray penetrations. Size wall penetration to accommodate full capacity of cable tray.

D. Identify through-penetration firestop systems with self-adhesive, vinyl label. Attach labels permanently to surface of penetrated construction on both sides of each firestop system. Include the following information on the labels:

1. “Warning – Through Penetration Firestop System – Do Not Disturb. Notify Building Management of Any Damage.”
2. Contractor’s name, address, and phone number.
3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-Penetration firestop system manufacturer’s name.

6. Installer's name.

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backboards.
2. Telecommunications equipment racks.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered Communications Distribution Designer.

1.3 SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, 19 by 1220 by 2440 mm (3/4 by 48 by 96 inches). Comply with requirements for plywood backing panels specified in Section 06 10 00 "Rough Carpentry."

2.2 EQUIPMENT FRAMES

A. Floor-Mounted Rack Requirements:

1. Distribution Frames: Floor mounted modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 480-mm (19-inch) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

2.3 GROUNDING

A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

2.4 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Comply with requirements in Section 27 05 28 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

END OF SECTION

SECTION 28 05 13

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Control-voltage cabling.
2. Control-circuit conductors.
3. Fire alarm wire and cable.
4. Identification products.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. IDC: Insulation displacement connector.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

E. RCDD: Registered Communications Distribution Designer.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of electronic safety and security cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONTROL-VOLTAGE CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

2.2 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in pathway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in pathway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF in pathway.

2.3 FIRE ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, No. 16 AWG.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 14 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

2.4 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

A. Install wiring in metal pathways and wireways.

1. Minimum conduit size shall be 21 mm (3/4 inch). Control and data-transmission wiring shall not share conduits with other building wiring systems.
2. Comply with requirements in Section 28 05 28 "Pathways for Electronic Safety and Security."

B. Install cable, concealed in accessible ceilings, walls, and floors when possible.

C. Wiring on Racks and within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM's "Cabling Termination Practices" chapter. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
2. Install lacing bars and distribution spools.
3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
4. Install conductors parallel with or at right angles to sides and back of enclosure.
5. Connect conductors associated with intrusion system that are terminated, spliced, or interrupted in any enclosure onto terminal blocks.
6. Mark each terminal according to system's wiring diagrams.
7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

D. General Requirements for Cabling:

1. Comply with TIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels. Leave a minimum of 150 mm (6 inches) of slack at outlet terminations and coil loosely into box after termination on outlet fitting.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 760 mm (30 inches) and not more than 150 mm (6 inches) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Maintain minimum cable bending radius during installation and termination of cables.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Do not exceed manufacturer's rated cable-pulling tension.

9. Comply with Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communication cables or cables in nonmetallic pathways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 127 mm (5 inches).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 300 mm (12 inches).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 600 mm (24 inches).

3. Separation between communication cables in grounded metallic pathways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 64 mm (2-1/2 inches).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 150 mm (6 inches).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 300 mm (12 inches).

4. Separation between cables in grounded metallic pathways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 75 mm (3 inches).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 150 mm (6 inches).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or hp and Larger: A minimum of 1200 mm (48 inches).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 127 mm (5 inches).

3.4 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 28 05 28 "Pathways for Electronic Safety and Security."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.

3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or pathway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 GROUNDING

A. For low-voltage wiring and cabling, comply with requirements in Section 27 05 26 "Grounding and Bonding for Communication Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

B. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 28 05 28

PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetallic conduits, tubing, and fittings.
3. Boxes.

1.2 SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Product Description: As specified in Section 26 05 36 “Raceways and Boxes for Electrical Systems”.

2.2 BOXES

A. Product Description: As specified in Section 26 05 33, except as noted below.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Minimum Pathway Size: 3/419-mm (-inch) trade size.

B. Comply with requirements in Section 26 05 33 “Raceways and Boxes for Electrical Systems.”

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 150 mm (6 inches) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications wiring conduits for which only two 90-degree bends are allowed. Support within 300 mm (12 inches) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 300 mm (12 inches) of enclosures to which attached.

   1. Change from RNC to IMC before rising above floor.

I. Stub-ups to Above Recessed Ceilings:

   1. Use EMT, IMC, or RMC for pathways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

M. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits of 53-mm (2-inch) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 90-kg (200-lb) tensile strength. Leave at least 300 mm (12 inches) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Q. Pathways for Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 21-mm (3/4-Inch) Trade Size and Smaller: Install pathways in maximum lengths of 15 m (50 feet).
2. 27-mm (1-Inch) Trade Size and Larger: Install pathways in maximum lengths of 23 m (75 feet).
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

R. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

S. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of office, storage, and mechanic bay spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."

END OF SECTION

SECTION 28 09 23

GAS INSTRUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes the Following Gas Instruments:

1. Carbon-dioxide NO2 detection and control system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
2. Installation instructions, including factor affecting performance.
3. Product description with complete technical data, performance curves, product specification sheets.

B. Shop Drawings:
1. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas instruments to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 CARBON-DIOXIDE and NO2 DETECTION AND CONTROL SYSTEM

A. Basis of Design: Monoxivent.

B. Detection Control Panel (for use in areas where sensor quantity requires separate control panel):
1. Centralized gas detection monitoring, accepting the signals of multiple remote CO/NO2 sensors.
2. Communicates with networked remote sensing panels via RS-485 communication port.
3. NEMA 4X enclosure.
4. 24 VAC.
5. Provide 24 volt transformer, with enclosure.

6. Three fully programmable alarm levels.
7. 4 DPDT relays.
8. 65 dBA buzzer.
9. Include a real time clock to allow for operation of output signals for a specific timeframe.
10. LCD display for display of gas concentration, gas detected, and location of alarming sensor in a continuous sweep of all associated sensors.
11. Data logging capability.

C. Remote Sensing Panel (for use in areas where sensor quantity requires separate control panel):
1. Two alarm levels.
2. Programmable time delays.
3. Powered by the Detection Control Panel, 24VAC.
4. Communicates with control panel via RS-485 communication port.
5. 2 DPDT relays.
6. Electrochemical cell sensing for CO or NO2.
   a. Range CO: 0-250 ppm.
   b. Range NO2: 0-10ppm.
7. 85 dBA audible alarm.
8. LCD display for gas concentration readings.

D. Dual Stand Alone Detection System with Remote Sensor (for use in areas requiring only a single CO sensor and a single NO2 sensor):
1. Stand alone gas detector with on-board CO electrochemical sensor and remote NO2 sensor.
2. Dual gas capability.
3. Two low/high alarm levels per sensor, with independent SPDT fail-safe relays per alarm level.
4. Provide 24 volt transformer, with enclosure.
5. Electrochemical cell sensing for CO or NO2.
   a. Range CO: 0-250 ppm.
   b. Range NO2: 0-10ppm.
6. 85 dBA audible alarm.
7. LCD display for gas concentration readings.

E. Horn/Strobe:
1. Weatherproof.
2. Horn rated at 85 dB at 10 feet.
3. 120V or 24V, as required by detection system.
4. Red lens.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, wiring, and conduit to comply with requirements indicated.

3.3 ELECTRICAL POWER

A. Furnish and install electrical power to products requiring electrical connections.

3.4 INSTRUMENTS, GENERAL INSTALLATION REQUIREMENTS

A. Mounting Location:
   1. Where indicated on Drawings.

B. Mounting Height:
   1. Mount sensors within appropriate range for sensing specified gas.

3.5 CHECKOUT PROCEDURES

A. Check out installed products before calibration.

B. Check instruments for proper location and accessibility.

3.6 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

   1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
   2. Provide diagnostic and test equipment for calibration and adjustment.
   3. Field instruments and equipment used to test and calibrate installed instruments shall have an accuracy of at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
   4. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
   5. If, after calibration, indicated performance cannot be achieved, replace out-of-tolerance instruments.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

END OF SECTION

SECTION 28 13 00

ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access control system requirements.
2. Access control units and software.
3. Access control point peripherals, including readers.
4. Accessories.
5. Access control devices.
6. Access control panels.
7. Access control software.

1.2 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Electrically operated door hardware, for interface with access control system.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
D. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Diagrams for cable management system.
2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
3. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics including the following:

   a. Workstation outlets, jacks, and jack assemblies.
   b. Patch cords.
   c. Patch panels.

