

IOWA DEPARTMENT OF NATURAL RESOURCES

PROJECT MANUAL



CODY SHOOTING RANGE

PHASE 2

SCOTT COUNTY, IOWA

ATTENTION BIDDERS

ALL SUBSTITUTION REQUESTS AND QUESTIONS MUST BE SUBMITTED BY
4:30PM THE FRIDAY PRIOR TO THE BID LETTING TO BE CONSIDERED.

PREPARED BY

IOWA DEPARTMENT OF NATURAL RESOURCES

ENGINEERING SECTION

6200 Park Avenue, Suite 200

Des Moines, IA 50321

PROJECT NO. 25-06-82-02

Obtain complete sets of contract documents including Drawings, Specification, bid documents, bidders' list in
electronic format at: www.beelineandblue.com

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Notice to Bidders - Iowa Department of Natural Resources

Please note that the DNR Central Office has moved to 6200 Park Avenue, Suite 200, Des Moines

Sealed bids will be received by the Iowa Department of Natural Resources, at 6200 Park Avenue, Suite 200,, Des Moines, IA, 50321, or via email at constructionbids@dnr.iowa.gov until **11:00am, March 19, 2026** for the public improvement projects listed below, at which time they will be opened publicly. When emailing bid documents, the subject line of the email must state the following: Project Number - Project Location, and Bid Letting Date. Please ensure the first page of the emailed attachment, or first of multiple attachments, is the bid proposal.

Direct substitution requests, questions about the project, or questions concerning bidding and contract procedures to DNR Procurement. To be considered, these requests must be emailed to constructionbids@dnr.iowa.gov by 4:30pm the Friday prior to bid letting with the following subject line: **Contractor Question - Project Number – Project Location**

After the bid opening, bid results may be obtained by visiting the Department's website at <https://programs.iowadnr.gov/engreal/projectlist.asp>. In addition to attending the bid opening in person, interested parties may also call in to the following number to listen to the bid opening:

Conference call number: +1 (484) 816-5310
PIN: 154 121 290#

Project documents, including drawings, specifications, proposal forms, and addenda items for the project are available at Beeline and Blue, at 2507 Ingersoll Ave, Des Moines, IA, 50312. Please visit www.beelineandblue.com or contact (515) 244-1611 for more information. Alternatively, Bid Documents can be viewed or printed online at <https://programs.iowadnr.gov/engreal/projectlist.asp>

The Department shall comply with all public improvement procurement laws, as outlined in the plans and specifications and including but not limited to: Iowa Code chapter 26 related to public construction bidding; Iowa Code chapter 73 related to preferences; Iowa Code chapter 573 related to labor and materials on public improvements; rules promulgated by the Department of Administrative Services – General Services Enterprise as they may apply; rules promulgated by the Department of Natural Resources and the Natural Resources Commission, as they may apply; and any federal statutes, rules and/or executive orders that may be associated depending on funding sources. Bidders shall comply with these laws to be considered and are encouraged to be familiar with public improvement procurement requirements and the bidding documents before submitting a bid.

Each bidder shall accompany the bid with a bid security as defined in Iowa code section 26.8. Copies of the bid security will be accepted for those bidders submitting bids electronically. Additionally, if the apparent lowest responsible, responsive bidder submits an electronic bid security, the original security must be mailed to the Department, at 6200 Park Avenue, Suite 200, Des Moines, IA, 50321, within five business days of the bid letting date. The bid security must be in an amount set forth in the bidding documents and made payable to the Iowa Department of Natural Resources. Failure to execute a contract for the proposed work and file an acceptable Performance Bond, in an amount equal to 100% of the contract price and a certificate of liability insurance, within thirty days of the date of the award of the contract, will be just and sufficient cause for the rescinding of the award and the forfeiture of the bid security.

SPECIAL NOTICE TO CONTRACTORS

Project Estimate: \$1,680,000.00

Funding Source: Federal PR, F&W Trust – Other, and Marine Fuel Tax

Please be advised of the following public improvement timetable and department specific contacts.

PUBLIC IMPROVEMENT TIMETABLE	Date/Time (Central Standard Time)
Direct substitution requests, questions about the project, or questions concerning bidding and contract procedures to DNR Procurement. To be considered, these requests must be emailed to constructionbids@dnr.iowa.gov by 4:30pm the Friday prior to bid letting with the following subject line: <i>Contractor Question - Project Number – Project Location</i>	March 13, 2026 4:30pm
Answers to Contractor submitted questions and any addenda will be posted by 12:00pm the Tuesday prior to bid letting.	March 17, 2026 12:00pm
Project Bid Deadline and Public Bid Opening.	March 19, 2026 11:00am

Once Bid Letting has occurred, Contractors may also contact the following:

Direct questions concerning the Project Design, Drawings and Specifications to:

Brian Phipps, Project Manager
Phone: (515) 452-9438
Brian.phipps@dnr.iowa.gov

Direct questions concerning a Pre-construction Conference, Site Review and Project Inspection to:

Bruce Flippin, District Engineer
Phone: (515) 689-8009
Bruce.flippin@dnr.iowa.gov

Contractor is responsible for contacting State Stormwater program coordinator (515-217-0875) for information relating to stormwater permit that is necessary if construction activities disturb one acre or more.

In accordance with Iowa Code Section 423, Contractors may purchase qualifying items for work on this contract exempt from sales tax. The DEPARTMENT will issue an authorization letter and exemption certificate to the prime contractor and each approved subcontractor. *Complete information on qualifying materials and supplies can be found in Iowa Administrative Rules Chapter 701-219. Additional guidance for contractors can be found at <https://tax.iowa.gov/>, the Iowa Department of Revenue Web site.*

Recorded bid results can be accessed at <https://programs.iowadnr.gov/engreal/projectlist.asp>.

Time and Date of Letting **11:00 AM, March 19, 2026**

PROPOSAL

Project Description and Location

Project No. **25-06-82-02**

Phase 2

Cody Shooting Range

Scott County, Iowa

Proposal of: _____
(Name of Bidder)

Located at: _____
(Address) (Telephone include area code)

Amount of Proposal Guarantee	Specified completion date or Number of Working Days	Approx. or Specified Starting Date or Number of Working Days	Liquidated Damages Per Day
\$100,000.00	October 31, 2026	N/A	\$1,000.00

The undersigned hereby agrees, if awarded the contract, to execute the proposed contract and to furnish an approved performance bond in a amount not less than 100 percent of the contract award within 30 days after the date of approval of award of the contract, and to provide all labor, materials, and equipment required to complete the project designated above, for the price hereinafter set forth, in strict compliance with the contract documents prepared by the Iowa Department of Natural Resources.

The undersigned agrees, if awarded the contract, to commence the work within a reasonable time after the preconstruction conference or by the specific starting date, if so specified, and to complete the work within the contract period, or to pay liquidated damages in the amount stipulated herein for each calendar day the work remains uncompleted after the expiration of the contract period or any authorized reduction thereof.

A proposal guarantee in the amount stipulated herein is included with this proposal, to be forfeited to the Iowa Department of Natural Resources if the undersigned fails to execute the contract and furnish an approved performance bond, if awarded the contract.

By virtue of statutory authority, preference will be given to products and provisions grown and coal produced within the state of Iowa, and also, a resident bidder shall be allowed a preference against a nonresident bidder from a state or foreign country which gives or requires a preference to bidders from that state or foreign country on projects in which there are no federal funds involved.

BY

(Iowa Contractor Registration No.) (Signed) (Date)

(Phone Number) (Fax Number)

(Email Address)

By signing and submitting the proposal, the bidder:

1. Gives an unsworn declaration on behalf of each person, firm, association, partnership, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with such contract, and is not under debarment currently by the Federal government for a criminal violation which is reasonably related to bidding and contracting procedures; and

2. Affirms to have examined the plans, specifications, and job site to become acquainted with the adjacent areas, means of approach to the site, conditions of the actual job site, and the facilities for delivering, storing, placing, and handling of materials and equipment.

SCHEDULE OF PRICES

Project Description and Location

Phase 2, Cody Shooting Range, Scott County

Name of Bidder

THE "UNIT PRICE" AND "AMOUNT" COLUMNS MUST BE FILLED IN FOR THIS PROPOSAL TO BE CONSIDERED COMPLETE. IF THERE IS A DISCREPANCY BETWEEN UNIT BID PRICES, EXTENSIONS, OR TOTAL AMOUNTS OF BID, THE UNIT PRICES SHALL GOVERN.

Item No.	Description	Estimated Quantity		Unit Price	Amount
1	Mobilization	1	LS		
2	DIVISION 1 - GENERAL AND ADMINISTRATIVE	1	LS		
3	DIVISION 2 - EXISTING CONDITIONS	1	LS		
4	DIVISION 3 - CONCRETE	1	LS		
5	DIVISION 5 - METALS	1	LS		
6	DIVISION 6 - WOOD	1	LS		
7	DIVISION 7 - THERMAL AND MOISTURE	1	LS		
8	DIVISION 8 - OPENINGS	1	LS		
9	DIVISION 9 - FINISHES	1	LS		
10	DIVISION 10 - SPECIALTIES	1	LS		
11	DIVISION 12 - FURNISHINGS	1	LS		
12	DIVISION 22 - PLUMBING	1	LS		
13	DIVISION 23 - HEATING, VENTILATION, AND COOLING(HVAC)	1	LS		
14	DIVISION 26 - ELECTRICAL	1	LS		
15	DIVISION 27 - COMMUNICATIONS	1	LS		
16	DIVISION 28 - ELECTRONIC SAFETY AND SECURITY	1	LS		
17	DIVISION 31 - EARTHWORK	1	LS		
18	DIVISION 32 - EXTERIOR IMPROVEMENTS	1	LS		
19	DIVISION 33 - SITE UTILITIES	1	LS		

Base Bid Total	

Alternate #1					
20	ADD ALTERNATE #1 – EQUIPMENT AS SHOWN ON TECHNOLOGY PLANS	1	LS		
Alternate #1 Total					

Alternate #2					
21	ADD ALTERNATE #2 - EQUIPMENT OUTLINED IN SPECIFICATION 110000	1	LS		
Alternate #2 Total					

Bidder Acknowledges Receipt Of Any Issued Addenda (Number and Date):		

Subcontractor Information

Name	Iowa Contractor Registration Number



EPA Project Control Number

United State Environmental Protection Agency
Washington, DC 20460

**Certification Regarding
Debarment, Suspension, and Other Responsibility Matters
EPA Form 5700-49 (11-83)**

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

- a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agencies.
- b. Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for the commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- c. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
- d. Have not within a three-year period preceding this application/proposal had one or more public transaction (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine up to \$10,000 or imprisonment for up to 5 years, or both.

Type Name & Title of Authorized Representative

Signature of Authorized Representative

Date

☐ I am unable to certify to the above statements. My explanation is attached.

Instructions

Under Executive Order 12549, an individual or organization debarred or excluded from participation in Federal assistance or benefit programs may not receive any assistance award under a Federal program, of a sub agreement thereunder for \$25,000 or more.

Accordingly, each prospective recipient of an EPA grant, loan, or cooperative agreement and any contract or sub agreement participant thereunder must complete the attached certification or provide an explanation why they cannot. For further details, see 40 CFR 32.510, Participants' responsibilities, in the attached regulation.

Where To Submit

The prospective EPA grant, loan, or cooperative agreement recipient must return the signed certification of explanation with its application to the appropriate EPA Headquarters or Regional office, as required in the application instructions.

A prospective prime contractor must submit a completed certification or explanation to the individual or organization awarding the contract.

Each prospective subcontractor must submit a completed certification or explanation to the prime contractor for the project.

How To Obtain Forms:

EPA includes the certification form, instructions, and a copy of its implementing regulation (40) CFR Part 32) in each application kit. Applicants may reproduce these materials as needed and provide them to their prospective prime contractors, who, in turn may reproduce and provide them to prospective subcontractors.

Additional copies/assistance may be requested from:

Compliance Branch
Grants Administration Division (PM-216F)
US Environmental Protection Agency
401 M St SW
Washington DC 20460
(Telephone: 202-475-8025)

EPA Region VII Procedures for Implementation of 40 CFR Part 33.240 (Minority Business Enterprise/Women's Business Enterprise)

The following information must be contained in solicitation documents for construction contracts and engineering agreements pursuant to 40 CFR Part 33.240)

Each bidder/offeror must fully comply with the requirements, terms, and conditions of EPA's policy to award a fair share of sub agreements to minority and women's businesses. The bidder/offeror commits itself to taking affirmative steps contained herein. Bidders/offerors will take affirmative steps prior to submission of bid/proposal.

Affirmative Steps

- A. When feasible, segmenting total work requirements to permit maximum MBE/WBE participation.
- B. Assuring that MBEs and WBEs are solicited whenever they are potential sources of goods or services. This step may include:
 - 1. Sending letters or making other personal contacts with MBEs and WBEs, (e. g. those whose name appear on lists prepared by EPA or the grantee and other MBE/WBEs known to the bidder/offeror.) MBEs and WBEs should be contacted when other potential subcontractors are contacted, within reasonable time (fifteen days) prior to bid submission or closing date for receipt of initial offers. Those letters or other contacts should communicate the following:
 - a. Specific description of the work to be subcontracted;
 - b. How and where to obtain a copy of the drawings and specifications or other detailed information needed to prepare a detailed price quotation;
 - c. Date the quotation is due to the bidder/offeror;
 - d. Name, address, and phone number of the person in the bidder/offeror's firm whom the prospective MBE/WBE subcontractor should contact for additional information.
 - 2. Sending letters or making other personal contacts with local, state, federal and private agencies and MBE/WBE associations relevant to the project. Such contacts should provide the same information provided in the direct contacts to MBE and WBE firms.
- C. Where feasible, establishing delivery schedules which will encourage participation by MBE and WBEs.

Determination of Compliance

It is to be noted that bidders/offerors must demonstrate compliance with MBE/WBE requirements in order to be deemed responsible. Demonstration of compliance shall include, but is not limited to, the following information:

- 1. Names, addresses and phone numbers of MBE/WBEs expected to perform the work;
- 2. Work to be performed by MBEs and WBEs;
- 3. Aggregate dollar amount of work to be performed by MBEs and WBEs, showing aggregate to MBEs and aggregate to WBEs separately;
- 4. Description of contacts to MBE and WBE organizations, agencies and associations which serve MBE/WBEs, including names of organizations, agencies and associations and dates of contacts;
- 5. Description of contacts to MBEs and WBEs, including number of contacts, fields, (i. e. equipment or material supplier, excavator, transport services, electrical subcontractors, plumbers, etc.) and dates of contacts.

All bidders/offerors should complete the Minority and Women's Business Enterprise Utilization Worksheet and submit to the grantee prior to contract award.

(Grantee may establish alternative methods of compliance equivalent to or more stringent than the above.)