4. Cable Administration Drawings: As specified in "Identification" Article.
5. Battery and charger calculations for central station, workstations, and controllers.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Credential card blanks, ready for printing. Include enough credential cards for all personnel to be enrolled at the site plus.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

   1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70, "National Electrical Code."

E. Comply with [SIA DC-01 and]SIA DC-03[and SIA DC-07].

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Control System Software, Controllers, and Input Devices:
   1. DSX.

2.2 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new access control system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
   1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

C. Access Control System: Control access to building using encoded cards:
   1. Exterior Doors: Control access into building.

2.3 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and associated software compatible with readers to be connected.

2.4 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Provide readers compatible with credentials to be used.

D. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 7100.

2.5 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Contractor.
   1. Provide credentials compatible with readers and control units/software to be used.

C. Provide cables as indicated or as required for connections between system components.

D. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

2.6 COMPONENTS

A. Security Access Control Panel:
   1. Product: DSX 1042 Package.
   2. Product: DSX-LAN communication module.

B. Encoded Card Readers:
   1. Product: Small mullion mount reader; Proxpoint plus.

C. System Cable:
   1. Product: CMR Smartwire 4 Element Access Control Cable.

D. Electric Door Strikes:
   1. Reference section 08 7100 - Door Hardware: Electrically operated door hardware, for interface with access control system.

E. Door Position Switches:
   1. Reference section 08 7100 - Door Hardware: Electrically operated door hardware, for interface with access control system.

F. Request to Exit:
   1. Product: T. Rex Exit detector with tamper and timer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."
B. Install cables and wiring according to requirements in Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Wiring Method: Install wiring in raceway except within consoles, cabinets, and door frames. Conceal raceway and wiring except in unfinished spaces.

D. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.4 GROUNDING

A. Comply with Section 28 05 26 "Grounding and Bonding for Electronic Safety and Security."

B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.5 IDENTIFICATION

A. In addition to requirements in this article, comply with applicable requirements in Section 26 05 53 "Identification for Electrical Systems" and with TIA/EIA 606-A.

B. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain security access system. See Section 01 79 00 "Demonstration and Training."

END OF SECTION

SECTION 28 31 12

ZONED (DC LOOP) FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Notification appliances.
3. Graphic annunciator.
4. Digital alarm communicator transmitter.

B. Related Requirements:

1. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.2 SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, and profiles and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician; Level III minimum.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide the "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Record copy of site-specific software.
e. Provide the "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

f. Manufacturer's required maintenance related to system warranty requirements.
g. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: One extra set for access to locked.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with and operate as an extension of existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. All components provided shall be listed for use with the selected system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm zone at fire-alarm control unit.
3. Transmit an alarm signal to the remote alarm receiving station.

C. Supervisory signal initiation shall be by one or more of the following devices and systems:

1. Valve supervisory switch.
2. User disabling of zones or individual devices.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in internal circuits of fire-alarm control unit.

E. System Trouble and Supervisory Signal Actions:

1. Annunciate at fire-alarm control unit.

2.3 FIRE-ALARM CONTROL UNIT

A. Basis of Design: Simplex 4006 Series

B. General Requirements for Fire-Alarm Control Unit:

1. Modular, power-limited design with electronic modules, UL 864 listed.

a. Include a real-time clock for time annotation of events.

b. The FACP shall be listed for connection to a central-station signaling system service.

C. Alphanumeric Display and System Controls: Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two lines of 40 characters, minimum.

D. Circuits:

1. No Fewer Than Five Initiating-Device Circuits: NFPA 72, Class B.
2. No Fewer Than Two Notification-Appliance Circuits: NFPA 72, Class B.

E. Notification-Appliance Circuit: Operation shall sound an alarm.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by the 24-V dc source.

1. Alarm current draw of the entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed, valve-regulated, recombinant lead acid.

2.4 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 25-mm- (1-inch-) high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.5 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Zone of the alarm initiating device.
2. Zone of the supervisory signal.
3. Zone of the trouble initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

F. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.

6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Install wall-mounted equipment, with tops of cabinets not more than 1980 mm (78 inches) above the finished floor.

C. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

D. Audible Alarm-Indicating Devices: Install not less than 150 mm (6 inches) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

E. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 150 mm (6 inches) below the ceiling. Install all devices at the same height unless otherwise indicated.

3.3 PATHWAYS

A. Pathways shall be installed in EMT.

B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. Connect supervised interface devices to the following devices and systems. Install the interface device less than 910 mm (36 inches) from the device controlled.

1. Supervisory connections at valve supervisory switches.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct the visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing, and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

B. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

C. Fire-alarm system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

F. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with the visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

SECTION 31 1000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

D. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

E. Section 31 2200 - Grading: Topsoil removal.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.04 QUALITY ASSURANCE

A. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Maintain one copy of each document on site.

1.05 PROJECT CONDITIONS

A. 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.

B. Comply with other requirements specified in Section 01 7000.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 31 2200 - Grading

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01 7000.

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 EXAMINATION

A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area for placing removed materials.

3.03 PREPARATION

A. Contact Iowa One Call location service at (800) 292-8989 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

3.04 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.

3.05 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, lawns, and planting beds.

B. Do not remove or damage vegetation beyond the limits indicated on drawings.
   1. 40 feet outside the building perimeter.
   2. 15 feet each side of roadway curbs and main utility trenches.
   3. Within High Pressure Gas Pipelines easement

C. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

D. 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. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.

E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.06 PROTECTION

A. Protect bench marks, survey control points, from damage or displacement.

3.07 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of 6 inches.

3.08 DEBRIS

A. Remove debris, rock, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

D. Do not burn or bury materials on site. Leave site in clean condition.

END OF SECTION

SECTION 31 2200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures and building pads.

C. Finish grading .

1.02 RELATED REQUIREMENTS

A. Section 31 1000 - Site Clearing.

B. Section 31 2316 - Excavation.

C. Section 31 2323 - Fill: Filling and compaction.

D. Section 31 2316.13 - Trenching: Trenching and backfilling for utilities.

E. Section 31 2316.26 - Rock Removal.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of Iowa, Highway Department standards.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 2323.

B. Other Fill Materials: See Section 31 2323.

C. Aggregate and Base Course: 32 1123.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

A. Remove minimum of 1'-0" of topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 2323 for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile excavated subsoil on site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 8 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 6 inches compacted depth.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 inches in 10 feet, unless otherwise noted.

E. Make grade changes gradual. Blend slope into level areas.

F. or replace items indicated to remain damaged by excavation or filling.

3.06 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

E. Place topsoil during dry weather.

F. Remove roots, weeds, rocks, and foreign material while spreading.

G. Near plants spread topsoil manually to prevent damage.

H. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

3.07 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

C. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

D. Top Surface of Finish Grade: Plus or minus 1/2 inch.

3.08 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.09 FIELD QUALITY CONTROL

A. See Section 31 2323 for compaction density testing.

3.10 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 2316
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for footings, slabs-on-grade, paving, and foundations.

B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Soil removal from surface of site.

B. Section 31 2200 - Grading: Grading.

C. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

D. Section 31 2316.26 - Rock Removal: Removal of rock during excavating.

E. Section 31 2323 - Fill: Fill materials, filling, and compacting.

F. Section 31 2316.26 - Rock Removal: Removal of rock during excavating.

G. Section 31 3700 - Riprap.

1.03 REFERENCES

A. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

B. Local utility standards when working within 24 inches of utility lines.

1.04 SUBMITTALS

A. Section 01 3000 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.05 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Iowa.

1.06 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Contact Iowa One Call location service at (800) 292-8989 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 2200 for additional requirements.

3.03 EXCAVATING

A. Underpin adjacent structures that could be damaged by excavating work.

B. Excavate subsoil to accommodate new structures, construction operations, and building foundations, slabs-on-grade and site structures.

C. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

D. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity.

E. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

F. Do not interfere with 45 degree bearing splay of foundations.

G. Cut utility trenches wide enough to allow inspection of installed utilities.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. See Section 31 2316.26 for removal of larger material.

I. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

J. Grade top perimeter of excavation to prevent surface water from draining into excavation.

K. Remove excavated material that is unsuitable for re-use from site.

L. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.

M. Remove excess excavated material from site.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.05 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31 2316.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Site grading.

B. Section 31 2316 - Excavation: Building and foundation excavating.

C. Section 31 2323 - Fill: Backfilling at building and foundations.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.

B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

E. 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.

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

G. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

H. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Compaction Density Test Reports.

1.06 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.

C. Separate differing materials with dividers or stockpile separately to prevent intermixing.

D. Prevent contamination.

E. Protect stockpiles from erosion and deterioration of materials.

F. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.01 FILL MATERIALS - SEE SECTION 31 2323.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven, monofilament.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.02 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.03 PREPARATION

A. Contact Iowa One Call location service at (800) 292-8989 not less than three working days before performing Work.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 2200 for additional requirements.

D. Locate, identify, and protect utilities that remain and protect from damage.

E. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

F. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

G. Protect bench marks, survey control points, and fences from excavating equipment and vehicular traffic.

H. Do not interfere with 45 degree bearing splay of foundations.

I. Protect plants, lawns, rock outcroppings, and other features to remain.

J. Cut trenches wide enough to allow inspection of installed utilities.

K. Hand trim excavations. Remove loose matter.

L. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

M. Remove lumped subsoil, boulders, and rock up to 1/6 cu yd measured by volume.

3.04 TRENCHING

A. Remove excavated material that is unsuitable for re-use from site.

B. Stockpile excavated material to be re-used in area designated in Section 31 2200.

C. Remove excess excavated material from site.

D. Do not advance open trench more than 200 feet ahead of installed pipe.

E. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume. Remove larger material as specified in Section 02316.

F. When subsurface materials at bottom of trench are loose or soft, notify Architect/Engineer, and request instructions.

3.05 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.06 BACKFILLING

A. When subsurface materials at bottom of trench are loose or soft, notify Architect/Engineer, and request instructions.

B. Backfill to contours and elevations indicated using unfrozen materials.

C. Fill up to subgrade elevations unless otherwise indicated.

D. Employ a placement method that does not disturb or damage other work.

E. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

H. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

I. Slope grade away from building minimum 6 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

J. Correct areas that are over-excavated.
   1. Thrust bearing surfaces: Fill with concrete.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

K. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 95 percent of maximum dry density.

L. Reshape and re-compact fills subjected to vehicular traffic.

3.07 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Protect open trench to prevent danger to the public.
   1. Use general fill unless otherwise specified or indicated.
   2. Utility Piping, Conduits, and Duct Bank:
      a. Bedding: Use general fill.
      b. Cover with general fill.
      c. Fill up to subgrade elevation.
      d. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
   3. At Pipe Culverts:
      a. Bedding: Use general fill.
      b. Place filter fabric specified in Section 33 0513 over compacted bedding.
      c. Cover with general fill.
      d. Fill up to subgrade elevation.
      e. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
   4. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
      a. Drainage fill and geotextile fabric: Section 33 4600.
      b. Cover drainage fill with general fill.
      c. Fill up to subgrade elevation.
      d. Compact to 95 percent of maximum dry density.

3.08 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.09 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D3017.
   1. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
   2. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.10 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 2323
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, site structures, and subgrade elevations and over-excavation.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Removal and handling of soil to be re-used.

B. Section 31 2200 - Grading: Site grading.

C. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.

D. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

E. Section 31 2316.26 - Rock Removal: Removal of rock during excavating.

F. Section 03 3000 - Cast-in-Place Concrete.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

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.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

D. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Conforming to State of Iowa Highway Department standard.

B. Structural Fill: Conforming to State of Iowa Highway Department standard.

C. Concrete for Fill: As specified in Section 03 3000; compressive strength of 2500 psi.

D. Granular Fill: Coarse aggregate, conforming to State of Iowa Highway Department standard.

E. Sand: Conforming to State of Iowa Highway Department standard.

F. Topsoil: See Section 31 2200.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven, monofilament.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 2200 for additional requirements.

D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

E. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

G. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

H. Compaction Density Unless Otherwise Specified or Indicated:

I. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Under Interior Slabs-On-Grade:
   1. Use granular fill.
   2. Depth: 4 inches deep.
   3. Compact to 95 percent of maximum dry density.
   4. Cover with sand.
      a. Depth: 2 inches.
      b. Compact to 95 percent of maximum dry density.

C. At Foundation Walls and Footings:

1. Use Granular fill.
2. Compact each lift to 90 percent of maximum dry density.
3. Do not backfill against unsupported foundation walls.
4. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

D. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
1. Drainage fill and geotextile fabric: Section 33 4600.
2. Cover drainage fill with general fill.
3. Fill up to subgrade elevation.
4. Compact to 95 percent of maximum dry density.

E. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
1. Bedding: Use general fill.
2. Cover with general fill.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

F. At Lawn Areas:
1. Use general fill.
2. Fill up to 6 inches below finish grade elevations.
3. Fill up to subgrade elevations.
4. Compact to 95 percent of maximum dry density.
5. See Section 31 2200 for topsoil placement.

G. At Planting Areas Other Than Lawns :
1. Use general fill.
2. Fill up to 12 inches below finish grade elevations.
3. Fill up to subgrade elevations.
4. Compact to 95 percent of maximum dry density.
5. See Section 31 2200 for topsoil placement.

H. At asphalt and Concrete Paving:
1. Use Geotextile Fabric
2. Use general fill.
3. Fill up to 12 inches below finish grade.
4. Compact to 95 percent of maximum dry density.

3.05 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Within Building Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted fill in accordance with ASTM D2922.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Proof roll compacted fill at surfaces that will be under slabs-on-grade and paving.

3.07 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 31 3700
RIPRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Riprap .

PART 2 PRODUCTS

2.01 MATERIALS

A. Riprap: Broken stone, 6 inch minimum size, 12 inch maximum size; solid and nonfriable.

B. Geotextile Fabric: Non-biodegradable, woven, and monofilament.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not place riprap bags over frozen or spongy subgrade surfaces.

3.02 PLACEMENT

A. Place geotextile fabric over substrate, lap edges and ends.

B. Place riprap at as indicated.

C. Installed Thickness: 6 inch average.

3.03 SCHEDULES

A. Storm Drain Ends: Bagged, placed one layer thick, 6 inch average thickness, concealed with topsoil fill.

END OF SECTION

SECTION 32 1123
AGGREGATE & AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate Base Course.

B. Paving Aggregates.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Preparation of site for base course.

B. Section 31 2316.13 - Trenching: Compacted fill over utility trenches under base course.

C. Section 31 2323 - Fill: Topsoil fill at areas adjacent to aggregate base course.

D. Section 31 2323 - Fill: Compacted fill under base course.

E. Section 32 1216 - Asphalt Paving: Binder and finish asphalt courses.

F. Section 32 1313 - Concrete Paving: Finish concrete surface course.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2004).

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

E. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

F. 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.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

H. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements

1.05 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance Iowa DOT SSHBC Series 2012.

C. Maintain one copy of document on site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate Type A1: Coarse aggregate, Class A crushed stone conforming to Iowa DOT SSHBC - Series 2012, Section 41 2004 Highway Department.