MINORITY, WOMEN'S AND SMALL RURAL BUSINESS ENTERPRISE WORKSHEET

Grant Applicant: _____ Project No.: _____

Contractor/Engineer: _____

Address: _____

Contact Person: _____ Telephone No.: _____

Amount of Contract: _____ MBE Percentage: _____ WBE Percentage: _____

1. MBE Subcontractor: _____ WBE: _____

Address: _____

Contact Person: _____ Telephone No.: _____

Amount of Subcontract: _____

Scope of Work: _____

2. MBE Subcontractor: _____ WBE: _____

Address: _____

Contact Person: _____ Telephone No.: _____

Amount of Subcontract: _____

Scope of Work: _____

3. MBE Subcontractor: _____ WBE: _____

Address: _____

Contact Person: _____ Telephone No.: _____

Amount of Subcontract: _____

Scope of Work: _____

4. MBE Subcontractor: _____ WBE: _____

Address: _____

Contact Person: _____ Telephone No.: _____

Amount of Subcontract: _____

Scope of Work: _____

5. MBE Subcontractor: _____ WBE: _____

Address: _____

Contact Person: _____ Telephone No.: _____

Amount of Subcontract: _____

Scope of Work: _____

6. MBE Subcontractor: _____ WBE: _____

Address: _____

Contact Person: _____ Telephone No.: _____

Amount of Subcontract: _____

Scope of Work: _____

Comments: _____

Prepared By _____

Telephone No. _____

Date _____

GUIDANCE FOR MINORITY BUSINESS ENTERPRISE AND WOMEN'S BUSINESS ENTERPRISE REQUIREMENT OF 40 CFR 31.36(e)

I. PURPOSE

This guidance is to assist States, EPA assistance recipients, prime contractors, consultants, minority business owners and women's business owners in complying with EPA's Minority Business Enterprise (MBE) and Women's Business Enterprise (WBE) requirements in the Agency's procurement regulations, 40 CFR Part 31. This guidance provides suggestions for carrying out the affirmative steps included in EPA procurement regulations. Also included is a description of activities to be undertaken by EPA or delegated States, as well as suggestions for MBE/WBEs to take in pursuing opportunities for work in EPA-funded projects.

II. DEFINITIONS

A. Minority Business Enterprise (MBE): A minority business enterprise is a business which is

1. certified as socially and economically disadvantaged by the Small Business Administration;
2. certified as a minority business enterprise by a State or Federal agency; or
3. an independent business concern which is at least 51 percent owned and controlled (as defined below) by minority group member(s). A minority group member is an individual who is a citizen of the United States and one of the following:
 - a. Black American
 - b. Hispanic American (with origins from Puerto Rico, Mexico, Cuba, South or Central America)
 - c. Native American (American Indian, Eskimo, Aleut, native Hawaiian)
 - d. Asian-Pacific American (with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, the US Trust Territories of the Pacific, Northern Marianas, Laos, Cambodia, Taiwan or the Indian Subcontinent)

B. Women's Business Enterprise (WBE): A women's business enterprise is a business which is certified as such by a State or Federal agency, or which meets the following definition:

A women's business enterprise is an independent business concern which is at least 51 percent owned by a woman or women who also control and operate it. Determination of whether a business is at least 51 percent owned by a woman or women shall be made without regard to community property laws. For example, an otherwise qualified WBE which is 51 percent owned by a married woman in a community state will not be disqualified because her husband has a 50 percent interest in her share. Similarly, a business that is 51 percent owned by a married man and 49 percent owned by an unmarried woman will not become a qualified WBE by virtue of his wife's 50 percent interest in his share of the business.

C. Ownership and Control:

1. The minority or women's ownership's interest in the firm must be real, substantial and continuing. Such interest may include:
 - a. risk of loss/share of profit commensurate with the proportional ownership; and
 - b. receipt of the customary incidents of ownership, such as salary and/or intangible benefits.
2. A minority or woman owner must have and exercise the authority to independently control the business. The minority or woman owner need not be continually present to be deemed in control. Characteristics of control may include:
 - a. authority to sign contracts;
 - b. making decisions in price negotiations;
 - c. incurring liabilities for the firm;
 - d. making final staffing decisions;
 - e. policy-making; and

f. making general company management decisions.

3. Only those firms performing a useful business function according to custom and practice in the industry are qualified as MBEs or WBEs. Acting merely as a passive conduit of funds to some other, non-minority firm where such activity is unnecessary to accomplish the project the project does not constitute a “useful business function according to custom and practice in the industry.”

D. Recipient: A party receiving federal financial assistance under an EPA program pursuant to a grant or cooperative agreement.

E. Project: The scope of work from which a cooperative agreement, grant or grant amendment is awarded.

F. Bidder: A party seeking to obtain a contract with a recipient through a competitive, advertised, sealed bid process.

G. Offeror: A party seeking to obtain a contract with a recipient through a negotiated procurement process.

III. RESPONSIBILITIES

A. Headquarters.

1. The office in charge of the assistance program (program office) has primary responsibility for implementation of the MBE/WBE program, in cooperation with the Office of Small and Disadvantaged Business Utilization (OSDBU).
2. OSDBU is responsible for serving as the Agency focal point for inquiries on the MBE/WBE program, providing explanation of the program and guidance to MBEs and WBEs interested in working on EPA funded projects.

B. Regional Responsibilities.

1. Provide guidance and advice to recipients as requested.
2. Maintain lists of those MBE and WBE firms which have participated in EPA funded projects. The Region may also add MBEs and WBEs requesting to be included on source lists. Such lists are for information purposes only, and shall carry a clear and prominent statement that the firms listed are neither endorsed nor guaranteed by EPA as bona fide MBE/WBEs. It is not necessary to be on any list in order to qualify as a bona fide MBE/WBE.

3. Monitor recipients for compliance with MBE/WBE requirements and for determining levels of MBE/WBE participation.

IV. RECIPIENT RESPONSIBILITIES

A. The recipient shall take affirmative steps to contract with MBEs and WBEs and ensure that its contractors and consultants take affirmative steps to contract with MBEs and WBEs during all phases of work funded or to be funded under an EPA assistance agreement. The recipient’s affirmative steps as defined in EPA procurement regulations are the following:

1. When feasible, dividing the total work to be contracted into smaller tasks in the solicitation documents to permit maximum MBE/WBE participation.
2. Placing qualified MBEs and WBEs on solicitation lists of EPA Regional Offices and appropriate minority/women’s business associations and agencies.
3. Assuring that MBEs and WBEs are solicited whenever they are potential sources of service and supplies, for example, by:
 - a. Holding pre-bid conferences, with interested MBEs and WBEs in attendance when possible, to highlight the requirements of this program to prospective bidders;
 - b. Including this MBE/WBE interim guidance in requests for proposals (RFP) and invitations for bid (IFB);
 - c. Publishing announcements of MBE/WBE opportunities for work on EPA funded projects;
- d. Developing a source list of MBE/WBEs and providing its list to prospective bidders/offerors;

4. The recipient may wish to engage a MBE/WBE liaison to compile the list.
 5. The recipient may wish to use available lists such as those of the EPA Regional Office, adjacent municipalities, appropriate minority/women associations. Names of these agencies with address and phone number should also be included on the recipient's source list.
 - a. Providing necessary and appropriate liaison services between MBE/ WBEs and prospective bidders/offers. (Liaison service should not be delegated to consultants where a potential for conflict of interest exists.)
 6. When project requirements permit, establishing delivery schedules which encourage participation of MBE/WBEs.
 7. Using the services and assistance of the Small Business Administration (SBA), the Minority Business Development Agency (MBDA), and other federal, State and local agencies when appropriate.
- B. Unless otherwise provided in the specifications, compliance with the MBE/WBE requirement in the regulations is a matter of bidder/offers responsibility.
 - C. The recipient is responsible for monitoring work in progress to ensure that MBE and WBE subcontractors and joint venturers are actually participating in the performance of the subcontract or joint venture contract and to insure that the consultant/contractor is fulfilling its obligations with respect to MBE/WBE requirements under the contract.
 - D. As part of the documentation required under 40 CFR 31.36(b)(9), the recipient shall maintain and update records of MBE/WBE participation and supply data to the delegated State when requested. Such records may include:
 1. Name of MBE/WBEs being utilized;
 2. Work designated to be performed by MBE/WBE;
 3. Dollar value of that work;
 4. Portion of project being performed by MBEs and WBEs.

V. BIDDER AND OFFEROR RESPONSIBILITIES

- A. Affirmative Steps: Activities during preparation of bids and offers. Bidders/offers shall take affirmative steps in compliance with the regulations, prior to submission of bids or closing date for receipt of initial offers, to encourage participation in projects by MBEs and WBEs. Such efforts include:
 1. When feasible, segmenting total work requirements to permit maximum MBE/WBE participation.
 2. Assuring the MBEs and WBEs are solicited whenever they are potential sources of goods or services. This step may include:
 - a. Sending letters or making other personal contacts with MBEs and WBEs, (e.g. those whose names appear on lists prepared by EPA or the recipient and other MBE/WBEs known to the bidder/offers). MBEs and WBEs should be contacted when other potential subcontractors are contacted, within reasonable time prior to bid submission or closing date for receipt of initial offers. Those letters or other contacts should communicate the following:
 - 1) Specific description of the work to be subcontracted;
 - 2) How and where to obtain a copy of plans and specifications or other detailed information needed to prepare a detailed price quotation;
 - 3) Date the quotation is due the bidder/offers;
 - 4) Name, address, and phone number of the person in the bidder/offers's firm whom the prospective MBE/WBE subcontractor should contact for additional information.
 - b. Sending letters or making other personal contacts with local, State, federal and private agencies and MBE/WBE associations relevant to the project. Such contacts should provide the same information provided in the direct contacts to MBE/WBE firms.
3. Where feasible, establishing delivery schedules which will encourage participation by MBEs and WBEs.

- B. Bidders/offerors must demonstrate compliance with the MBE/WBE requirements in order to be deemed responsible. Demonstration of compliance may include the following information, however the recipient may specify other methods of demonstrating compliance:
 - 1. Names, addresses and phone numbers of MBE/WBEs expected to perform work.
 - 2. Work to be performed by the MBEs and WBEs.
 - 3. Aggregate dollar amount of work to be performed by MBEs and WBEs, showing aggregate to MBEs and aggregate to WBEs separately.
 - 4. Description of contacts to MBE and WBE organizations, agencies and associations which service MBEs/WBEs, including names of organizations, agencies and associations and dates of contact.
 - 5. Description of contacts to MBEs and WBEs, including number of contacts, fields, (i.e. equipment or material supplier, excavators, transport serviced, electrical subcontractors, plumbers, etc.) and dates of contacts.
- C. Successful bidders/offerors should take reasonable affirmative steps to subcontract with MBEs and WBEs whenever additional subcontracting opportunities arise during the performance of the contract.

VI. MBE AND WBE RESPONSIBILITIES

MBEs and WBEs are responsible for promoting themselves and taking the initiative to obtain contracts and subcontracts, and for encouraging joint venture arrangements. MBEs/WBEs interested in working on EPA funded projects are strongly encouraged to take the following steps:

- A. Submit information to the recipients to identify status as a MBE/WBE.
- B. Become certified as MBE/WBE under available State or federal agency procedures.
- C. Contact federal, State, and local MBE/WBE liaison offices to obtain information on potential jobs.
- D. Provide capability statements to State agencies, recipients, consulting engineers, and contractors, stating type(s) of work performed by the firm, size of job that the firm can handle, bonding information, and any special skills.
- E. Make every effort to establish contacts and relationships with contractors for potential future business, including attending pre-bid conferences and subscribing to industry and trade journals.
- F. Contact EPA Regional offices or appropriate State offices to obtain information on planned EPA funded projects.
- G. Respond promptly to solicitation requests.

VII. REMEDIES FOR NONCOMPLIANCE

- A. Protests. A bidder/offeror for EPA funded work or MBE/WBE with an adversely affected direct financial interest may file a bid protest with the recipient pursuant to EPA procurement regulations 40 CFR 31.36(b)(12). These procedures are available to protest alleged violation of federal MBE/WBE requirements and may not be used to enforce local or State MBE/WBE requirements.
- B. Upon a finding by EPA that a recipient, bidder/offeror, consultant, contractor or subcontractor has not complied with the MBE/WBE requirements of EPA regulations, EPA may invoke any and all sanctions and remedies specified in EPA regulations.

VIII. STATE OR LOCAL LAW

Nothing in this program prevents a State or recipient from applying more stringent MBE/WBE requirements or procurement obligations which pertain to bid responsiveness or percentage of MBE and WBE participation.

US ENVIRONMENTAL PROTECTION AGENCY
CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to contracts, subcontracts, and agreements with the applicants who are themselves performing Federally assisted construction contracts, exceeding \$10,000, which are not exempt from the provisions of the Equal Opportunity Clause.)

By the submission of this bid, the bidder, offeror, applicant, or subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATION OF NONSEGREGATED FACILITIES

A Certification of Non-segregated Facilities, as required by the May 9, 1967 order (33 F.R. 7808, May 28, 1968) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

Signature

Date

Name and Title of Signer (Please Type)

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001

EPA-7 5720-4.2 (6/2/77)

Recipient Certification - Anti-Lobbying Act of 1990
US Department of the Interior
Certification Regarding Lobbying

This certification is required by Section 1352, title 31, US Code, entitled "Limitation on use of appropriated funds to influence certain Federal contracting and financial transactions."

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

Certification for Contracts, Grants, Loans, and Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- 1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to person for influencing or attempting to influence an officer or employee of any agency, a Member Congress, and officer or employee of Congress, or an employee of a Member of Congress in with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- 2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form -LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- 3) The undersigned shall require that of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify accordingly.

This certification is a material representation of fact upon which reliance was placed when this was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, US Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Signature _____ Date _____

Instructions for Certification

1. This certification and a disclosure form should be filed by each person as required, with each submission that initiates agency consideration of such person for: (1) award of a Federal contract, grant, or cooperative agreement exceeding \$100,000 or (2) an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$ 150,000.
2. This certification and a disclosure form should be filed by each person as required, upon receipt by such person of (1) a Federal contract, grant, or cooperative agreement exceeding \$100,000; or (2) a loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000, unless such person previously filed a certification, and a disclosure form, if required, at the time agency consideration was initiated.
3. Any person who requests or receives from a person referred to in paragraphs (1) and (2) above: (1) a subcontract exceeding \$100,000 at any tier under a Federal contract; (2) a subgrant, contract, or subcontract exceeding \$100,000 at any tier under a Federal grant (3) a contract or subcontract exceeding \$100,000 at any tier under a Federal loan exceeding \$150,000; or, (4) a contract or subcontract exceeding \$100,000 at any tier under a Federal cooperative agreement, shall file a certification, and a disclosure form, as required, to the next tier above.
4. All disclosure forms, but not certifications, shall be forwarded from tier to tier until received by the person referred to in paragraphs (1) or (2) above. That Person shall forward all disclosure forms to the appropriate Bureau/Office within the Department of the Interior.
5. Any certification or disclosure form filed under paragraph (4) above shall be treated as a material representation of fact upon which all receiving tiers shall rely. All liability arising from an erroneous representation shall be borne solely by the tier filing that representation and shall not be shared by any tier to which the erroneous representation is forwarded. Submitting an erroneous or disclosure constitutes a failure to file the required certification or disclosure, respectively. If a person fails to file a required certification or disclosure, the United States may pursue all available remedies, including those authorized by Section 1352, title 31. US Code.

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subwardee or prime federal recipient, at the initiation or receipt of a covered federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with a covered federal action. Use the SF-LLL-A Continuation Sheet for additional information if the space on the form is inadequate. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered federal action.
2. Identify the status of the covered federal action.
3. Identify the appropriate classification of this report. If this is a follow-up report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered federal action.
4. Enter the full name, address, city, state and zip code of the reporting entity. Include congressional district, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee (e.g., the first subawardee of the prime is the first tier). Subawards include, but are not limited to, subcontracts, subgrants and contract awards under grants.
5. If the organization filling the report in Item 4 checks "Subawardee," then enter the full name, address, city, state and zip code of the prime federal recipient. Include congressional district, if known.
6. Enter the name of the federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the federal program name or description for the covered federal action (Item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate federal identifying number available for the federal action identified in Item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant or loan award number; the application/proposal control number assigned by the federal agency). Include prefixes (e.g., "RFP-DE-90-001").
9. For a covered federal action where there has been an award or loan commitment by the federal agency, enter the federal amount of the award/loan commitment for the prime entity identified in Item 4 or 5.
10. a) Enter the full name, address, city, state and zip code of the lobbying entity engaged by the reporting entity identified in Item 4 to influence the covered federal action.

b) Enter the full names of the individual(s) performing services, and include full address if different from 10(a). Enter last name, first name and middle initial (MI).
11. Enter the amount of compensation paid or reasonably expected to be paid by the reporting entity (Item 4) to the lobbying entity (Item 10). Indicate whether the payment has been made (actual) or will be made (planned). Check all boxes that apply. If this is a material change report, enter the cumulative amount of payment made or planned to be made.

12. Check the appropriate box(es). Check all boxes that apply. If payment is made through an in-kind contribution, specify the nature and value of the in-kind payment.
13. Check the appropriate box(es). Check all boxes that apply. If other, specify name.
14. Provide a specific and detailed description of the services that the lobbyist has performed, or will be expected to perform, and the date(s) of any services rendered. Include all preparatory and related activity, not just time spent in actual contact with federal officials. Identify the federal official(s) or employee(s) contacted or the officer(s), employee(s), or member(s) of Congress that were contacted.
15. Check whether or not a SF-LLL-A Continuation Sheet(s) is/are attached.
16. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

Public reporting burden for this collection at of intermission is estimated to average 30 minutes per response. Including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project, (0348-0045), Washington DC 20503

(See reverse for public burden disclosure)

1. Type of Federal Action: ☐ a. contract ☐ b. grant ☐ c. cooperative agreement ☐ d. loan ☐ e. loan guarantee ☐ f. loan insurance		2. Status of Federal Action: ☐ a. Bid/Offer/Application ☐ b. Initial Award ☐ c. Post-award		3. Report Type: ☐ a. Initial/Filing ☐ b. material change For Material Change Only: year _____ quarter _____ date of last report _____	
4. Name and Address of Reporting Entity: ☐ Prime ☐ Subawardee Tier _____, if known Congressional District, if known			5. If Reporting Entity in No. 4 is Subawardee, enter name and Address of Prime: Congressional District, if known		
6. Federal Department/Agency:			7. Federal Program Name/Description: CFDA Number, if applicable		
8. Federal Action Number, if known:			9. Award Amount, if known: \$		
10. a. Name and Address of Lobbying Entity: (if individual, last name, first name, MI) (Attach Continuation Sheet(s) SF-LLL-A if Necessary)			b. Individuals Performing Services (including address if different from No. 10a) (last name, first name, MI)		
11. Amount of Payment (check all that apply): \$ _____ ☐ actual ☐ planned			12. Form of Payment (check all that apply): ☐ a. cash ☐ b. in-kind; specify: nature _____ value _____		
13. Type of Payment (check all that apply): ☐ a. retainer ☐ b. one-time fee ☐ c. commission ☐ d. contingent fee ☐ e. deferred ☐ f. other; specify: _____					
14. Brief Description of Services Performed or to be performed and Date(s) of Service, including officer(s), employee(s), or Member(s) contracted, for Payment indicated in item 11: (Attach Continuation Sheet(s) SF-LLL-A if Necessary)					
15. Continuation Sheet(s) SF-LLL-A attached: ☐ Yes ☐ No					

16: The information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of facts upon which evidence was placed by the above when this transaction was made or started into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the congress semi-annually and will be available for public inspection. Any person which fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Signature: _____
Print Name: _____
Title: _____

For Federal Use Only:

**Authorized for local reproduction
Standard Form-LLL**

Telephone No.: _____ **Date:** _____

DISCLOSURE OF LOBBYING ACTIVITIES
CONTINUATION SHEET

Approved By OMB
0348-0046

Reporting Entity: _____ Page _____ of _____

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Standard Form LLL-A

NONDISCRIMINATION IN EMPLOYMENT

(Instructions for Bidders)

By the submission of its bid, each bidder acknowledges that he understands and agrees to be bound by the equal opportunity requirements of EPA regulations (40 CFR Part 8, particularly Section 8.4(b)), which shall be applicable throughout the performance of work under any contract awarded pursuant to this solicitation. Each bidder agrees that if awarded a contract, it will similarly bind contractually each subcontractor. In implementation of the foregoing policies, each bidder further understands and agrees that if awarded a contract, it must engage in affirmative action directed at promoting and ensuring equal employment opportunity in the workforce used under the contract (and that it must require contractually the same effort of all subcontractors whose subcontracts exceed \$ 10,000). The bidder understands and agrees that "affirmative action" as used herein Shall constitute a good faith effort to achieve and maintain that amount of minority employment in the on-site workforce used on the project which corresponds, for each trade used, to the minority population in the serving labor market area from which workers are reasonably available for hire for the project.

PROPOSAL GUARANTEE BOND

KNOW ALL MEN BY THESE PRESENTS:

That we, _____
of _____ as PRINCIPAL,
and _____
of _____ as SURETY(S),
are hereby held and firmly bound unto the state of Iowa in the penal sum of:

One hundred thousand Dollars \$ 100,000.00
for the payment, whereof, the said PRINCIPAL and SURETY(S) bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The conditions of this obligation are such that whereas the PRINCIPAL is herewith submitting to the state of Iowa, acting by and through the Iowa Department of Natural Resources, hereinafter called the DEPARTMENT, its sealed proposal for a contract for the

at _____ in _____ County, Iowa.

NOW THEREFORE,
the conditions of this obligation are such that, if said proposal is rejected by the DEPARTMENT, or if said proposal is accepted by the DEPARTMENT and the PRINCIPAL shall enter into a contract in the form specified by the DEPARTMENT in accordance with the terms of the proposal and shall furnish a bond for the faithful performance of said contract in the form specified by the DEPARTMENT, this obligation shall be null and void. Otherwise it shall remain in full force and effect.

In the event that the said proposal is accepted by the DEPARTMENT and the PRINCIPAL shall fail to enter into the contract as defined herein or shall fail to furnish the performance bond as noted above within thirty (30) days of the approval of the award, the PRINCIPAL and SURETY(S) agree to forfeit to the DEPARTMENT the penal sum herein mentioned, it being understood that the liability of the SURETY(S) shall in no event exceed the penal sum of this obligation.

IN WITNESS WHEREOF,
the above bounden parties have executed this instrument under their several seals
this _____ day of _____,
_____, the name and corporate seal of each party being hereto affixed and
_____, 20 _____ these
presents duly signed by its undersigned representative pursuant to authority of its governing body.

PRINCIPAL:

If a partnership all partners must sign.

SURETY:

(Project Location)
(Project Description)
Project No.
(County), Iowa

THIS AGREEMENT, made this _____ day of, _____, 20____ by and between
the state of Iowa acting through the Department of Natural Resources hereinafter called the **DEPARTMENT** and:

_____ **located at** _____
hereinafter called the **CONTRACTOR**

WITNESSETH: That the **DEPARTMENT** agrees to pay the **CONTRACTOR** the contract price provided herein for the fulfillment of the work and the performance of the covenants set forth herein, and the **CONTRACTOR** agrees with the **DEPARTMENT** to commence and complete the project described as follows:

For the Sum of: _____ **Dollars (\$)** _____
and all extra work in connection therewith, all in accordance with the terms and conditions herein contained: and to furnish at the **CONTRACTOR'S** own proper cost and expense, all material, equipment, labor, insurance, and other accessories and services necessary to construct and complete, in a workmanlike manner, ready for continuous operation, the above mentioned project. The work shall be performed in accordance with the requirements and provisions of the following documents, all of which are made a part hereof and collectively evidence and constitute the contract:

1. Notice to Bidders.
2. Instructions to bidders.
3. DNR Standard Specifications and Current Supplemental Specifications
4. Project Specifications Including Addenda Number _____ Through _____
5. Drawings, Sheet Number _____ Through _____ Inclusive
6. Contractor's Proposal.
7. Proposal Guarantee Bond.
8. Performance Bond.
9. This Instrument.
10. Modifications or Change Orders pursuant to DNR Standard Specifications
11. Resident Bidder Preference Certification on Non-Federal-Aid Projects

The parties to this contract understand that time of completion of the work under this contract is the essence to the contract. The **CONTRACTOR** hereby agrees to commence work under this contract in accordance with Section 1108 of the DNR Standard

Specifications and to complete all the work by _____

The **CONTRACTOR** hereby agrees that liquidated damages in the amount of _____ Dollars \$ _____ shall be retained or assessed against the **CONTRACTOR** for each day and every day the completion of the work is delayed beyond the time specified herein, not as a penalty, but as a mutually agreed to, predetermined amount to reimburse the **DEPARTMENT** for salaries of engineers and reviewers, clerk hire, interest charged during the period for delays and loss of use.

It is understood that the **CONTRACTOR** consents to the jurisdiction of the courts of Iowa, to hear, determine and render judgment as to any controversy arising hereunder, and that this contract shall be governed by, and construed according to, the laws of the state of Iowa.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, in the day and year first above mentioned.

FOR THE DEPARTMENT:

Director

This contract was approved by the **NATURAL
RESOURCES COMMISSION** at its meeting held on

(Date)

FOR THE CONTRACTOR:

(Signature and Title)

(Firm)

(Address and Zip Code)

Seal if by a Corporation:

Identification Number _____

Soc. Sec. No. _____

Or Fed. I. D. No. _____

KNOW ALL MEN BY THESE PRESENTS:

That we, _____
of _____ as PRINCIPAL,
and _____
of _____ as SURETY(S),
are hereby held and firmly bound unto the state of Iowa in the penal sum of:

_____ Dollars \$ _____
for the payment, whereof, the said PRINCIPAL and SURETY(S) bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The conditions of this obligation are such that whereas the PRINCIPAL entered a certain contract, hereto attached, and made part, hereof to the state of Iowa, acting by and through the Iowa Department of Natural Resources, hereinafter called the DEPARTMENT,

dated _____ for the _____
at _____ in _____ County, Iowa.

NOW THEREFORE,

the conditions of this obligation are such that, if the PRINCIPAL shall faithfully perform the contract in accordance with the plans, specifications and contract documents, and shall fully indemnify and save harmless the state of Iowa from all cost and damage which the state of Iowa may suffer by reason of the PRINCIPAL's default or failure to do so and shall fully reimburse and repay the state of Iowa all outlay and expenses which the state of Iowa may incur in making good any such default, then this obligation shall be null and void, otherwise it shall remain in force and effect.

In the event that the PRINCIPAL is in default under this contract as defined herein, the DEPARTMENT shall by written notice inform the PRINCIPAL that this contract is in default; and may, at its option, without process or action at law:

1. Take over all or any portion of the work and complete it either by day labor or reletting the work. The DEPARTMENT may retain all material, equipment and tools on the work, at a rental which it considers reasonable, until the work has been completed.
2. Allow the surety to take over the work within fifteen (15) days and assume completion of said contract and become entitled to the balance of the contract price.
3. Allow the PRINCIPAL to complete the contract.

As required by Chapter 573 of the Code of Iowa.

1. The PRINCIPAL SURETY(S) on this bond hereby agree to pay all persons, firms or corporations having contracts directly with the PRINCIPAL or with subcontractors, all just claims due them for labor performed or material furnished, in the performance of the contract on account of which this bond is given, when the same are not satisfied out of the portion of the contract price shall have been established as provided by law.
2. Every Surety on this bond shall be deemed and held, any contract to the contrary notwithstanding, to consent without notices:
 - a. To any extension of time to the contractor in which to perform the contract.
 - b. To any change in the plans, specifications, or contract, when such changes does not involve an increase of more than 20 percent of the total contract price, and then only as to such excess increase.
 - c. That no provision of this bond or any other contract shall be valid which limits less than one year from the time of the acceptance of the work, the right to sue on this bond for defect in workmanship or material not discovered or known to the DEPARTMENT at the time such work was accepted.

No provision of this bond or any other contract shall be valid which limits to less than five years after the acceptance of the work, the right to sue on this bond for defects in workmanship or material in connection with paving or concrete work.

IN WITNESS WHEREOF,

the above bounden parties have executed this instrument under their several seals

this _____ day of _____

, the name and corporate seal of each party being hereto affixed and

_____, 20 _____ these

presents duly signed by its undersigned representative pursuant to authority of its governing body.

PRINCIPAL:

SURETY:

If a partnership all partners must sign.

This bond approved by the Iowa Department of Natural Resources this _____ day of _____, 20 _____

By: _____

Director

**IOWA DEPARTMENT OF NATURAL RESOURCES
GENERAL COVENANTS AND PROVISIONS
SECTION NO. 00700
JANUARY 1993 (Revised 12/12/2023)**

This section consists of the general provisions applying to all types of construction and maintenance as set forth in the following sections

- Part 1100. Definitions
- Part 1101. Instructions to Bidders
- Part 1102. Bidder Qualifications
- Part 1103. Award and Execution of Contract
- Part 1104. Scope of Work
- Part 1105. Control of Work
- Part 1106. Control of Materials
- Part 1107. Legal Relations and Responsibilities to the Public
- Part 1108. Prosecution and Progress
- Part 1109. Measurement and Payment

PART 1100. DEFINITIONS

1100.01 GENERAL

- A. Whenever in these specifications or in other contract documents, the following definitions, or terms or both, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:
- B. In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be done, if, as, or, when, or where “contemplated, required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable, suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned,” it shall be understood as if the expression were followed by the words “by the Engineer” or “to the Engineer.”
- C. The titles or headings of the sections and articles herein, or referred to on the plans, are intended for convenience of reference and shall not be considered as having any bearing on their interpretation.
- D. Working titles and pronouns used for any person referred to in these specifications may be used with a masculine gender for the sake of brevity and are intended to refer to persons of either sex.

1100.02 DEFINITIONS OF ABBREVIATIONS

- A. Whenever the following abbreviations are used in these specifications or on the plans, they are to be construed the same as the respective expressions represented.