B. Coarse Aggregate Type A2: (Gravel) Crushed stone base, 13 gradation, macadam; conforming to Iowa DOT SSHBC - Series 2012, Section 4122.02

C. Coarse Aggregate Type A3: (Gravel) Choke stone conforming to Iowa DOT SSHBC - Series 2012, Section 4122.02.

2.02 FINE AGGREGATE MATERIALS

A. Fine Aggregate Type A5: Porous Backfill, conforming to Iowa DOT SSHBC - Series 2012, Section 4132.

B. Fine Aggregate Type A6 (Sand): Granular Backfill, conforming to Iowa DOT SSHBC - Series 2012, Section 4133.

2.03 FINE AGGREGATE MATERIALS

A. Geotextile Fabric: Non-biodegradable, woven.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

B. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 AGGREGATE PLACEMENT

A. Spread aggregate over prepared substrate to a total compacted thickness of 6 inches.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 INSTALLATION

A. Place aggregate in maximum 4 inch layers and roller compact to specified density.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.05 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation From Design Elevation: Within 1/2 inch.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.07 CLEANING

A. Leave unused materials in a neat, compact stockpile.

3.08 STOCKPILING

A. Stockpile materials on site at locations designated by Architect/Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.09 STOCKPILE CLEANUP

A. Leave unused materials in neat, compact stockpile.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.10 SCHEDULES

A. Under Asphalt Pavement:

1. Compact placed aggregate materials uniformly to achieve minimum 95 percent of maximum density over geotextile fabric.

B. Under Concrete Pavement:

1. Compact placed aggregate materials uniformly to achieve minimum 95 percent of maximum density over geotextile fabric.

END OF SECTION

SECTION 32 1216
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

B. Double course bituminous concrete paving.

C. Surface sealer.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Preparation of site for paving and base.

B. Section 31 2323 - Fill: Compacted subgrade for paving.

1.03 REFERENCE STANDARDS

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; 1997.

B. AI MS-19 - A Basic Asphalt Emulsion Manual; Fourth Edition.

C. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Iowa DOT SSHBC - Series 2012.

B. Mixing Plant: Conform to Iowa DOT SSHBC - Series 2012.

C. Obtain materials from same source throughout.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Section 01 6000 - Product Requirements: Environmental conditions affecting products on site.

B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

C. Place bitumen mixture when temperature is not more than 15 degrees F below temperature at when initially mixed and not more than maximum specified temperature.

1.06 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate for Base Course: In accordance with Iowa DOT SSHBC - Series 2012, Section 4127, Type A for materials only..

B. Aggregate for Binder Course: In accordance with Iowa DOT SSHBC - Series 2012, Section 4127, Type A for materials only..

C. Fine Aggregate: .

D. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter, In accordance with Iowa DOT SSHBC - Series 2001, Section 4127

E. Tack Coat: In accordance with State of Iowa DOT SSHBC - Series 2001, Section 4127. Highways standards.

F. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full depth removal of existing asphalt concrete pavements. In accordance with Iowa DOT SSHBC - Series 2012, Section 2303.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Use dry material to avoid foaming. Mix uniformly.

B. Base Course: 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

C. Binder Course: 5.5 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

D. Wearing Course: 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

E. Mix Temperature: range from 260 to 330 degrees F.

2.03 SOURCE QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Submit proposed mix design of each class of mix for review prior to beginning of Work.

C. Test mix design and samples in accordance with Iowa DOT SSHBC - Series 2012, Section 23 0304 for testing only..

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.02 SUBBASE COURSE

A. Place and compact base course.

3.03 PREPARATION - PRIMER

A. Apply primer in accordance with manufacturer's instructions.

B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.

C. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT

A. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of.02 gal/sq yd, undiluted. Conform to Iowa DOT SSHBC - Series 2001, Section 2303 for materials only.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying primer or tack coat.

B. Place binder course to 3 inch compacted thickness.

C. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more then 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

D. Place wearing course to 3 inch compacted thickness.

E. Compact pavement course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 SEAL COAT

A. Apply seal coat to surface course in accordance with AI MS-19.

3.07 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for quality control.

B. Provide field inspection and testing. Take samples and perform tests in accordance with Iowa DOT SSHBC - Series 2012, Section 23 0304 for testing only..

3.09 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 72 hours or until surface temperature is less than 140 degrees F.

3.10 SCHEDULE

A. Asphalt in interior of hoop building only.

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks, parking areas, and drives.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.

D. Section 31 2323 - Fill: Compacted subbase for paving.

E. Section 03 1000 - Concrete Forming and Accessories.

F. Section 03 2000 - Concrete Reinforcing.

G. Section 03 3000 - Cast-in-Place Concrete.

H. Section 07 9005 - Joint Sealers: Sealant for 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 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

D. ACI 305R - Hot Weather Concreting; 2010.

E. ACI 306R - Cold Weather Concreting; 2010.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

H. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.

I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

J. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

K. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

L. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

N. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

O. 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 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on joint filler, admixtures, and curing compound.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

A. Comply with applicable requirements of ACI 301.

B. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, standard gray color Portland cement, broom finish.

C. Paving for driveways and parking areas: 4,000 psi 28 day concrete, 6 inches thick unless otherwise noted, sandard gray color, wood float finish.

2.02 FORM MATERIALS

A. Form Materials: As specified in Section 03 1000, conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber.
   1. Thickness: 1/2 inch.
   2. Product: W.R. Meadows.

2.03 REINFORCEMENT

A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 2000.

B. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi yield strength; deformed billet steel bars; unfinished finish.

2.04 CONCRETE MATERIALS

A. Concrete Materials: As specified in Section 03 3000.

2.05 ACCESSORIES

A. Salt Protecting Liquid Surface Sealer: Crete Defender as basis of design.
   1. Other Manufacturers:
      a. Prosoco Salt Gurard
      b. L & M Aquapell Plus

B. Joint Sealer: Specified in Section 07 9005.

2.06 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 Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

2.07 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted granular base 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 32 1123 for construction of base course for work of this Section.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect minimum 24 hours prior to commencement of concreting operations.

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.

3.05 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at expansion joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

D. Provide doweled joints 12 inch on center at interruptions of concrete.

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, or surface is wet or frozen.

3.07 PLACING CONCRETE

A. Place concrete as specified in Section 03 3000.

B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

D. Place concrete to pattern indicated.

3.08 JOINTS

A. Provide scored joints.
   1. At 3 feet intervals.
   2. Between sidewalks and curbs.
   3. Between curbs and pavement.

B. Place expansion joints as shown on Drawings.

C. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for joint sealant placement by Section 07 9005.

D. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/4 into depth of slab.

3.09 FINISHING

A. Area Paving: according to site plan.

B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

C. Place curing compound/sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 JOINT SEALING

A. See Section 07 9005 for joint sealer requirements.

3.11 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

3.12 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Iowa DOT employees performing tests.

B. Three concrete test cylinders will be taken for every 75 or less cu yds of concrete placed each day.

C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd 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.

F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.13 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit vehicular traffic over pavement until 75 percent design strength of concrete has been achieved.

3.14 SCHEDULES

A. Concrete Sidewalks: 3,000 psi 28 day concrete, 4 inches thick, medium broom finish.

B. Approach Aprons: 4,000 psi 28 day concrete, 6 inches think, medium broom finish.

C. Approach Slabs: 4,000 psi 28 day concrete, 6 inches thick, medium broom finish.

D. Driveways and Parking Ares: 4,000 psi 28 day concrete, 4 inches thick, smooth finish

END OF SECTION

SECTION 32 1723.13
PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Parking lot markings, including parking bays.

1.02 RELATED REQUIREMENTS

A. Section 32 1216 - Asphalt Paving.

B. Section 32 1313 - Concrete Paving.

C. Section 32 1726 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.03 REFERENCE STANDARDS

A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

B. FHWA MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Installation methods.

C. Maintenance Materials: Furnish the following for Iowa Department of Transportation's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint: 2 containers, 1 gallon size, of each type and color.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.

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.

1.06 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. Handicapped Van Parking Hatching : Yellow.

B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

C. Tactile Warning Surfaces: See Section 32 1726.

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 Architect 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. 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.

D. 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.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

F. Temporary Pavement Markings: When required or directed by Architect, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.
   1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
   2. At Contractor's option, temporary marking tape may used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to Iowa Department of Transportation.

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 or more than 95 degrees F.

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.
   1. Apply paint in one coat only.
   2. Wet Film Thickness: 0.015 inch, minimum.
   3. Width Tolerance: Plus or minus 1/8 inch.

G. 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.

H. 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 Iowa Department of Transportation.

END OF SECTION

SECTION 32 1726
TACTILE WARNING SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast tactile and detectable warning tiles for pedestrian walking surfaces.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Perimeter and joint sealant for tiles.

B. Section 32 1723.13 - Painted Pavement Markings: Crosswalk and curb markings.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. 49 CFR 27, 37, and 38 - Transportation for Individuals with Disabilities; Final Rule; Department of Transportation; current edition.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

D. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; 2011.