AAN - American Association of Nurserymen

AAR - Association of American Railroads

AASHTO (or AASHO) - American Association of State Highway and Transportation Officials

ACI - American Concrete Institute

AIA - American Institute of Architects

ANSI - American National Standards Institute

APWA - American Public Works Association

ARA - American Railway Association

AREA - American Railway Engineering Association

ASCE - American Society of Civil Engineers

ASLA - American Society of Landscape Architects

ASTM - American Society of Testing and Materials

AWPA - American Wood Preservers Association

AWS - American Welding Society

AWWA - American Water Works Association

CFR - Code of Federal Regulations

DNR - Iowa Department of Natural Resources

DOT - Iowa Department of Transportation

EEI - Edison Electric Institute
EPA - Environmental Protection Agency
FHWA - Federal Highway Administration
FSS - Federal Specifications and Standards
IEES - Institute of Electrical and Electronics Engineers
IES - Illuminating Engineering Society
ICEA (or IPCEA) - Insulated Cable Engineers Association
MUTCD - Manual on Uniform Traffic Control Devices
NEC - National Electrical Code
NECA - National Electrical Contractors Association
NEMA - National Electrical Manufacturers Association
NFPA - National Fire Protection Association
NRC - Natural Resource Commission
SBC - State Building Code
UBC - Uniform Building Code
UL - Underwriters Laboratories, Incorporated
UMC - Uniform Mechanical Code
UPC - Uniform Plumbing Code
US - United States
USC - United State Code

B. Abbreviations may be used for materials and classes of work:

AC - Asphalt cement
ACC - Asphalt cement concrete
ATB - Asphalt treated base
BSC - Bituminous seal coat
BTA - Bituminous treated aggregate
CTG - Cement treated granular
PCC - Portland cement concrete
SAS - Soil-aggregate subbase
SLS - Soil-lime subbase

1100.03 DEFINITIONS OF TERMS

1. Acceptable Work - Work in reasonably close conformance with the contract requirements.
2. Addendum or Addenda - Changes, revisions, or clarifications of the specifications of contract documents which have been issued to prospective bidders, prior to the time of receiving bids.
3. Advertisement - The public announcements, publications, or solicitations as required by the Contracting Authority, inviting bids for work to be performed.
4. Approval of Award - The acceptance by the Contracting Authority of a bid.
5. Approximate Starting Date - A calendar day shown on the proposal on which it is anticipated, at the time of the letting, that conditions will be such as to permit the Contractor to commence work.
6. Assignment of Contract - The written agreement whereby the Contractor sells, assigns, or transfers his rights in the contract to any person, firm, or corporation.
7. Award - The execution of the contract.
8. Bidder - An individual, firm, corporation, or joint venture submitting a bid for the advertised work.
9. Bureau Chief - The individual appointed by the Iowa Department of Natural Resources as the head of the Land and Waters bureau.
10. Calendar Day - Every day shown on the calendar.
11. Change Order - A written order to the Contractor, signed by the Engineer, ordering a change which has been found necessary in the work from that originally shown by the plans and specifications. Change orders duly signed and executed by the Contractor constitute authorized modifications of the contract.
12. Channel - A natural or artificial water course.

13. Classes of Work - The divisions made for the purpose of measuring and paying for labor to be performed or materials to be furnished according to the methods of construction involved, as indicated by the items for which bids have been received for each specific contract.
14. Commencement of Work - Work will be considered commenced when the Contractor's operations are started on items of work covered by the contract documents and which require inspection, or when the Contractor notifies the Engineer, and the Engineer agrees, that the Contractor's equipment and personnel are available at the site, but his operations are prevented by weather or soil conditions.
15. Commission - The state Natural Resources Commission as constituted under the laws of the state of Iowa (which is the party of the first part in the contract, let in behalf of the State, of which these specifications are a part).
16. Commissioner - A member of the state Natural Resources Commission.
17. Contract (Also Contract Document) - The written agreement between the Contracting Authority and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to, the performance of the work, the furnishing of labor and materials, and the basis of payment. The contract includes the notice to bidders, proposal, contract form, and contract bonds specifications, supplemental specifications, special provisions, all items covered on the table of contents, plans, notice to proceed, and any change orders and agreements which are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof, all of which constitute one instrument.
18. Contract Item (Pay Item) - A specifically described unit of work for which a price is provided in the contract.
19. Contract Period (Also Contract Time) - The number of working days or calendar days allowed for completion of the contract, including authorized time extensions. In case a calendar date of completion is shown in the proposal, in lieu of or in addition to the working days, the contract shall be completed by that date.
20. Contract Sum - The aggregate sum obtained by totaling the amounts arrived at by multiplying the number of units of each class of work, as shown in the contracts by the unit price specified in the contract for that class of work.
21. Contracting Authority - The governmental body, board, commission, or officer having authority to award a contract.
22. Contractor - The individual, firm, corporation, or joint venture contracting with the Contracting Authority for performance of prescribed work.
23. Contractor Registration - The registration number issued by the Division of Labor Service, in accordance with Chapter 91C of the Code of Iowa.
24. Deficient Work - Work not in reasonably close conformance with the contract requirements, or otherwise inferior, but in the opinion of the Engineer, reasonably acceptable for its intended use and allowed to remain in place.
25. Department of Economic Development - As defined in Chapter 15, Code of Iowa.
26. Department of Labor Services - As defined in Chapter 91, Code of Iowa.
27. Department of Natural Resources (Department)- The Department of Natural Resources, as defined in Chapter 455A, Code of Iowa.
28. Department of Revenue and Finance - As defined in Chapter 421, Code of Iowa.
29. Department of Transportation -The Department of Transportation, as defined in Chapter 307, Code of Iowa.
30. Director - The duly appointed executive officer for the Department of Natural Resources.
31. Drainage Ditch -An artificially constructed, open depression, other than a road ditch, which is constructed for the purpose of carrying surface water runoff.
32. Drawings (or Plans) - The approved plans, profiles, typical cross sections, working drawings, and supplemental drawings, or exact reproductions thereof, including modifications, altered plan, revisions, and amendments, which show the locations characters dimensions, and details of the work to be done.
33. Employee - Any person working on the project, mentioned in the contract of which these specifications are a party, and who is under the direction or control, or receives compensation from, the Contractor or subcontractor.
34. Engineer - The Bureau Chief, or other authorized representative of the Contracting Authority, acting within the scope of the particular duties assigned, or of the authority given.
35. Equipment - All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and tools and apparatus necessary for the proper construction and acceptable completion of the work.

36. Extra Work - Work not provided for in the contract, as awarded, but deemed essential to the satisfactory completion of the contract within its intended scope and authorized by the Engineer. Extra work shall not include additional materials, equipment, and labor used due to natural variations in the surface and subsurface conditions, except as specifically provided for elsewhere in the contract documents.
37. Extra Work Order - A change order concerning the performance of work or furnishing of materials involving additional work. Such additional work may be performed at agreed prices, or on a force-account basis, as provided elsewhere in these contract documents.
38. Independent Contractor - Any person, firm, or corporation who contracts with the Contractor to perform a service for which the basis of payment is in terms of units of service rather than salary or wages.
39. Inspector - An employee of the Contracting Authority and who is the authorized representative of the Engineer, assigned to make detailed inspections of any or all portions of the work, or materials included in the work.
40. Instruction to Bidders - The clauses setting forth in detail the information relative to the proposed work and requirements for the submission of proposals.
41. Invitation for Bids - See Notice to Bidders.
42. Item -See Contract Item.
43. Joint Venture - Two or more individuals, firms or corporations combining any equipment, personnel or finances for the purpose of submitting a single bid.
44. Laboratory - The testing laboratory of the Contracting Authority, or any other testing laboratory which may be designated or approved by the Engineer.
45. Lands Acquired for the Work - The land area, reserved or secured by the Contracting Authority, upon which to construct the work, or where to obtain material therefrom.
46. Major Item of Work - Any contract item (Pay item) for which the original contract amount plus authorized additions is more than 10% of the total original contract sum or \$50,000, whichever is less.
47. Materials - Any substances specified for use in the construction of the project and its appurtenances.
48. Notice to Bidders - That portion of the contract documents, prepared and furnished by the Contracting Authority for the information of bidders submitting proposals, which notice specifies provisions, requirements, and instructions pertaining to the method, manner, and time of submitting bids.
49. Notice to Proceed - Written notice to the Contractor to proceed with the contract work including, when applicable, the date of beginning of contract time.
50. Official Publications - The official publications are the formal resolutions and notices relative to the proposed improvement that are required by law to be published in a prescribed manner and that have been published in accordance with the statutes relating to them. Official publications area by statutes vested with all of the force and effect of contract obligations.
51. Owner - The state of Iowa, acting through the Iowa Department of Natural Resources as constituted under the laws of the state of Iowa.
52. Performance Bond - The bond executed by the Contractor and its surety in favor of the owner, guaranteeing the faithful performance of the contract and the payment of all debts pertaining to the work.
53. Plans (or Drawings) - The approved plans, profiles, typical cross sections, working drawings, and supplemental drawings, or exact reproductions thereof, including modifications, altered plan, revisions, and amendments, which show the locations characters dimensions, and details of the work to be done.
54. Project - One or more correlated improvements which constitute the complete improvement of a designated park, recreational reserve, state monument, lake, reserve, game area, fish hatchery, parkway, or other area under jurisdiction of the Department of Natural Resources.
55. Project Engineer - The representative of the Department of Natural Resources, regardless of actual title, directly in charge of the work.
56. Proposal - The formal offer of a bidder, on the prescribed form, to perform the work and to furnish the labor and materials at the prices quoted.
57. Proposal Form - The approved form on which the Contracting Authority requires formal bids to be prepared and submitted for the work.
58. Proposal Guarantee - The security furnished by the bidder with the proposal for a project(s), as guaranty the bidder will execute the contract for the work if the proposal is accepted..
59. Reasonably Close Conformity - Reasonably close conformity means compliance with reasonable and customary manufacturing and construction tolerances where working tolerances are not specified. Where working

tolerances are specified, reasonably close conformity means compliance with such working tolerances. Without detracting from the complete and absolute discretion of the Engineer to insist upon such working tolerances as establishing reasonably close conformity, the Engineer may accept variations beyond such tolerances, as reasonably close conformity, where they will not materially affect value or utility of the work and the interest of the State.

60. Right-of-Way - The land area, the right to possession of which is secured or reserved by the Contracting Authority for road purposes.
61. Road - A general term denoting a public way for vehicular travel, including the entire area within the right-of-way.
62. Shop drawings - See "working drawings".
63. Special Provisions - Additions and revisions to the standard and supplemental specifications covering conditions peculiar to an individual project, method and manner.
64. Specifications - The requirements contained herein and in any supplemental specifications, or special provisions applying to the contract, and pertaining to the method and manner of performing the work, or to the quantity and quality of the materials to be furnished under the contract.
65. Specified Completion Date - The date specified in the proposal for completion of the work. After work has commenced or if the completion date is not specified, the last day of the contract period shall be the completion date.
66. Specified Starting Date - A calendar day shown on the proposal on which date commencement of the work is expected.
67. State - The State of Iowa acting through its authorized representative.
68. Station - One hundred lineal feet.
69. Subcontractor - Any individual, firm, or corporation to whom the Contractor, with the written consent of the Contracting Authority, sublets any part of the contract.
70. Superintendent - The Contractor's authorized representative in responsible charge of the work.
71. Supplemental Agreement - Written agreement between the Contractor and the Contracting Authority, modifying the original contract.
72. Surety - The corporation, partnership, or individual, other than the Contractor, executing a bond furnished by the Contractor.
73. Targeted Small Business - Any enterprise, located in the state of Iowa, which is operated for profits under a single management, and which is 51 percent owned, operated, and actively managed by one or more women or minority persons, and has been certified by the Iowa Economic Development Authority.
74. Unacceptable Work - Work not in reasonably close conformance with the contract requirements and ordered to be removed and replaced.
75. Unauthorized Work - Work neither contemplated by the contract documents nor authorized by the Engineer, and work done contrary to the instructions of the Engineer.
76. Work - Work shall mean the furnishing of all labor, materials, equipment, and other incidentals, as detailed in the plans, specifications, and by the Engineer, necessary or convenient to the successful completion of the project and the carrying out of all the duties and obligations imposed by the contract.
77. Work Order - A written order, signed by the Engineer, of contractual status, requiring performance by the Contractor without negotiation of any sort, and which may involve starting, resuming, or the suspension of work. (Not to be confused with extra work order.)
78. Working Day - Prior to commencement of work, beginning on the date designated in the notice to proceed or beginning on the specified starting date, or as soon thereafter as provided in the specifications, a day other than Saturday, Sunday, or another recognized legal holiday. Any weekdays exclusive of Saturdays, Sundays, or recognized legal holidays on which weather or other conditions not under control of the Contractor, will permit construction operations to proceed for not less than 3/4 of a normal workday in the performance of a controlling item of work. If such conditions permit operations to proceed for at least 1/2 but less than 3/4 of the normal working hours, 1/2 of a working day will be counted. The days counted will exclude Saturdays, Sundays, and recognized legal holidays the Contractor does not work, but will include Saturdays, Sundays, and recognized legal holidays the Contractor does work. Nonproductive work that does not require inspection may be done on Saturdays with no time charged. Working days will not be charged for the day before or after a holiday when the contract documents specifically prohibit work and the Contractor does not work. Working days will not be

counted during periods of suspension of work ordered by the Engineer, except when the suspension is a result of a violation of terms of the contract.

79. Working Drawings - Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval. Also referred to as "shop drawings". After approval by the Engineer the working drawings became a part of the plans.

PART 1101. INSTRUCTIONS TO BIDDERS

1101.01 GENERAL

- A. These instructions are intended to serve as a guide to the requirements with which the bidder must comply prior to and in submitting a proposal, including various "conditions" affecting the award of the contract. They do not in themselves inform the bidder of all the requirements that must be complied with under the contract.
- B. The time for bid openings shall be the prevailing Central Standard or Daylight Savings time in force at Des Moines, Iowa on the date set forth in the Notice to Bidders.
- C. Before submitting a bid, the bidder shall examine all the drawings and specifications enumerated in the table of contents of this project manual. The successful bidder will be required to do all the work that is shown on the drawings, mentioned in the specifications, or reasonably implied as necessary to complete this contract.
- D. The bidder shall visit and examine the site to become acquainted with the adjacent areas, means of approach to the site, conditions of the actual job site, and the facilities for delivering, storing, placing, and handling of materials and equipment.
- E. Failure to visit the site or failure to examine any and all contract documents will not relieve the successful bidder from the necessity of furnishing any materials or equipment, or performing any work that may be required to complete the work, in accordance with the drawings and specifications. Neglect of the above requirements will not be accepted as reason for delay in the work or additional compensation.

1101.02 DRAWINGS AND SPECIFICATIONS

- A. The drawing and specifications, which are part of this contract, are enumerated in the table of contents of this project manual.
- B. It is the responsibility of the bidder to examine the plans, proposal form, specifications, supplemental specifications, special provisions, the site of the works and the state of the work of other contractors on the project to assure that all requirements of the contract and the plans are fully understood. It is the bidder's responsibility to satisfy herself/himself as to the nature of the work and all reasonably ascertainable conditions that may affect his/her performance under the contract.

1101.03 INTERPRETATION

- A. Nonverbal explanation or instructions will be given in regard to the meaning of the drawings or specifications during the bid period. Bidders shall bring all inadequacies, omissions, or conflicts to the Engineer's attention, at least ten days before the date set for the bidding. Prompt clarification will be supplied to all bidders of record by addendum.
- B. Neither the Department of Natural Resources nor the Engineer will be responsible for verbal instructions.
- C. Failure to request clarification or interpretation of the drawings and specifications will not relieve the successful bidder of responsibility. Signing of the contract will be considered as an implicit indication that the Contractor has thorough understanding of the scope of the work and comprehension of the contract documents.

1101.04 CONTENTS OF PROPOSAL FORMS

- A. Bidders will be furnished with proposal forms stating the location and description of the proposed work, the approximate quantities of work to be performed or materials to be furnished, the form and amount of the required proposal guarantee, and the contract period.
- B. The statement, "By virtue of statutory authority, preference will be given to products, provisions grown and coal produced within the state of Iowa where applicable," which is on the face of the proposal form shall not be applicable to contracts involving Federal-aid participation in construction.
- C. The following bidding and letting regulations shall apply to all construction projects for which the Department receives bids.

1. Contracts will be recommended for approval for award on the basis of the greatest total savings in the public interest. The determination of which projects are to be awarded will be based on the approval by the appropriate Commission or other contracting agency.
2. Contractors shall not be permitted to tie projects or to designate on the bidding proposal the limit of the amount they will accept.

1101.05 PREPARATION OF PROPOSALS

- A. Only signed proposals, submitted on forms furnished by the Contracting Authority, will be considered, and the bidder will be assumed to have familiarized himself with the requirements of all applicable contract documents. To insure consideration, the bidder shall specify a unit price in figures for each pay item for which a quantity is given and shall also show the products for the respective unit prices and quantities, written in figures in the column provided for the purposes and the total amount of the proposal obtained by adding the amounts of the several items. All the unit price figures shall be in ink or typed. If there is a discrepancy between unit bid prices, extensions, or total amounts of bid, the unit bid prices shall govern.
- B. If the proposal is made by a partnership or corporations the name of the partnership or corporations its agents and its principal place of business shall be shown. The proposal shall be signed by an authorized agent of the partnership or corporation.
- C. If the proposal is made on the basis of a joint bid, the proposal shall be signed by each of the joint bidders, or in the case of a firms' partnerships or corporations by an authorized agent for such firms' partnerships or corporations and the principal place of business for each shall be shown.
- D. By signing and submitting the proposal, the bidder gives an unsworn declaration on behalf of each person, firm, association, partnership, or corporation submitting a proposal, certifying that such person, firm, association, partnership, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with such contract, and is not under debarment currently by the Federal government for a criminal violation which is reasonably related to bidding and contracting procedures.
- E. The attention of the bidders for the work covered by a proposal and referred to as this work, is directed to the fact that contracts for work other than the work covered in this proposal may have been awarded, are being advertised for letting on the same date as this work, or may be awarded in the future.
- F. Completion of work covered by this proposal may be contingent upon certain work covered by other contracts being performed on the project in advance of this work, likewise, completion of work covered by other contracts may be dependent upon completion of work covered by this proposal.
- G. The contract documents will list types of work involving other contracts anticipated to be let on the same letting date or same time within the contract period anticipated for this work. The contract documents will also list other governmental agencies, railroads, utilities, or other parties who will have work with which it is known that this work must be coordinated.
- H. The bidder is expected to be familiar with work already in progress or previously let on this project, the contract periods, the progress being made, and any other conditions regarding that work which may affect his/her bid or his/her performance under this contract.
- I. Cooperation and coordination of all contractors and other agencies authorized to do work on the project will be required.
- J. The bidder for this work acknowledges these facts and agrees that it is in the public interest to have the work of certain contracts and agencies performed concurrently rather than consecutively. The bidder further agrees to cooperate and coordinate his work with that of other contractors or agencies to the mutual interest of all parties doing work on the project, whether by contract with the State, County, or City or necessary work being done by governmental agency or utility force.
- K. By the submission of a bid on this works the bidder acknowledges and agrees that an investigation and inquiry has been made regarding the contracts for work with which this work must be coordinated.
- L. In the event disputes arise between contractors or other agencies, or both, doing work on the project as to their mutual rights or obligations, the Contracting Authority or its authorized representative will, when requested to do so or upon his own motion, act as referee and define the rights of all interested parties with regard to the conduct of the work, which decision shall be final as provided in 1105.01.

- M. If a prospective bidder, for a project for which the Department is the Contracting Authority, is in doubt as to the true meaning of any part of the contract documents, he may submit to the Contracting Authority a request for additional information, explanations, or interpretations. Interpretations may be in the form of an addendum to the proposal. The Contracting Authority will not be responsible for any information, explanation, or interpretation from any other source.

1101.06 IRREGULAR PROPOSALS

- A. Proposals will be considered irregular, and may be rejected, for any unauthorized changes in the proposal form or for any of the following reasons:
1. If on a form other than that furnished by the Contracting Authority, or if the form is altered or any part thereof is detached.
 2. If there are unauthorized additions, conditional or alternate bids, or irregularities of any kind which may tend to make the proposal incomplete, indefinite, or ambiguous as to its meaning.
 3. If the bidder adds any provisions reserving the right to accept or reject an award because he is low bidder on another project in the same letting,
 4. If the bidder adds any provisions reserving the right to accept or reject an award or to enter into contract pursuant to an award.
 5. If a bid on one project is tied to a bid on any other project, except as specifically authorized on the proposal form by the Contracting Authority,
 6. If the proposal does not contain a unit price for each pay item listed, except in the case of authorized alternate pay items.

1101.07 ESTIMATE OF QUANTITIES

- A. For all work let on a unit price basis, the Engineer's estimate of quantities, as shown in the notice to bidders and the proposals is understood to be approximate only, and will be used only for comparing bids except as otherwise provided in the basis of payment for the various classes of work.

1101.08 SUBMISSION OF PROPOSALS

- A. All proposals shall be submitted on the standard proposal form prepared specifically for this project. An example of which is bound in this specification volume. Only proposals which are submitted on this form will be considered.
- B. One copy of the proposal shall be submitted.
- C. No proposal for any subdivision or any subclassification of the work, except as indicated, will be accepted. Any conditional bid, amendment to the proposal form, or the inclusion of any correspondence, written or printed matter, or details of any essential provision of the contract documents, or required consideration of unsolicited material or data in determining the award of the contracts will disqualify the proposal.
- D. The bid amounts shall be inserted in the spaces provided on the proposal form, setting forth clearly and concisely, all designations and prices. Erasures or other changes on the proposal form must be explained or noted over the signature of the bidder.
- E. Addenda issued during the time of bidding shall become part of the contract documents. Bidders shall acknowledge receipt of each addendum in the appropriate space provided on the proposal form. If no addenda are issued, the word "none" is to be entered in the space provided.
- F. When samples are required, they must be submitted by the bidder so as to arrive at the designated office prior to the hour set for opening the proposals. Samples shall be furnished free of expense to the Department of Natural Resources, properly marked by identifications and accompanied by a list when there is more than one sample. The Department of Natural Resources reserves the right to mutilate or destroy any samples submitted whenever it may be considered necessary to do so for the purpose of testing. Samples not so mutilated or destroyed, when no longer required to be retained in connection with the award or delivery of supplies, will be returned at the bidder's expense, if such return is requested in the proposal.
- G. All proposals must state the full business address of the bidder and be signed with the bidder's usual signature. Proposals by partnerships must state the full names of all partners and must state the name of the partnership followed by the signature and designation of one of the members of the partnership or an authorized representative. Proposals by corporations must state the legal name of the corporation and the name of the

state of incorporation followed by the signature and designation of the president, secretary, or other person authorized to bind the corporation to the proposal. Contractors are required to include the Iowa Contractors registration number assigned to them by the Iowa Division of Labor Services. The name of each person signing the proposal shall be typed or printed below the signature.

- H. A proposal by a person who affixes to their signature the word “president”, “secretary”, “agent”, or any other designation without disclosing their principals may be held to be the proposal of the individual whose name is signed thereon. When requested by the Department of Natural Resources, satisfactory evidence of the authority of the officers signing in behalf of the corporation shall be furnished.
- I. Proposals shall be submitted via email to the address specified in the Notice to Bidders. The subject line of the email containing the proposal and proposal guarantee must state the following: Project Number, Project Title, and the Bid Date. The bidder shall be responsible for emailing the proposal, with the proposal guarantee, on or before the date and time specified in the Notice to Bidders. The officer whose duty it is to open the proposal will decide when the specified time has arrived. Proposals received thereafter will not be considered. The Department shall notify the bidder in the event that a bid is determined to be late.
- J. No bidder shall submit more than one proposal for identical work for the same project.

1101.09 WITHDRAWAL OF PROPOSALS

- A. Proposals may be withdrawn by written or telegraphic request received from the bidder or authorized representative prior to the time fixed for opening of bids, without prejudice to the right of the bidder to file a new proposal. No proposals may be withdrawn by telephone request. Withdrawn proposals will be returned unopened. Negligence on the part of the bidder in preparing the proposal confers no right for withdrawal of the proposal after it has been opened.

1101.10 TAXES

- A. The bidder shall include in the proposal all applicable federal and state taxes required by law. See Sales Tax Exemption below.
- B. For the purposes of retail sales tax and use tax, general construction contractors, special construction contractors, and construction subcontractors are regarded as consumers or users of all tangible personal property which they purchaser acquire, or manufacture for use in complying their respective construction contracts.
- C. Iowa retailers making sales, within the state of Iowa, of tangible personal property to a construction contractor for such use, are making sales at retail, the receipts of which are subject to retail sales tax. This means that a construction contractor should pay retail sales tax to his Iowa suppliers when purchases of tangible property are made within the state of Iowa. If a Contractor uses tangible personal property in completing the constructions which the Contractor has manufactured or fabricated, the tax will be 5% of the cost of manufacture.
- D. This likewise means that any construction contractor purchasing, acquiring, or manufacturing tangible personal property outside the state of Iowa, for such use in Iowa, owes use tax on such out-of-state purchases, measured at the rate of 5% of the purchase prices or in the case of a product manufactured by the Contractor, the Contractor owes 5% of the cost of manufacture.
- E. The use tax is to be paid by the Contractor directly to the Iowa Department of Revenue and Finance, using the retailer’s sales and use tax return, unless the out-of-state vendor from whom purchased is registered with the Use Tax Section of the Iowa Department of Revenue and does bill and collect the Iowa Use Tax for the state.
- F. In accordance with Iowa Code Section 423 , the DEPARTMENT will issue a Sales Tax Exemption Certificate to the CONTRACTOR, and each approved subcontractor, which will permit the material suppliers to sell material which will becomes an integral part of the structure exempt from Iowa sales tax and some applicable local option taxes and school infrastructure local option sales taxes.
- G. The CONTRACTOR is responsible for keeping records identifying the materials and supplies purchased and verifying they were used as an integral part of the structure governed by this Contract. Any material purchased tax free and not used on this project are subject to taxes payable within the same quarter as the project completion date.
- H. The Sales Tax Exemption Certificate must not be used to claim exemption for tax items not used on this project or that does not qualify for exemption under the provisions of the Iowa Code Sections listed above. Such misuse will result in civil or criminal penalties.

- I. Bidders should anticipate that the sale and use tax could increase the cost of non-exempted services and material by at least 5% and make the necessary allowance before submitting a bid.
- J. The Department will reclaim sales taxes, after receiving a Contractor's Statement of Sales Tax for those projects for which a Tax Exemption Certificate was not issued.

1101.11 WORK BY THE DEPARTMENT OF NATURAL RESOURCES

- A. Unless specifically provided in the contracts the Department of Natural Resources will not furnish any labor, materials, or supplies necessary to complete the work under this contract.

1101.12 PREFERENCE FOR LABOR AND MATERIALS

- A. The Contractor shall observe all of the laws of the state of Iowa with regard to preference for labor and materials, except that preference for Iowa labor and materials shall not apply when federal funding is to pay for any part of the project. When a project is federally funded it is indicated in the notice to bidders.

1101.13 PROPOSAL GUARANTEE

- A. All proposals submitted by bidders must be accompanied by a proposal guarantee in the form of a certified check, cashier's check, or a proposal guarantee bond prepared on the standard proposal guarantee bond form furnished to the bidder by the Department of Natural Resources, an example of which is bound in this specification volume.
 - 1. The proposal guarantee shall be made payable to the Department of Natural Resources in the amount specified in the Notice to Bidders and on the proposal form.
 - 2. If the bond form is utilized in lieu of certified check or cashier's checks it must be executed by a surety company authorized by the Commissioner of Insurance for the state of Iowa to do business in Iowa and which has filed its certificate of authority with the Clerk of Court. One copy of the proposal guarantee bond form is furnished by the Department of Natural Resources with the contract documents. Only one executed copy must be submitted with the bid proposal.
- B. Any bid which is not accompanied by a proposal guarantee will be considered no bid and will not be read at the bid opening.
- C. All proposal guarantees submitted by unsuccessful bidders will be returned as stated in Section 1103.03 of the General Covenants and Provisions.

1101.14 AWARD OF THE CONTRACT

- A. It is the intent of the Owner to award a contract to the lowest responsible Bidder provided the Bid has been submitted in accord with the requirements of the Bidding Documents, is judged reasonable, and does not exceed the funds available. Award of this contract will be at the place and at the time of the regularly scheduled meeting of the appropriate commission of the Department of Natural Resources following the opening of the proposals, except for reasonable delays as provided in Section 1103.02 of the General Covenants and Provisions.
- B. The Department of Natural Resources reserves the right to reject all bids or any proposal or to waive informalities in any proposal or to accept any proposal which will best serve the interests of the state of Iowa.
- C. If, at the time this contract is to be awarded, the lowest proposal submitted by a qualified responsible bidder is in the best interest of the state of Iowa, the contract will be awarded, and the bidder to whom the award is made will be promptly notified after the Department of Natural Resources meeting.
- D. The Owner shall have the right to accept Alternates in any order or combination and to determine the low bidder on the sum of the Base Bid and the Alternates accepted.

1101.15 EXECUTION OF THE CONTRACT

- A. The successful bidder shall, within thirty calendar days after the date of the award of the contract, enter into a written contract with the Department of Natural Resources on the forms furnished by the Department for the performance of the awarded work.

1101.16 PERFORMANCE GUARANTEE BOND

A. Simultaneously with delivery of the signed contract, the Contractor shall furnish a performance guarantee bond prepared on the standard performance guarantee bond form furnished to the Contractor by the Department of Natural Resources, an example of which is bound in the specification volume.