E. FED-STD-595C - Colors Used in Government Procurement (Fan Deck); 2008 (Chg Notice 1).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data, standard details, details specific to this project; written installation and maintenance instructions.

C. Shop Drawings: Submit plan and detail drawings. Indicate:
   1. Locations on project site. Demonstrate compliance with referenced accessibility standards.
   2. Sizes and layout.
   3. Pattern spacing and orientation.
   4. Attachment and fastener details, if applicable

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.

B. Installer Qualifications: Company certified in writing by product manufacturer as having successfully completed work substantially similar to the work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver to project site in manufacturer's protective wrapping and in manufacturer's unopened packaging.

B. Store covered and elevated above grade and in manufacturer's unopened packaging until ready for installation. Maintain at ambient temperature between 40 and 90 degrees F.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 TACTILE AND DETECTABLE WARNING DEVICES

A. Precast Concrete Tactile Warning Panels:
   1. Material: High strength cementitious concrete panels, enhanced with microsilica, reinforced with structural monofilament fibers.

2. Installation Method: Cast in place.
3. Shape: Rectangular.
4. Square Dimensions: 24 inches square.
5. Pattern: Truncated cones in compliance with ADA Standards.
6. Color: FED-STD-595C, Table IV, Federal Yellow No. 33538.
7. Products:
   a. Masco Masons Supply, CASTinTact 3: www.masco.net.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Sealant: See Section 07 9005.

PART 3 EXECUTION

3.01 EXAMINATION

A. When installation location is near site boundary or property line, verify required location using property survey.

B. Verify that work area is ready to receive work:
   1. If existing conditions are not as required to properly complete the work of this section, notify Architect.
   2. Do not proceed with installation until deficiencies in existing conditions have been corrected.

C. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions.
   1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.
   2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.

B. Field Adjustment:
   1. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.
   2. Orient so dome pattern is aligned with the direction of ramp.

C. Install units fully seated to substrate, square to straight edges and flat to required slope.

3.03 INSTALLATION - CAST IN PLACE

A. Install by method described in manufacturer's written instructions.

B. Place units into wet concrete.

C. Press assembly into concrete to achieve final elevation.

D. Finish concrete adjacent to plate. Remove wet concrete spilled onto plate surface.

3.04 PROTECTION

A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.

B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION

SECTION 32 3113
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fence framework, fabric, and accessories.

B. Excavation for post bases; concrete foundation for posts.

C. Manual gates and related hardware.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.03 REFERENCE STANDARDS

A. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a.

B. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric; 2011.

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 F567 - Standard Practice for Installation of Chain-Link Fence; 2011.

E. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Chain Link Fences and Gates:
   1. Master-Halco, Inc.: www.masterhalco.com.
   2. Merchants Metals: www.merchantsmetals.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Posts, Rails, and Frames: ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 30 ksi.

B. Posts, Rails, and Frames: Formed from hot-dipped galvanized steel sheet, ASTM A653/A653M, HSLAS, Grade 50, with G90 (Z275) zinc coating.

C. Wire Fabric: ASTM A392 zinc coated steel chain link fabric.

D. Concrete: Type specified in Section 03 3000.

2.03 COMPONENTS

A. Line Posts: 1.9 inch diameter.

B. Corner and Terminal Posts: 3.5 inch.

C. Gate Posts: 6.63 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for welded fabrication.

F. Fabric: 2 inch diamond mesh interwoven wire, 6 gage, 0.1620 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.

2.04 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, vertical.

D. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

F. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

G. Install center brace rail on corner gate leaves.

H. Position bottom of fabric 2 inches above finished grade.

I. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

J. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

END OF SECTION

SECTION 33 0513
MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

C. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2015.

D. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections [Metric]; 2015.

E. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008 (Reapproved 2013).

F. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2008b (Reapproved 2013).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

C. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

D. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).

2.02 COMPONENTS

A. Lid and Frame: ASTM A48/A48M, Class 30B Cast iron construction, machined flat bearing surface, removable lockable lid, closed lid design; Heavy Duty; sealing gasket; lid molded with identifying name. Manufacturer: 1. Neenah 2. Deeter.

2.03 CONFIGURATION

A. Shape: Cylindrical.

B. Clear Inside Dimensions: 48 inch diameter.

C. Design Depth: As indicated.

D. Clear Lid Opening: 26 inches diameter.

E. Pipe Entry: Provide openings as indicated.

F. Steps: As required by code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

A. Place concrete base pad, trowel top surface level.

B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Cut and fit for pipe.

D. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

E. Set cover frames and covers level without tipping, to correct elevations.

F. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION

SECTION 33 1116
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. domestic water lines, fire water lines, and Domestic water and fire lines.

B. Valves.

C. Hydrants.

D. Backflow preventers.

E. Bedding and cover materials.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating of trenches.

B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 2323 - Fill: Bedding and backfilling.

D. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

E. Section 33 1300 - Disinfecting of Water Utility Distribution: Disinfection of site service utility water piping.

F. Section 03 3000 - Cast-in-Place Concrete: Concrete for thrust restraints.

1.03 REFERENCES

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

D. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

E. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

F. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.

G. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

H. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 1998 (Reapproved 2011).

I. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

J. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

K. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; 2009.

L. AWWA C502 - Dry-Barrel Fire Hydrants; 2014.

M. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; 2011.

N. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; 2010.

O. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2007.

P. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; 2008.

Q. UL 246 - Hydrants for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Section 01 6000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.

C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

E. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

A. PVC Pipe: AWWA C900 Class 100:
   1. Fittings: AWWA C111/A21.11, cast iron.
   2. Joints: ASTM D3139 compression gasket ring.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

2.02 VALVES

A. Gate Valves 2 inches and Smaller:
   1. Brass or Bronze body, MSS SP 80, Class 125, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Gate Valves 2 1/2 inches and Larger:
   1. MSS SP 70, Class 125, AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, post indicator, valve key, and extension box.
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. Horizontal Swing Check Valves From 2 inches and Smaller:
   1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
   2. Substitutions: See Section 01 6000 - Product Requirements.

D. Spring Loaded Check Valves 2 1/2 inches and Larger:
   1. MSS SP 71, Class 125, wafer style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

E. Temperature and Pressure Relief Valves:
   1. ANSI Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.03 HYDRANTS

A. Hydrants: Freezeless Wall Hydrant, ASSE 1019.
   1. Non-freeze, self-draining type with chrome plated wall plate hose thread spout, removable key, and integral vacuum breaker.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.04 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Watts Industries Model 909 Dual Check.
   2. Conbrako Dual Check Model 40 204 A2.

B. Substitutions: Section 01600 - Product Requirements.

2.05 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2316.13.

B. Cover: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. See the sections on excavation and fill for additional requirements.

B. See Section 31 2316.13 for additional requirements.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Maintain 10 feet separation of water main from sewer piping.

B. Group piping with other site piping work whenever practical.

C. Route pipe in straight line.

D. Install pipe to allow for expansion and contraction without stressing pipe or joints.

E. Slope water pipe and position drains at low points.

3.05 INSTALLATION - VALVES

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

3.06 INSTALLATION - CURB STOP ASSEMBLY

A. Install Work in accordance with local utility provider standards.

3.07 INSTALLATION - WATER METERS

A. Install Work in accordance with local utility provider standards.

3.08 SERVICE CONNECTIONS

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves and sand strainer.

B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Calk enlarged sleeve watertight.

C. Contractor is responsible for paying all permit fees, tao fees, hook up fees, and water meter or curb stop costs required by the water utility company.

3.09 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Iowa Department of Transportation.

END OF SECTION

SECTION 33 1300

DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disinfection of site domestic water lines, site fire water lines, and potable water distribution and transmission system; and testing and reporting results specified in Section 33 1116.

1.02 RELATED REQUIREMENTS

A. Section 33 1116 - Site Water Utility Distribution Piping.

1.03 REFERENCE STANDARDS

A. AWWA B300 - Hypochlorites; 2011.

B. AWWA B301 - Liquid Chlorine; 2010.

C. AWWA B302 - Ammonium Sulfate; 2010.

D. AWWA B303 - Sodium Chlorite; 2010.

E. AWWA C651 - Disinfecting Water Mains; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Test Reports: Indicate results comparative to specified requirements.

C. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

D. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

E. Disinfection report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   5. Date and time of flushing start and completion.
   6. Disinfectant residual after flushing in ppm for each outlet tested.

F. Bacteriological report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certification that water conforms, or fails to conform, to bacterial standards of authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

B. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum 3 years documented experience.

C. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of Des Moines, Iowa.

D. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: AWWA B301, Liquid Chlorine.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping system has been cleaned, inspected, and pressure tested.

B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

B. Provide and attach equipment required to perform the work.

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. Test samples in accordance with AWWA C651.

1. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
2. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
3. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.

END OF SECTION

SECTION 33 3111

SITE SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories.

B. Connection of building sanitary drainage system to municipal sewers.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating of trenches.

B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 2323 - Fill: Bedding and backfilling.

D. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

E. Section 03 3000 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

B. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2009 (Reapproved 2014).

C. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2015.

D. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.

E. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

F. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

G. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.

H. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

I. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings; 2005.

J. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

B. Contractor to pay all permit fees, tap fees, or hook up fees required by the sanitary sewer utility.

1.07 PROJECT CONDITIONS

A. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Plastic Pipe: ASTM D2729, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 4 inches, joints shall be integral, bell and spigot type, rubber gasket.

C. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service" in large letters.

2.03 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 2316.13.

B. Pipe Cover Material: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 2316.13 for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building sanitary sewer outlet, through installed sleeves.

E. Install trace wire 6 inches above top of pipe; coordinate with Section 31 2316.13.

3.03 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Iowa Department of Transportation.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 4111

SITE STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating of trenches.

B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 2323 - Fill: Bedding and backfilling.

D. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2014.

B. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

1.05 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.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, and pipe accessories .

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents:
   1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

B. Contractor is responsible for paying all storm sewer permit fees, hook up fees, and tap fees required by the local jurisdiction.

1.08 PRE-INSTALLATION MEETINGS

A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.09 COORDINATION

A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with termination of storm sewer connection outside building, trenching and backfilling.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Plastic Pipe: ASTM D2729, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 12 inches, joints shall be integral bell and spigot type, rubber gasket.

2.02 PIPE ACCESSORIES

A. Filter Fabric: Non-biodegradable, woven, monofilament.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Sewer Service " in large letters.

C. Steel Animal Guard: 12" Dia. band type, zinc coated steel bars at end of each storm drain.

D. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, cleanout cover, and tamper proof fasteners.
   1. Configuration: Angular.

E. Metal Apron at stomr drain tile outlet

2.03 UNDERGROUND PIPE MARKERS

A. Manufacturers:
   1. Presco Products.
   2. Substitutions: Refer to Section 01600 - Product Requirements.

B. Plastic Ribbon Tape for Non-Metallic Pipe: APWA Detectable, green color, 6” wide, 5 mil thick, imprinted with “Storm Sewer Service” in large letters.

C. Plastic Ribbon Tape for Metallic Pipe: APWA Non-Detectable, green color, 6” wide, 4 mil thick, imprinted with “Storm Sewer Service” in large letters.

2.04 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A1, As specified in Section 31 2316.13.

B. Cover: Fill Type A1, As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 2316.13 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with Iowa DOT SSHBC - Section 2416.0. Seal joints watertight.

B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

C. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

D. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

E. Connect to building storm drainage system, foundation drainage system, and run to drainage swale.

F. Make connections through walls through sleeved openings, where provided.

G. Install continuous trace wire 6 inches above top of pipe; coordinate with Section 31 2316.13.

3.03 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01 4000 - Quality Requirements.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Iowa Department of Transportation.

C. Infiltration Test: Test in accordance with ASTM 969.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 5111
SITE GAS DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for natural gas distribution on site outside buildings.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating of trenches.

B. Section 31 2323 - Fill: Bedding and backfilling.

C. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 03 3000 - Cast-in-Place Concrete: Foundations for storage tanks.

E. Section 22 1005 - Plumbing Piping.

F. Section 31 2316 - Excavation: Excavating of trenches.

G. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

H. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B16.11 - Forged Fittings, Socket-welding and Threaded; 2011.

C. ASME B31.8 - Gas Transmission and Distribution Piping Systems; 2014.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

E. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

H. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

I. NFPA 58 - Liquefied Petroleum Gas Code; 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Project Record Documents: Record actual locations of pipe mains, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.

B. Welders Certification: In accordance with ASME BPVC-IX.

C. Conform to NFPA 58.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

PART 2 PRODUCTS

2.01 PIPE

A. Pipe: Specified in Section 22 1005.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Natural Gas Service " in large letters.

2.02 GAS COCKS AND VALVES

A. Manufacturers:
   1. Fisher.
   2. Maxtrol.
   3. Robertson.
   4. Honeywell.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. 2 inches and Smaller: 150 psig WOG, bronze body, bronze tapered plug, lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.

C. Furnish valves with manufacturer's name and pressure rating marked on valve body.

D. Pressure Regulating Valves: Single stage, malleable iron body, corrosion-resistant, pressure regulator with atmospheric vent, elevation compensator; with threaded ends for 2 1/2 inch and smaller, flanged ends larger than 2 inch.
   1. Capacity:
      a. Inlet Gas Pressure 125 psig.
      b. Outlet Gas Pressure range: From 7 inch WC.
   2. Furnish valves with manufacturer's name and pressure rating marked on valve body.

2.03 UNDERGROUND PIPE MARKERS

A. Manufacturers:
   1. Presco Products.
   2. Substitutions: See Section 01 6000- Product Requirements.

B. Plastic Ribbon Tape for Non-Metallic Pipe: APWA Detectable, yellow color, 6” wide, 5 mils thick, imprinted with “Natural Gas Service” in large letters.

C. Plastic Ribbon Tape for Metallic Pipe: APWA Non-Detectable, yellow color, 6” wide, 4 mils thick, imprinted with “Natural Gas Service” in large letters.

2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2316.13.

B. Cover: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and utility gas main size, location and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Bevel plain end ferrous pipe over 2 inches diameter Thread ferrous pipe 2 inches diameter and under.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections with flanges and unions.

3.03 TRENCHING

A. See Section 31 2316.13 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPING

A. Maintain 10 foot separation of gas line from sewer and water piping in accordance with International Plumbing Code, State of Iowa Plumbing Code, and local jurisdictions code.

B. Group piping with other site piping work whenever practical.

C. Route piping in straight line.

D. Install piping to conserve space and not interfere with use of site space.

E. Install piping to allow for expansion and contraction without stressing pipe or joints.

F. Install cocks and other fittings.

G. Establish elevations of buried piping to ensure not less than 24 inches of cover in non-travelled areas and 48 inches of cover in driveways and parking areas.

H. Lay pipe on bedding.

I. Wrap couplings and fittings of steel pipe with polyethylene tape and heat shrink over pipe.

J. Install trace wire 6 inches above top of pipe; coordinate with Section 31 2316.13.

K. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.

L. Install Work in accordance with Municipality of Mason City Public Works standards.

M. Wrap valve and valve box with polyethylene tape and heat shrink.

3.05 SERVICE CONNECTIONS

A. Provide sleeve in foundation wall for gas service main. Seal enlarged sleeve watertight.

B. Anchor service main to exterior surface of foundation wall.

C. Install service regulator adjacent to building wall in specified location.

D. Install service regulator and riser pipe to prevent undue stress upon service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.

E. Provide regulator vent with rain and insect proof opening, terminating away from building openings.

F. Contractor is responsible for paying all permit fees, tap fees or hook up fees, and meter costs required by the natural gas utility.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. Pressure test gas piping to 30 psi for 30 minutes.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Iowa Department of Transportation.

END OF SECTION

SECTION 33 61 14

GEOTHERMAL WELLFIELD

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Geothermal Wellfield.