1. The bond must be executed by a surety company authorized by the Commissioner of Insurance of the State of Iowa to do business in Iowa and which has filed its Certificate of Authority with the Clerk of Court.
2. A copy of the performance guarantee bond form will be attached to a copy of the contract furnished by the Department to the Contractor after award of the contract. One executed copy of the bond must be returned to the Department with the signed contract, one copy of the bond may be retained by the surety company for its own records.

1101.17 CERTIFICATE OF INSURANCE

- A. On or before execution of the contracts the Contractor shall furnish to the Department a certificate of liability and property damage insurance.
 1. The bidder is directed to examine the insurance coverage limits section of this specification volume to determine the coverage limits which apply to this project. Insurance certificates furnished to the Department of Natural Resources showing inadequate limits of coverage will be rejected, thus delaying final execution of the contract. See Sections 1103.04, 1107.02, and 1107.03 of the General Covenants and Provisions.

1101.18 COMMENCEMENT AND COMPLETION

- A. The Contractor shall not commence work before the preconstruction meeting to be held after execution of the contract by all parties. The Contractor will be responsible for contacting the project Inspector to set up a time for the preconstruction meeting at the project site.
- B. The Contractor must agree to complete the work by the date specified, or within the number of working days indicated if so specified in the contract. Should it be found impossible to complete the work on or before the time specified for completion, a written request may be submitted for a time extension, setting forth the reasons believed to justify the granting of such requests.

1101.19 APPEAL OF CONTRACT AWARD

- A. If a Contractor who submitted a timely proposal disagrees with an award decision, it may appeal that decision by submitting a written appeal to department's director or the director's designee detailing the factual and legal basis for the challenge within five calendar days of the Notice of Intent to Award. The Issuing Officer may submit a written response to the Contractor's written appeal within five business days after receipt of the appeal. The department's director or designee will issue a written decision within seven business days of receipt of the Issuing Officer's written response.

PART 1102. BIDDER QUALIFICATIONS

1102.01 COMPETENCY AND OF BIDDERS

- A. Bidders submitting proposals must be recognized contractors, engaged in the class of work provided for in the plans and specifications, and must possess sufficient resources to complete the work. Before the contract is awarded, the bidder may be required to furnish evidence to the satisfaction of the Contracting Authority of the ability to perform and complete the contract.

1102.02 QUALIFICATIONS OF THE BIDDER

- A. Before award of the contract can be approved, the Department shall be satisfied that the bidder involved:
 1. Maintains a permanent place of business.
 2. Has adequate equipment to do the work properly and expeditiously.
 3. Has suitable financial status to meet the obligations incident to the work.
 4. Has appropriate technical experience.
 5. Has satisfactorily completed past projects.
 6. Is not ineligible due to discrimination in employment.

- B. The Engineer will make such investigations as deemed necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Engineer all such information and data for this purpose as the Engineer may request.
 - 1. The Department of Natural Resources reserves the right to reject a bid if the evidence submitted by, or an investigation of, such bidder fails to satisfy the Department of Natural Resources that the bidder is responsible and qualified to carry out the obligations of the contract and to complete the work contemplated therein.
- C. Targeted Small Business set-aside projects.
 - 1. All contractors submitting proposals for set-aside projects shall meet the "Targeted Small Business" definitions and be capable of being certified by the Iowa Economic Development Authority within thirty (30) days after the bid letting date. Failure of the low bidder to become certified within this time will be just and sufficient cause for the denial of the award.
 - 2. Contractors eligible for "Targeted Small Business" designation, but not currently certified as such by the Department of Inspections and Appeals, should do so immediately by contacting the Targeted Small Business Officer, Lucas State Office Building, Des Moines, Iowa 50319 -0083.

1102.03 REDUCTIONS IN BIDDER QUALIFICATIONS RESTRICTIONS

- A. The requirements and conditions for bidder qualifications may be reduced by the Contracting Authority either for contractors who have well established performance records in other fields or for contractors having adequate financial responsibility and experienced supervisory personnel available for the work that is under consideration or for both the above reasons.
- B. Likewise, the requirements may be modified by the Contracting Authority for newly formed or reorganized firms or corporations whose basic organization is composed of individuals who are veterans of the construction industry, with proven records of satisfactory performance in the field in which they have elected to bid, provided, however, that they have adequate financial responsibility, equipment, and available experienced supervisory personnel.

1102.04 IMPOSITION OF INCREASE IN BIDDER QUALIFICATION REQUIREMENTS, SUSPENSIONS AND DISQUALIFICATION

- A. The requirements and conditions for bidder qualification in 1102.01 may be imposed or re-imposed or increased, or a contractor may be suspended or disqualified.
- B. The requirements and conditions for qualifications of a contractor may be imposed or re-imposed or increased if or when:
 - 1. The Contractor seriously delays commencement or completion of any work within the contract period or any extension thereof under circumstances that would normally give rise to a right of the Contracting Authority for liquidated damages or declaration of defaults or;
 - 2. The Contractor does any act or omits doing or performing any act which, in the judgment of the Contracting Authority, evidences a material change in the contractor's financial responsibility or work capability where, in the judgment of the Contracting Authority, the same will materially prejudice the contractor's ability to successfully prosecute such public improvement contracts, or he knowingly submits false information concerning prequalification, or;
 - 3. The Contractor takes or fails to take any action which the Contracting Authority deems to warrant an imposition of increase in bidder qualification requirements.
- C. A contractor may be suspended from bidder qualification if or when:
 - 1. The Contractor continually fails or refuses to remove and replace materials or work found by the Engineer not to be in reasonably close conformity with the contract documents or to correct such material or work so as to cause such materials or finished product to be reasonably acceptable work, or;
 - 2. The Contractor continually and, in the judgment of the Engineer, without good cause therefor, fails to carry on the work in an acceptable manner, or refuses to comply with a written order of the Engineer within a reasonable time, or;
 - 3. The Contractor fails to perform with his own organization the work as required in 1108.01, or otherwise assigns or disposes of work or the contract or any part thereof without approval of the Contracting Authority, or;

4. The Contractor forfeits a proposal guaranty and fails to enter into the contract upon an offer of award by the guarantee Contracting Authority in response to a prior advertisement for bids for the same project for which award is currently being considered, or;
 5. The Contractor fails to comply with nondiscrimination requirements of the Standard Specifications or Special Provisions, or;
 6. The Contracting Authority deems a suspension is appropriate for reasons stated in Paragraph A, above.
 7. The Contractor is debarred from doing work for the federal government.
 8. The Contractor knowingly submitted false or misleading information concerning qualifications.
- D. A suspension is intended to be for an indefinite period of time or, in the case of Paragraph C4, for a specific project. A suspension shall continue until the contractor resolves, to the satisfaction of the Contracting Authority the problem for which the suspension was made.
- E. A contractor may be disqualified from bidder qualification if or when:
1. Currently debarred by some other state or Federal agency, or;
 2. Subcontracts, employs, or otherwise uses services, for work of the Contracting Authority, of one who is debarred by the Contracting Authority or disqualified according to Paragraph 1, except to fulfill agreements for work on existing contracts, or;
 3. Is convicted of or pleads guilty or nolo contendere to a charge of engaging in any conspiracy, combination, or other unlawful act in restraint of trade or of similar charges in any Federal court or a court of this or any other state, or;
 4. Has offered or given gifts or gratuities to employees of the Contracting Authority in violation of State law or has had his employee a person who was at that time also an employee of the Contracting Authority, or;
 5. The Contracting Authority deems a disqualification is appropriate for reasons stated in Paragraph C above.
- F. A disqualification is intended to be for a specified time. A disqualification shall not exceed 36 months. The Contracting Authority will issue a written notice of any intent to disqualify or suspend a contractor, except when suspended for a specific project according to Paragraph C4.
- G. Should the Contractor believe that the increase in bidder qualification requirements, intended suspensions or intended disqualification is based on false, biased, or incomplete information or that the increase or intended action is severe or unwarranted, the Contractor may make a written request to the Contracting Authority for an opportunity to be heard in a contested case pursuant to Chapter 17A, Code of Iowa.
1. If notice is given, the written request for a hearing must be filed with the Contracting Authority within 10 days of receipt of the notice of intended agency action.
 2. If the basis of the intended disqualification is a criminal violation which is reasonably related to bidding and contracting procedures, the intended disqualification may be applied to the organization, including a person, firm, association, partnership, or corporation, to an affiliated officer, representative, or employee thereof, and to any other such organization in which the organization or affiliate or the officer, representative, or employee has an interest as either officer or owner.
- H. When a notice is given or when any action is contested, the Contracting Authority will issue a notice of the final action taken.

1102.05 FOREIGN CORPORATIONS

- A. Before entering into a contract involving construction or maintenance work, corporations organized under the laws of any other state shall file with the Contracting Authority a certificate from the Secretary of State of the State of Iowa showing that they have complied with all of the provisions of Chapter 489 Code of Iowa, governing foreign corporations. For contracts involving only the furnishing of materials, the foregoing requirement does not apply.
- B. When a contract not involving federal-aid participation for a public improvement is to be awarded to the lowest responsible bidder, a resident bidder shall be allowed a preference over a nonresident bidder from a state or foreign country which gives or requires a preference to bidders from that state or foreign county. The preference is equal to the preference given or required by the state or foreign country in which the nonresident bidder is a resident.
- C. If another state or foreign country has a more stringent definition of a resident bidder, the more stringent definition is applicable to bidders from that state or foreign county.

- D. Any joint venture that includes a nonresident bidder will be considered nonresident, and the preference rule will be used.

1102.06 INCOME TAX DEDUCTION ON NON-RESIDENT CONTRACTORS

- A. Each nonresident person or firm doing business as an individual and each nonresident co-partnership will be required, as precedent to receiving an award, to file a certificate issued by the State Tax Commissions as provided in Section 422.17, Code of Iowa, releasing the Contracting Authority from withholding any and all sums required by the provisions of Section 422.17, Code of Iowa.

PART 1103. APPROVAL FOR AWARD AND AWARD OF THE CONTRACT

1103.01 CONSIDERATION OF BIDS

- A. The Contracting Authority reserves the right to waive technicalities and to reject any or all proposals. Bidders may be denied a contract award for any one of the following reasons:
1. For failure to meet the Contracting Authority's requirements for qualification of bidders, as set forth in Section 1102.02 and in the special provisions for the project.
 2. For failure to maintain satisfactory progress on work already under contract.
 3. For failure to meet promptly financial obligations undertaken in connection with other work under contract.
 4. For filing more than one proposal at any letting for the same work under the same or different names.
 5. For an unsatisfactory record of performance and cooperation on previous contracts.
 6. For submitting an obviously unbalanced bid.
 7. For having sublet or otherwise assigned work without the approval of the Contracting Authority.
 8. For forfeiture of a proposal guarantee and failure to enter into contract upon an offer of an award by the Contracting Authority in response to a prior advertisement for bids for the same project or any combination of projects involving the project for which award is currently being considered.
 9. For failure to file and maintain with the Contracting Authority a current Certificate of Insurance meeting the requirements of 1107.02.
 10. For failure to provide a current Iowa contractor's registration number according to the provisions of Chapter 91C of the Code of Iowa.

1103.02 APPROVAL FOR AWARD

- A. In the approval for award of contracts consideration will be given not only to prices bid but also to the mechanical and other equipment available to the bidders the financial responsibility of the bidders and his ability and experience in performance of like or similar contracts.
- B. Approvals for award will be made as promptly as practical after bids have been opened and read. The Contracting Authority reserves the right to delay the approval for award for such time as is needed for consideration of bids and for receipt of concurrence in recommended approvals for award from other governmental agencies whose concurrence may be required.

1103.03 RETURN OF PROPOSAL GUARANTEE

- A. Original submissions of proposal guaranties will be returned to the unsuccessful bidders by mail promptly after the approval for award has been made. Return to the successful bidder will be made promptly after the filing of the contract documents.

1103.04 CERTIFICATE OF INSURANCE

- A. The Contractor's certificate of liability and property damage insurance described in 1107.02 shall be filed with the Contracting Authority on or before the execution of the contract and shall be maintained throughout the prosecution of the work and until final acceptance and completion of the contract. A separate verification shall be required for contracts awarded on the basis of joint bids.

1103.05 REQUIREMENT OF CONTRACT BOND

- A. In compliance with Section 573 of the Code of Iowa, the Contractor shall, at the request of the Contracting Authority, on all contracts amounting to twenty-five thousand (\$25,000.00) dollars or more, file an acceptable bond in an amount not less than 100 percent of the contract sum with the Contracting Authority.

1. The bond shall be executed on the standard form provided by the Contracting Authority.. This bond shall be held to cover all work included in the contracts whether performed by the Contractor or under a subcontract or assignment. The bond shall be executed by the Contractor and by a surety company authorized to do business in the state of Iowa.
 2. The Contractor shall not begin work on any contract before he is notified, in writing, that the required bond has been approved and accepted, or until the signed contract is returned to him.
- B. Prime contractors that are certified through Iowa Iowa Economic Development Authority as a Targeted Small Business may request a performance bond waiver.
1. The waiver shall be applied only to a prime contract where the project does not exceed \$50,000.00, not withstanding Section 573.2 of the Iowa Code.
 2. The waiver shall only apply to those contractors which are able to demonstrate the inability of securing a bond because of a lack of experience.
 3. A waiver shall not apply to business with a record of repeated failure of substantial performance or material breach of contract in prior circumstances. The granting of a waiver shall in no way relieve the business from its contractual obligations and shall not preclude the Contracting Authority from pursuing any remedies under the law upon default or breach of contract.

1103.06 EXECUTION OF CONTRACT

- A. The bidder to whom a contract is being awarded shall execute and file such contract with the Contracting Authority.

1103.07 FAILURE TO EXECUTE CONTRACT

- A. Unless the time limit is modified by Special Provisions, failure to execute a contract and file an acceptable bond within 30 days of the date of the approval for award herein provided, will be just and sufficient cause for annulment of the approval for award and for forfeiture of the proposal guarantee to the Contracting Authority.

1103.08 SUBCONTRACTORS

- A. The bidder to whom a contract is being awarded shall file a list of subcontractors with the Contracting Authority within 30 days of the date of the approval for award. All subcontracts must comply with the provisions of 1106.01.

1103.09 MATERIAL SUBSTITUTION

- A. The bidder to whom a contract is being awarded shall file all requests for materials substitutions within 30 days of the approval of award of the contract.

PART 1104. SCOPE OF WORK

1104.1 INTENT OF PLANS AND SPECIFICATIONS

- A. The intent of the plans and specifications is to provide for the construction and completion of every detail of the work described therein. It shall be understood that the Contractor shall furnish all labor, material, tools, transportation, and supplies required for all or any part of the work to make each item complete in accordance with the spirit of the contract. It is understood that the apparent silence of the specifications as to any detail or the apparent omission of a detailed description concerning any point shall be regarded as meaning that only the best general practice is to prevail and that only materials and workmanship of the first quality are to be used.
- A. For the purpose of design and the preparation of the Engineer's estimate, the Contracting Authority or its representatives may perform a reasonable amount of exploratory work to gain information relative to surface and subsurface conditions relating to types of soils moisture content, and types and extent of rock strata.
1. This information, when shown on the plans, represents a summary of conditions as of the date the survey was made, it is only an approximate estimation of the site conditions made merely to be suggestive to the Contracting Authority of construction conditions and quantities and classes of work. This information may be used as the bidder sees fit. The appearance of this information on the plans or specifications will not constitute a guarantee that conditions other than those indicated will not be encountered at the time of construction.

2. The bidder is advised that all information concerning the project, compiled by the Contracting Authority preceding the design, is available for examination at the Contracting Authority's headquarters. The prospective bidder shall conduct an examination as provided in 1102.06 to satisfy himself as to the character of the work to be done, the probable construction conditions, and any other reasonably ascertainable conditions and the potential effect these could have on the performance of work under the contracts which shall be the basis for the bid to be prepared.
- B. Any bidder interested in the work is authorized to make whatever additional investigation he considers advisable. In making such additional investigation, the bidder is directed to the Engineer for information relating to available right-of-way. If there are, at that time, any parcels of land over which the Contracting Authority does not have jurisdiction, right-of-entry must be secured by the prospective bidder from those authorized to grant such permission.
 1. All such additional investigation work shall be performed without costing or obligating the Contracting Authority in any way.

1104.02 SPECIAL WORK

- A. Any conditions not covered by these Standard Specifications are stated in the Special Provisions.

1104.03 INCREASED OR DECREASED QUANTITIES

- A. The Contracting Authority reserves the right to make such increase or decrease in the quantities of the work shown on the plans as may be considered necessary to complete fully and satisfactorily the construction included in the contract. The compensation to the Contractor for such changes will be as provided in 1109.04.
- B. Except as provided in 1109.05, no significant change in quantities, as defined in 1109.17, shall be made by increasing or decreasing the project area to be improved as shown on the plans and described in the proposal forms unless the Contractor gives written consent to such increase or decrease. However, such consent will not be required for maintenance or restoration work ordered by the Engineer.
 1. For the purpose of this article a material change shall be defined as an increase or decrease of more than 20 percent in the measured quantity of any item in the contract.

1104.04 EXTRA WORK

- A. The Contracting Authority reserves the right to order, in writing, the performance of work of a class not contemplated in the proposal but which may be considered necessary to complete satisfactorily the work included in the contract. Such extra work will be paid for as provided in 1109.04B.

1104.05 MAINTENANCE OF DETOURS

- A. Unless so required by the plans or the special provisions, the Contractor will not be required to assume any responsibility in connection with the maintenance or marking of suitable detours.

1104.06 REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS

- A. The contractor for bridge and culvert work shall remove any existing structure, or part of structure, that in any way interferes with the new construction. If specific payment for such work has not been provided in the contract, it will be paid for as extra work.
- B. The contractor for road work shall remove any materials or structures found on the right-of-way which are not designated to remain in place or which have not been designated for use in the new construction.
 1. The removal and disposal of pipe culverts will not be paid for directly but shall be considered as incidental works and the cost of such removal and disposal shall be considered to be included in the contract price for other items. Pipe culverts designated for salvage shall be removed by methods that will cause a minimum of damage to the pipe culverts.
 2. The removal and disposal of bridges or other masonry or monolithic concrete construction will be paid for. If the contract does not contain an item for such work, it will be paid for as extra work.

1104.07 RIGHTS IN AND USE OF MATERIALS FOUND ON THE RIGHT-OF-WAY

- A. Unless stated to the contrary in the contract documents, all materials, such as stone, gravel, sand, timber, and structures or parts of structures, found on the right-of-way or on land acquired for the work, are the property of the Contracting Authority or the owner of the fee title to the land.
 - 1. If such materials are to be removed but use or salvage is not designated on the plans, they shall become the property of the Contractor, and shall be disposed of by the Contractor.
 - 2. When the Contractor is permitted to use materials found on the right-of-way, any excavations that are made below the grade elevations shall be backfilled with other suitable materials so that the finished road conforms to the grade shown on the plans. No extra compensation will be allowed for such backfilling.

1104.08 FINAL CLEANING UP

- A. Before final acceptance of the work, the Contractor shall remove all unused material and rubbish from the site of the work, remedy any objectionable conditions the Contractor may have created on private property, and leave the project site in a neat and presentable condition. The Contractor shall make no agreement which allows salvaged or unused material to remain on private property within view of the project except when consistent with previous land use.
- B. All ground occupied by the Contractor in connection with the work, which is within view of or adjacent to a road, shall be restored. Restoration shall include appropriate smoothing to its original condition and may include making the area suitable for cultivation and, where vegetation has been disturbed, seeding of the area.
 - 1. Unless otherwise provided for, the Contractor shall be responsible for securing waste privileges on private property. The general Contractor shall be responsible for cleanup of subcontractors at the completion of all work.
- C. This article is not intended to restrict burning in accord with applicable regulations.
- D. Final clean up shall be subject to approval of the Engineer.

1104.09 RIGHT-OF-WAYS OR LANDS ACQUIRED FOR THE WORK

- A. Access to the construction site will be over designated routes of travel, on land owned or made available by the Contracting Authority for the specific use of the Contractor.
- B. Right-of-way or lands will be provided without cost to the Contractor, and it is contemplated that all of the needed right-of-way or lands will have been acquired for the work placed under contract.
 - 1. Whenever it is necessary to secure additional right-of-way or land, performance of the work affected thereby is contingent upon the securing of such right-of-way or land. No claims will be allowed for loss or damage occasioned by delays in securing right-of-way or lands.

1104.10 PERMITS AND ARRANGEMENTS WITH OTHER GOVERNMENTAL AGENCIES

- A. Whenever the work involves construction with which federal, state, or local governmental agencies are concerned, the performance of the work is contingent on arrangements and/or permits with those concerned agencies.
 - 1. The Contracting Authority shall secure all necessary permits, certificates, and licenses required to prosecute the work, except specifically designated permits, local building permits, and any cost for inspections required by local authorities, which shall be paid for and secured by the Contractor.
 - 2. No additional compensation will be allowed for any delays, inconvenience, or damages sustained by the Contractor due to actions of those concerned agencies with respect to any arrangements or permits they may require.

1104.11 RAILROAD CROSSINGS

- A. Whenever the work involves construction with which railroad companies are concerned, the performance of the work is contingent upon arrangements with the railroad companies for the proposed construction.
 - 1. The performance of the work shall be in accord with arrangements established by the Contracting Authority. The Contractor may make additional arrangements.
 - 2. No claim will be allowed for loss or damage caused by failure of the railroad to comply with provisions of the agreement with the Contracting Authority. Upon notice given, the Contracting Authority will institute necessary legal action to enforce the conditions of its agreement with the railroad company.

1104.12 PUBLIC UTILITIES

- A. The Contracting Authority will notify all utility companies, all pipeline owners, or other parties affected, and will endeavor to have all necessary adjustments of the public or private utility fixtures, pipelines, and other appurtenances within or adjacent to the limits of construction made as soon as practicable.
- B. The Contractor shall be responsible for notification concerning work near pipelines, required by Section 479.47, Code of Iowa, and for conducting his work as required therein.
- C. Waterlines, gaslines, wirelines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners at their expense, except as otherwise provided for in the special provisions or as noted on the plans.
- D. It is understood and agreed that the Contractor has considered in the bid all of the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained by him/her due to any interference from the utility appurtenances or their operation or relocation.

1104.13 DRAWINGS AND SPECIFICATIONS

- A. Unless otherwise provided in the contract documents the Contracting Authority shall furnish to the Contractor, awarded the contract, free of charge, all copies of drawings and specifications reasonably necessary for the execution of the work.

1104.14 THE CONTRACTING AUTHORITY'S RIGHT TO OCCUPY

- A. The Contracting Authority shall have the right to enter the building or work site and store or attach such fixtures or furniture as it may elect, or to do such other work providing that such storage or work will not interfere with the completion of the Contractor's work. Such occupancy by the Contracting Authority shall in no way imply final acceptance of any portion of the Contractor's work.

1104.15 CONTRACTOR'S UNDERSTANDING

- A. It is understood and agreed that the Contractor has, by careful examination, satisfied him/herself as to the nature, character and location of the work, conformation of the ground, character, quality and quantity of the materials to be encountered, character of the equipment and facilities needed, preliminary to and during the prosecution of the work, general and local conditions and all other matters which can in any way affect the work under this contract. No verbal agreement or conversation with any officer, agency, or employee of the Contracting Authority, either before or after the execution of the contracts shall affect or modify any of the terms or obligations herein contained.

1104.16 HISTORICAL AND ARCHEOLOGICAL

- A. If during the course of construction evidence of deposits of historical or archeological interest is found, the Contractor shall cease operations affecting the find and shall notify the Iowa Department of Natural Resources and the state Historic Preservation Officer. No further disturbance of the deposits shall occur until the contractor has been notified by the agency that he/she may proceed. The agency will issue a notice to proceed only after the state official has surveyed the find and made a determination to the Iowa Department of Natural Resources.
- B. Compensation to the contractor, if any, for lost time or changes in construction to avoid the finds shall be determined in accordance with changed conditions or change order provisions of the specifications.

PART 1105. CONTROL OF WORK

1105.01 AUTHORITY OF ENGINEER

- A. The Engineer will decide all questions which may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work, all disputed and mutual rights between contractors, all plans and specifications, and all questions as to the acceptable fulfillment of the contract on the part of the Contractor. Except as provided in Section 1109, the Engineer's decisions will be final.
- B. For authority to temporarily suspend work see 1105.08 and 1108.06.

1105.02 PLANS

- A. The official plans, profiles, and cross sections, on file in the office of the Contracting Authority, show the location, typical construction details, and dimensions of the work contemplated. The work shall be performed in conformity therewith, except in case of errors or unforeseen contingencies.
- B. The plans are made from careful surveys and represent the foreseen construction requirements. Any appreciable deviation from the plans made necessary to expedite construction, or because of errors shall be called to the attention of the other party, in writing, by the party discovering such conditions. If necessary, revised plans will be provided.

1105.03 WORKING DRAWINGS

- A. The plans will be supplemented by such working drawings as are necessary to adequately control the work. Working drawings shall be furnished by the Contractor, as required by the specifications or the plans.
 - 1. When certification by a professional structural or civil engineer registered in Iowa is required, it will be so designated on the plans or in other contract documents.
 - 2. Working drawings may include shop drawings of fabricated materials, erection plans, falsework plans, cofferdam plans, or other supplemental plans or data. Contractor submitted shop drawings for steel structures shall show fully detailed dimensions and sizes of all component parts of the structure, descriptions of drains, etc.
 - 3. Prior to review of working drawings, any work done or material ordered shall be at the Contractor's risk.
 - 4. The Contractor shall expressly understand that the Contracting Authority's review of working drawings submitted by the Contractor covers only requirements for strength and arrangement of component parts.
 - 5. The Contracting Authority assumes no responsibility for errors in dimensions and assumes the Contractor will use material complying with requirements of the contract documents, or, where not specified, those of sound and reasonable quality, and will erect the subjects of such working drawings in accord with recognized standards of first-quality workmanship or, when specified, in accordance with standards of the contract documents.
 - 6. If unanticipated and either unusual or complex construction procedures or site conditions occur, the Engineer may require the Contractor to submit such working drawings as, in the judgment of the Engineer, are necessary to satisfactorily complete the proposed construction.

1105.04 ALTERATION OF PLANS OR CHARACTER OF WORK

- A. The Engineer will have the right to make alterations in plans or character of work as may be considered necessary or desirable during the progress of the work to satisfactorily complete the proposed construction. Such alteration will neither waive any conditions of the contract nor invalidate any of the provisions thereof.

1105.05 CONFORMITY WITH AND COORDINATION OF SPECIFICATIONS, PLANS AND SPECIAL PROVISIONS

- A. Discrepancies within contract documents:
 - 1. In case of any discrepancy between the drawings on the plans and the figures written thereon, the figures, unless obviously incorrect, are to govern.
 - 2. In case of any discrepancy between the plans, including plan notes, and the general or supplemental specifications, the plans are to govern.
 - 3. In case of a discrepancy between the general specifications and supplemental specifications, the supplemental specifications are to govern.
 - 4. In case of any discrepancy between the general or supplemental specifications and the special provisions or between the plans and the special provisions, the special provisions shall govern.
- B. The Contractor shall not take advantage of any apparent error or omission in the plans, specifications, or of any discrepancy between the plans or specifications. The Engineer shall be permitted to make such correction in interpretation as may be deemed necessary for the fulfillment of the intent of the plans and specifications, subject to compensation as provided in 1109.03, 1109.05, and 1109.06.
- C. The plans shall not be so changed as to materially affect the cost or the difficulty of performing any item or work for which the contract amount is more than 20 percent of the total contract sum, except with the consent of the Contractor.

- D. All work performed and all materials furnished shall be in reasonably close conformity with the lines, grades, cross sections, dimensions, and material requirements, including tolerances, shown on the plans or indicated in the specifications.
- E. If the Engineer finds the material, or the finished product in which the material, is used is not within reasonably close conformity with the plans and specifications, but that reasonably acceptable work has been produced, the Engineer shall determine, based on engineering judgment, if the work shall be accepted and remain in place.
 - 1. In this event the Engineer will document the basis of acceptance and supplement it by contract modification which will provide for an appropriate adjustment in the contract price for such work or materials as deemed necessary to conform to the Engineer's determination.
- F. If the Engineer finds the material, the finished product in which the material is used, or the work performed is not in reasonably close conformity with the plans and specifications and has resulted in an inferior or unsatisfactory product, the work or material shall be considered unacceptable and shall be removed and replaced, or otherwise corrected, as acceptable to the Engineer, by and at the expense of the Contractor.

1105.06 SUPERVISION BY CONTRACTOR

- A. The Contractor, when absent from the construction site, shall have on-site, at all times, a competent superintendent as its agent, capable of reading and thoroughly understanding the plans, specifications, and other contract documents and who shall be thoroughly experienced in the type of work being performed.
 - 1. The superintendent shall supervise, direct, and control the Contractor's operations, personnel, work, and subcontractor's operations. The superintendent shall have full authority to execute orders or directions of the Engineer, without delays, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required.
 - 2. The Contractor shall give the Engineer written notification of the name of the superintendent. The superintendent shall not be replaced, except with the consent of the Engineer, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in the Contractor's employ.