B. Vertical Heat Exchanger Drilling.

1.2 QUALIFICATIONS

A. Installing contractor shall have on the project a certified International Ground Source Heat Pump Association installer with the following qualifications:
   1. Minimum 5 years of experience in vertical heat exchanger drilling.
   2. At least three completed projects of underground closed circuit loop field work of at least 30 tons each.
   3. Certified by the Iowa Department of Natural Resources as a well installer in the State of Iowa.

1.3 SUBMITTALS FOR REVIEW

A. The Engineer will review qualification submittals of the drilling contractor. The qualifications submittal shall contain the following information:
   1. Contractor’s name and Company name if different.
   2. Contractor’s business address.
   3. Explanation of past experience in vertical geothermal installations meeting criteria above.
   4. List of specific job references with contact persons (addresses and telephone numbers).
   5. Qualification certifications of personnel who will be performing the work
   6. Certification that Contractor will be performing work with his own forces, and will not subcontract the work.
   7. Provide manufacturer, make and model number of drilling machines and grout placement pumps and feeders.

B. Product Data: Include manufacturer's specifications and catalog data for pipe, fittings, valves and other special items.

C. Certifications:
   1. Proof of heat fusion certification for each of Contractor’s personnel installing piping.
   2. Written verification that only personnel who are heat fusion certified have joined piping on this project.
   3. Written verification that only the prescribed installation methods and materials have been used on this project.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

A. Project Record Documents: Maintain documents at site during construction and submit at Contract Closeout.

B. Drilling log.

1. Starting and ending dates for drilling activities.
2. Drawing indicating accurate as-built locations of all borings and pipe trenches.
3. Copies of permits from the City, the County Health Department and the DNR.
4. Test results for grout conductivity tests.
5. Documentation of circuit cleaning and purging.
6. Circuit pressure test logs.
7. Percent of solution and quantity of system antifreeze installed.
8. Material and installation warranty certificates.

C. Piping test log.

D. Grout sample test reports after 10%, 50% and 80% drilling completion.

PART 2 - PRODUCTS

2.1 GEOTHERMAL WELL FIELD PIPING

A. Pipe: Virgin polyethylene extrusion in accordance with ASTM D2513, Sections 4.1 and 4.2.

1. Capable of 1600 psi hydrostatic design at 73.4F, per ASTM D2387.
2. Listed in PPI TR4 as a PE3408 piping formulation.
3. High density extrusion compound with cell classification of PE345464C.
4. Compound shall have a UV stabilizer of C, D, or E as specified in ASTM D3350, with the following exceptions:
   a. The material shall exhibit zero failures when tested for a minimum of 192 hours under ASTM D1693, condition C, as required in ASTM D3350.
5. Dimensions:
   a. Pipe with a diameter of less than 1-1/4” (nominal) shall be manufactured in accordance with ASTM D3035 with a minimum (based on pressure rating) dimension ratio of 11.
   b. Pipe manufactured with a diameter of 1-1/4” (nominal) and larger shall be manufactured in accordance with ASTM D3035 (minimum based on pressure rating dimension ratio of 15.5) or ASTM D2447 (Schedule 40).
   c. Pipe 3” (nominal) and larger shall be manufactured in accordance with ASTM D3035, (with a minimum based on pressure rating dimension ration of 17) or D2447 (Schedule 40).
   d. Table of Water Pressure Ratings at 73.4 degrees F. for DR-PR PE 3408 plastic Pipe.

	Dimension Ratio	Pressure Rating, psi
e.		
f.	7	267
g.	9	200
h.	9.3	193
i.	11	160
j.	13.5	128
k.	15.5	110
l.	17	100

6. Each section of pipe shall be permanently marked with the manufacturer’s name, nominal size, pressure rating, relevant ASTM standards, cell classification number and date of manufacture.
7. U-Bends: Factory fused u-bends. Approved manufacturers are Performance Pipe and Centennial Plastics.

B. Fittings: ASTM D2683 (for socket fusion fittings) or ASTM D3261 (for butt/saddle fusion fittings). Each fitting shall be identified with the manufacturer's name, nominal size, pressure rating, relevant ASTM standards and date of manufacture.

C. Infield Extended Header: The infield extended headers used to connect the heat exchanger u-bends in each circuit shall be constructed as shown on project drawings. Infield extended headers shall be manufactured or field fabricated.

D. Install sleeves where piping passes exterior walls below grade and concrete floors through grade in accordance with Section 230517.

E. Grout: Thermally enhanced bentonite grout shall enclose the u-bend piping circuit and seal the entire bore hole. The thermally enhanced grout shall have a minimum thermal conductivity of 0.88 Btu/hr ft F., and a permeability rate of less than 1x10-7 cm/sec. Grout material shall be listed on the Iowa DNR listing for approved grouts for use in sealing well casings.

2.2 WARNING TAPE

A. Magnetic detectable conductor, brightly colored plastic covering, imprinted, CAUTION GEOTHERMAL PIPELINE BURIED BELOW" in large letters.

2.3 AGGREGATE MATERIALS

A.

Sieve Size	Percent Passing
1. 3/8 inch (9.5 mm)	100
2. No. 4 (4.75 mm)	90 to 100
3. No. 8 (2.36 mm)	70 to 100
4. No. 200 (75 □m)	0 to 1.5

B. Horizontal Pipe Bedding Material:
1. Clean, natural river or bank sand.
2. Free from silt, clay, loam, friable or soluble materials, and organic matter.
3. ASTM D2487 Group Symbol SW.
4. Suitable for control compaction as scheduled.
5. Graded in accordance with ASTM C136 and Table I.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.

C. Give adequate notice to the City, Utility Companies, General Contractor, Owner and Engineer of the proposed work.

D. Notify the Owner and coordinate the removal and relocation of utilities. At the Owner's direction, the Contractor shall notify utility company to remove and relocate utilities.

E. Coordinate placement of pipe trenches, horizontal bores, and other components with parking lot and parking lot lights and underground supports, sidewalks, landscaping, underground utilities,

paving and the like. Refer to plans for indication of where these items are planned for on the site.

3.2 VERTICAL HEAT EXCHANGER DRILLING

A. Drilling: The horizontal boreholes shall be drilled to a depth allowing complete insertion of the heat exchanger to its specified depth. The maximum borehole diameter shall be six (6) inches. If a larger diameter is required, it must be approved by the Engineer.

B. Geothermal bore log: The Loop Field Contractor shall keep daily bore logs that document the history of each bore as it is installed. All boring data shall be compiled and submitted as part of the As-Built documents. The log shall include but is not limited to the following information.
   1. Number of bore, and depth of installation.
   2. GPS location of bore.
   3. As-built drawing showing locations of bores, vault, headers, and interconnecting piping.
   4. Date and time bore was finished.
   5. Grouting information for each bore.
   6. Sign off on bore log each day by the installing contractor's representative and the Owner's Representative and the Mechanical Contractor site representative.
   7. The Loop Field Contractor shall provide one copy of the log to the Engineer, Owner, and the Mechanical Contractor as part of the As-Built documents.

C. Contractor shall be responsible for any repairs and cleanup of the property required as a consequence of installing the loop field.

3.3 EXCAVATION AND BACKFILLING

A. The Contractor shall do all excavating, backfilling, shoring, bailing, and pumping for the installation of their work and will perform necessary grading to prevent surface water from flowing into trenches or other excavations. Sewer lines shall not be used for draining trenches. The end of all pipes shall be kept sealed and lines left clean and unobstructed during construction. Suitable backfilling materials shall be piled a sufficient distance from banks of trenches to avoid overloading. Unsuitable backfill material shall be removed as directed by the Design Engineer.

B. Sheathing and shoring shall be done as necessary for protection of work and personnel safety. Unless otherwise indicated, excavation shall be open cut except for short sections. The Contractor shall install geothermal marking (warning) tape 18 inches above all horizontal/header piping.

C. Prior to drilling or trenching, the Contractor shall be responsible for reviewing the location of underground utilities with the Owner's representative. Contractor shall arrange for utility marking. Existing utility lines uncovered during excavation shall be protected from damage during excavation and backfilling.

D. Trench Construction: Trenches and trench bottoms shall be constructed in accordance with ASTM D 2321 Section 6, Trench Excavation and Section 7, Installation. The vault structure shall be installed on stable base consisting of 12" class I materials compacted to 95% proctor density per ASTM F 1759, Section 4.2. All safety precautions for vault installation are the responsibility of the installing contractor.

E. Underpin adjacent structures that will be damaged by excavation work, including utilities and pipe chases.

F. Excavate subsoil required to accommodate site structures, construction operations, and other work.

G. Machine slope banks to angle of repose or less, until shored.

H. Excavation cut not to interfere with normal 45 degree bearing splay of foundation, except where excavation support system is used.

I. Grade top perimeter of excavation to prevent surface water from draining into excavation.

J. Notify Engineer immediately of unexpected subsurface conditions.

K. Stockpile and protect excavated material in area designated on site. Remove clean excess material not being reused to location on site designated by Owner. Remove from site excess excavated material not determined to be clean. Legally dispose of excess excavated material.

L. Hand trim excavation. Remove loose matter.

M. Horizontal header pipe bedding:
   1. Bedding materials shall be as specified in Part 2 of this Section.
   2. Place bedding material at trench bottom, level bedding materials in one continuous layer not exceeding 8 inches (200 mm) compacted depth, compact to 95 percent. Coordinate independent compaction testing with Construction Manager.

N. Horizontal header pipe backfilling:
   1. Maintain optimum moisture content of backfill materials within 4 percent to attain required compaction density.
   2. Systematically backfill to allow maximum time for natural settlement.
   3. Backfill around sides and to top of pipe with bedding material, extending to 6 inches above pipe.
   4. Backfill remaining excavation with cover fill, tamped in place at 6" intervals, compacted to 95 percent. Coordinate independent compaction testing through Construction Manager.

O. Backfill to existing contours and match surrounding elevations. Make grade changes gradual; blend slopes into level areas.

P. Tolerance for top surface of backfilling: Plus or minus 0.1 ft from indicated elevations.

Q. Seed or sod grassy areas in accordance with Section 32 92 19 and Section 32 92 23

3.4 PIPE INSTALLATION

A. Only Contractor's personnel who have been heat fusion certified, and who are experienced shall bond pipe and fittings. Proof of certification shall be provided.

B. Contractor shall verify in writing that only personnel who are heat fusion certified have joined piping on this project.

C. Contractor shall verify in writing that only the prescribed installation methods and materials have been used on the project.

D. All underground pipe joining shall be heat fused by socket, butt or saddle fusion in accordance with ASTM D2610, ASTM D2683 and the manufacturer's heat fusion specifications.

E. During installation, all debris shall be kept out of the pipe. Ends of the HDPE pipe shall be sealed until the pipe is joined to the circuits.

F. Cap piping securely at ends prior to final backfill.

G. Seal the u-bend pipe ends fusion caps or tape prior to insertion into the borehole. Reasonable care shall be taken to ensure that the geothermal loop field pipe is not crushed, kinked, or cut. Should any pipe be damaged, the damaged section shall be cut out and the pipe reconnected by heat fusion.

H. The heat exchanger loop shall be connected as indicated on the plans. The header design accounts for balanced flow as well as flushing and purging flow rates. No variations can be made in circuit hookup or the pipe sizes that are indicated without approval from the Engineer. The minimum bend radius for each pipe size shall be 25 times the nominal pipe diameter or the pipe manufacturer's recommendations, whichever is greater. The depth of all headers and supply and return piping is indicated on the drawings and shall be maintained.

I. All horizontal piping shall be installed at a minimum depth of 5 feet below finished grade.

3.5 GROUTING

A. Each bore hole shall be grouted from the bottom up in a continuous fashion using at least a 1" HDPE tremie pipe. The tremie pipe shall be pulled fully into the bore hole alongside the loop piping, following drilling of the bore. Grout shall be pumped through the tremie pipe as it is pulled out of the bore hole. The tremie pipe's end must be maintained just below grout level within the borehole to ensure complete and uniform grouting of the borehole. All state regulations shall be met for borehole grouting of the boreholes. The tremie pipe size may be increased if needed to reduce the grout pumping friction.

B. Grout Sampling: The Loop Field Contractor shall take at least three separate grout samples from the grout mixing/holding tank. The samples shall be taken from the actual grouting process. The samples shall be taken after ten percent of bores, 50 percent of the bores and 80 percent of the bores are completed. The Loop Field Contractor shall submit the samples to an independent testing agency to determine permeability and thermal conductivity. The Loop Field Contractor shall submit test results to the Engineer. Grout composition shall be changed as needed to bring non-compliant grout into specification compliance. The Owner reserves the right to take independent grout samples and have them tested during the process to confirm what the contractor testing finds.

3.6 TESTING, CLEANING, FLUSHING, PURGING, FILLING

A. Flush each circuit and interconnecting piping with clean water at minimum 2 feet per second velocity.

B. All piping shall be pressure tested before any backfilling of the header trenches is executed. The individual circuits shall be pressure tested hydrostatically to 100 psig. No leaks shall be present in an 8 hour period.
   1. Contractor shall maintain a piping test log for each system, to include:
      a. Description of the segment(s) of piping tested.
      b. Date, time, and weather conditions.
      c. Description of test, including final pressure.
      d. Description of any leaks, and their locations.
      e. Description of remedial repairs necessary.
      f. Description of re-test, as necessary.

C. Drain system and refill with fluids specified in Section 23 21 16 in coordination with mechanical subcontractor.

END OF SECTION

Form 131084 (11-16)

BID BOND

SOLICITATION NUMBER: _____

KNOW ALL PERSONS BY THESE PRESENTS: That we, _____
(Company Name)

_____ of _____
(City,State)

as principal, and the _____
(Surety)

of _____
(Address)

as Surety, are held and firmly bound unto the Iowa Department of Transportation and to the State of Iowa, or Municipality as defined in Iowa Code, Section 73A.1 as applicable, hereinafter defined as Obligee, to the percent of the submitted lump sum price shown in the solicitation documents of the specified project, by which payment by said principal and surety bind themselves, their heirs, executors, administrators, successors, and assigns jointly and severally, firmly by these presents.

WHEREAS, the principal is herewith submitting his/her or its sealed solicitation for:

County _____

Type of Work _____

Solicitation Due Date _____ , 20 _____ .

NOW THEREFORE, if the said solicitation or proposal submitted by said principal be accepted, and the principal be awarded a contract with the Obligee in accordance with the terms of such solicitation, and give such bond as may be specified in the solicitation or contract documents with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, then this obligation shall become null and void or in the event of the failure of the principal to enter such contract and give such bond, the principal shall pay to the Obligee the full amount of the bid bond, together with court costs, attorney's fees, and any other expense of recovery.

IN WITNESS WHEREOF, the principal and surety have caused these presents to be signed this _____ day of

_____ , 20 _____ .

_____
Principal
(Company Name)

By _____
Authorized Signature

_____
Address

_____
Surety

By _____
Authorized Surety Representative

Bidders Request for Alternatives or Exceptions (BRAE)

Letting Date: _January 11, 2017_____

Proposal No.: ___17841_____ BRAE form due on or before:_December 30, 2016

Item: _____ Spec. No.:_____

Request: _____

_____

Bidder Proposes to furnish in lieu of above: _____

_____

_____

_____

NOTE: The determination of acceptance of this BRAE request is only valid for the bid for which it was submitted. BRAE approvals received for this bid do not determine or set a precedent for what is acceptable in any other bid posted by the State of Iowa.

Email/Fax to:

Iowa Department of Transportation
Purchasing Section
Attention: Jody McNaughton
Email: jody.mcnaughton@iowadot.us

Fax No.: 515-239-1538

Submitted By _____

Company _____

Address_____

_____
City State Zip

Phone No. _____

Fax No. _____

==========

DOT USE ONLY

Approved _____ Disapproved _____

Reason _____

_____

_____

Signature: _____ Date: _____

Bidder _____

_____

_____

_____

SEALED BID

LETTING DATE: January 11, 2017
PROPOSAL NO: 17841
PROPOSAL DESCRIPTION: Construction of New Iowa Department of Transportation Maintenance Facility in Muscatine, IA

Iowa Department of Transportation
PURCHASING - SEALED BID PROPOSAL
800 Lincoln Way
Ames, IA 50010