1105.07 CONSTRUCTION STAKES AND BENCH MARKS

- A. If there is no provision in the Contract documents for a Construction Survey Bid Item, the Engineer will set the necessary centerline, slopes and grade stakes promptly upon notification by the Contractor that stakes are needed, unless otherwise noted on the Plans.
- B. For all structures, unless otherwise noted on the Plans, the Engineer will set stakes for centerline and such other stakes as are necessary to establish definitely, the location, elevations, and alignment of the structure. Every reasonable precaution will be taken by the Engineer and his technical assistants to ensure that the construction stakes and/or computations are true and accurate, but the Contractor shall ensure that no gross error exists before beginning operations. Should such mistakes or errors be allowed to exist, and work completed on erroneous data, the Contractor will be held responsible to remedy the work to conform to the correct lines, grades, or standards without expense to the Contracting Authority or the Engineer.
- C. The Contracting Authority shall not be responsible for delays due to lack of grade or line stakes, unless the Contractor has given the Engineer 48-hour written notice that such stakes will be needed, and the Contractor's work is being conducted in a satisfactory manner and at the specified rate of progress.
- D. The Contractor shall be held responsible for the preservation of stakes and marks. If, in the opinion of the Engineer, any of the survey stakes or marks have been carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them shall be charged against the Contractor.
- E. The Contractor shall provide and keep constantly upon the work site, first-class instruments for use in establishing the various lines, levels and grades for the construction and shall have a superintendent on the work who is thoroughly familiar with their use. The Contractor shall provide and maintain a permanent bench mark at the construction site for the use of mechanics and other subcontractors.

1105.08 AUTHORITY AND DUTIES OF INSPECTOR

- A. The Contracting Authority may appoint inspectors to represent the Engineer in the inspection of all materials used in and all work done under the Contract. Such inspection may extend to any part of the work and to preparation or manufacture of materials to be used.

1. The inspector will not be permitted to modify in any way the provisions of the contract documents or to delay the work by failing to inspect materials and work with reasonable promptness. An inspector is placed on the work to keep the Engineer informed as to its progress and the manner in which it is being performed. The inspector will not be authorized to approve or accept any portion of the work.
2. Results of inspection tests and examinations will be available to the Contractor on an informational basis. Absence or presence of representative test data does not alter the Contractor's responsibility for plan and specification compliance in accordance with 1104.01.
3. The inspector will not act as foreman or perform other duties for the Contractors nor improperly interfere with management of the work.
4. In case of dispute between the Contractor and inspector as to the quality of materials or manner of performing the works, the inspector will have authority to reject materials or suspend the work until the question at issue can be decided by the Engineer. Written notice of suspension of work will be given to the Engineer and Contractor by the inspector.

1105.09 INSPECTION OF WORK

- A. The Contractor shall furnish the Engineer with every reasonable facility for ascertaining whether the work is being performed in conformance with the contract documents. At any time before acceptance of the works upon request of the Engineer, the Contractor shall remove or uncover such portions of finished work as the Engineer may direct. After examination has been made, the Contractor shall restore such portions of the work to the standard required by the contract documents.
 1. If work thus exposed or examined proves acceptable, the uncovering or removing and replacing of coverings or the restoring of parts removed, shall be paid for as extra work, except that no payment will be made for work involved in checking smoothness of concrete surfaces.
 2. If work thus exposed and examined proves unacceptable, the Contractor shall replace the defective work in accordance with the specifications.
 3. If work thus exposed and examined proves either unacceptable or deficient, the Contractor will be paid only for work as finally accepted.
 4. Work done without the Engineer having been afforded ample opportunity to provide suitable inspection, or unauthorized work, may be ordered removed and replaced at the Contractor's expenses or may be excluded from the quantities measured for payment.
- B. If the specifications, Engineer's instructions, laws, ordinances, or any public authority require any work and/or materials to be specially tested or approved, the Contractor shall give the Engineer timely notice of readiness for review. If the review is to be made by authority other than the Engineer, the Contractor shall notify the Engineer of the date fixed for review. Reviews by the Engineer will be promptly made and, where practicable, at the source of supply.

1105.10 REMOVAL OF DEFECTIVE WORK

- A. Any defective work shall be removed and replaced at the Contractor's expense.
- B. Should the Contractor fail or refuse to remove defective work when so ordered by the Engineer, the Engineer shall have authority to order the Contractor to suspend further operations, and may withhold payment on estimates until such defective work has been removed and replaced in accordance with the plans and specifications.
 1. Continued failure or refusal on the part of the Contractor to correct defective work promptly shall be sufficient cause for the Contracting Authority to declare the contract in default and to complete the work in accordance with 1108.11.

1105.11 UNAUTHORIZED WORK

- A. Unauthorized work and work done in excess of that provided by the lines and grades shown on the plans or as given by the Engineer, or any work done without the authority of the Engineers will be considered as unauthorized and will not be paid for.
 1. Unauthorized work may be ordered to be removed and replaced at the Contractors expense.

1105.12 OTHER CONTRACTS

- A. The Contracting Authority reserves the right to do, or to contract for other work adjacent to, or in the vicinity of, the work herein described.
- B. The Contractor agrees to permit such other work to progress and to arrange for joint occupation of the site under such provision as the Engineer determines necessary. If in the judgment of the Engineer, such joint occupation of the site impedes progress on the work herein described, the Contracting Authority will proportionally extend the time for completion of the work.
 - 1. The Contractor hereby waives any claim for damages or extra compensation by reason of such interference with his work.

1105.13 FINAL INSPECTION

- A. Upon notification, by the Contractor or his authorized representative, that the work is completed, the Engineer shall make prompt final inspection of each item of work included in the contract. If the work is found not to be in accordance with the contract documents, the Contractor will be advised as to the particular defects to be remedied before final acceptance can be made.

1105.14 RESTRICTIONS ON MOVING AND USE OF HEAVY EQUIPMENT

- A. The following restrictions shall apply to the moving and use of heavy equipment:
 - 1. Movement of equipment to and from the project shall be in compliance with the laws governing the operation of vehicles on the highways of Iowa. Movement and operation of equipment over completed portions of pavements, bituminous surfaces, base courses, and structures which are a part of the project shall be with legal axle loads, except as modified in this article.
 - 2. In the case of earthwork and shouldering to be done in connection with either rigid or flexible pavement, or pavement widening and resurfacing, no tractor-drawn, earth-moving equipment shall be operated, or driven on or across the pavements, except at designated crossovers, as authorized by the Engineer.
 - a. When crossovers are specifically permitted, the Contractor will designate, before use, the location and number of crossovers to be used. The Engineer will not approve crossovers in areas of limited sight distances, near structures, railroad crossings, or at any other location which will place safety of the traveling public in jeopardy. At these crossovers, equipment having axle loads greater than the maximum permitted by law may be used.
 - b. Crossovers shall be 30 feet in length measured along the centerline and shall not be closer than 300 feet to each other.
 - c. For each crossover used, the Contractor shall, at the Engineer's option, either replace the pavement or pay the Contracting Authority at the rate of five thousand (\$5,000.00) dollars on the basis of a two-lane pavement.
 - d. In lieu of the surface crossover, approved hauling bridges may be used. The hauling bridge shall accommodate two lanes of public traffic, and it shall be removed from the roadway at the close of each day's operations. When a hauling bridge is used, no payment will be required.
 - e. The provisions of the Supplemental Specification for Traffic Controls in effect on the contract letting date, shall apply.
 - 3. No dragline, cranes, or power shovel shall be operated with any part of the machine resting upon a pavement, bituminous surface, base course, or structure except with approval of the Engineer and in accord with restrictions in that approval.
 - 4. Under no conditions shall machines equipped with metal lugs or similar projections on the treads be operated on the surface of a pavement, bituminous surface, or base course.
 - 5. For building shoulders, on completed pavements of any type, the maximum axle load used for equipment operating on pavement shall not exceed the legal axle load, as defined herein.
 - 6. Crawler-type tractors shall not be moved on or off a pavement or base course except at places where the compacted earth adjacent to slab is at least 2 inches higher than the surface of the pavement or base course. Whenever heavy, crawler-type equipment, such as a crane or mixers is moved on or off the edge of a pavement or base course, a substantial timber approach shall be built, at the edge of slab, to prevent overloading or otherwise injuring the edge of the slab.

7. Compacting equipment having axle loads greater than 20,000 pounds may be used on the work under the following provisions:
 - a. The equipment shall be transported to and from the work and across the bridges on the work in compliance with laws of the State of Iowa.
 - b. For compaction of subbase, the weight of equipment used shall not be greater than that of compaction equipment used in correction of the roadbed for grade and cross section.
 - c. For compaction of base course, the weight of equipment used shall not be greater than the weight of equipment used in compaction of the subbase on which the base is placed.
 - d. For compaction of surface courses, the weight of equipment shall not be greater than that of equipment used in compaction of the base on which the surface course is placed.
8. For grading or any other type of work, no rollers or other equipment, having an axle load greater than 50,000 pounds or a total weight in excess of 60,000 pounds shall be operated over a culvert, except as may be authorized by the Engineer, and then, in strict compliance with prescribed precautionary measures.

1105.15 PLACEMENT OF FILL MATERIAL IN STREAMS AND WATERBODIES

- A. The placement of fill material in streams is regulated by Federal law. The intent of this specification is to require contractor operations in streams and other waterbodies and adjacent swamps, marshes, bogs, or similar areas, to be in compliance with Federal regulations.
- B. Fill material shall mean; any material used for the primary purpose of replacing an aquatic area with dry land, or of changing the bottom elevation of a waterbody.
- C. Fill material shall consist of clean, suitable, naturally occurring material, free from toxic pollutants in other than trace quantities.
- D. Temporary stream crossings shall be bridged or culverted so as not to restrict expected high flows or disrupt the movement of aquatic life native to the stream or waterbodies. Expected high flows are those flows, which the Contractor expects to experience during the period of time that the crossing is in place.
 1. Temporary stream crossings shall:
 - a. Not extend over 100 feet into any swampy, boggy, marshy, or similar area that is adjacent to the stream or waterbody.
 - b. Be maintained to prevent unnecessary erosion and other nonpoint sources of pollution.
 - c. Be removed after they are no longer needed.

1105.16 COST REDUCTION INCENTIVE

- A. The Contractor may submit to the Engineer, in writing, proposals for modifying the plans, specifications, or other contract requirements for the sole purpose of reducing the total cost of construction.
 1. The proposals shall not impair, in any manner, essential functions or characteristics of the projects, including but not limited to, service life, economy of operation, ease of maintenance, desired appearance, or design and safety standards.
- B. Proposals shall contain the following changes:
 1. Existing requirements and proposed changes,
 2. Contract requirements that must be changed if the proposal is adopted,
 3. A detailed cost estimate of performing the work as stipulated and as proposed,
 4. The time within which the Engineer must make a decision thereon,
 5. The items of work affected by the proposed changes, including any quantity variation attributable thereto.
- C. The provisions of this article shall not be construed to require the Engineer to consider any cost reduction proposal which may be submitted hereunder.
 1. Proposed changes in basic design of a bridge or pavement type will not be considered an acceptable proposal.
 2. The Contracting Authority will not be liable to the Contractor for failure to accept, or act upon, any proposal submitted pursuant to this article, or for any delays to the work attributable to any such proposal.
 3. If a proposal is similar to a change in plans or specifications under consideration by the Contracting Authority for the project at the time said proposal is submitted, or if such a proposal is based on, or similar to, standard specifications, special provisions, or plans adopted by the Contracting Authority after the advertisement for the contract, the Engineer will not accept such proposals and the Contracting Authority

reserves the right to make such changes without compensation to the Contractor under provisions of this article.

- D. The Contractor shall continue to perform the work in accordance with contract requirements until a change order, incorporating the cost reduction proposal, has been issued. If a change order has not been issued by the date on which the Contractor's cost reduction proposal specifies that a decision thereon should be made, or such other date as the Contractor may subsequently have specified in writing, such proposal shall be deemed rejected.
- E. The Engineer shall be the sole judge of the acceptability of a cost reduction proposal and of the estimated net savings in construction costs from adopting all, or any part of, such proposal. In determining the estimated net savings, the right is reserved to disregard the contract bid prices if, in the judgment of the Engineer, such prices do not represent a fair measure of the value of work to be performed or to be deleted.
- F. The Contracting Authority reserves the right, where it deems such action appropriate, to require the Contractor to share in the Contracting Authority's costs of investigating a cost reduction proposal. Where such a condition is imposed, the Contractor shall indicate his acceptance thereof in writing, and such acceptance shall constitute full authority to deduct amounts, payable to the Contracting Authority from any money due, or that may become due, to the Contractor under the contract.
- G. If the Contractor's cost reduction proposal is accepted in whole or in part, such acceptance will be by change order, which shall specifically state that it is executed pursuant to this article. Such a change order shall incorporate the changes in the plans and specifications which are necessary to permit the proposal, or such part of it as has been accepted, to be put into effect and shall include any conditions upon which the Contracting Authority's approval is based, if the approval is conditional.
 - 1. The change order shall also set forth the estimated net savings in the cost of performing the work attributable to the proposal effectuated by the change order, and shall further provide that the Contractor be paid 50 percent of said estimated net savings amount.
- H. Acceptance of the cost reduction proposal and performance of the work thereunder shall not extend the time of completion of the contract, unless specifically provided for in the change order authorizing use of the proposal.
- I. The amount specified to be paid to the Contractor in the change order which effectuates a cost reduction proposal shall constitute full compensation to the Contractor for the proposal and performance of the work thereof pursuant to the said change order.
- J. The Contracting Authority expressly reserves the right to adopt a cost reduction proposal, for general use on contracts administered by the Contracting Authority, when it determines that said proposal is suitable for application to other contracts.
 - 1. When an accepted proposal is adopted for general use, only the contractor who first submitted such proposal will be eligible for compensation pursuant to this article, and in that case, only to those contracts awarded to him/her prior to submission of the accepted proposal and as to which such proposal is also submitted and accepted.
 - 2. Cost reduction proposals identical or similar to previously submitted proposals will be eligible for consideration and compensation under provisions of this article, if the identical or similar previously submitted proposals were not adopted for general application to other contracts administered by the Contracting Authority.
 - 3. Subject to the provisions contained herein, the State or any other public agency shall have the right to use all, or any part of any submitted cost reduction proposal without obligation or compensation of any kind to the Contractor.

PART 1106. CONTROL OF MATERIAL

1106.01 QUALITY OF MATERIALS

- A. It is the intent of the specifications that first-class materials shall be used throughout the work, and that these first-class materials shall be incorporated in such a manner as to produce completed construction which is acceptable in every detail. Only materials conforming to the requirements of these specifications, approved by the Contracting Authority, shall be incorporated into the work
- B. When more than one kind of manufacture of a material is specified, the option will be with the Contractor, but the choice shall be confined to the materials mentioned.

- C. Whenever in any of the contract documents, an item of material or equipment is defined by describing a proprietary product or by using the name of a manufacturer or vendor, the terms “or equivalent”, or “or equal”, if not inserted, shall be implied. This specific item of material or equipment mentioned shall be understood as establishing a standard of type, function, efficiency, minimum basis of design, and quality desired. Other manufacturer’s products of comparable quality, design and efficiency, and suitable for the service intended will be considered, but no change will be made without written approval of the Contracting Authority.
- D. Requests for materials substitutions must be submitted in duplicate, or in the quantities required elsewhere in the specifications, and meet the requirements of 1103.09

1106.02 SOURCE OF MATERIALS

- A. At the option of the Engineer, the source of supply of each material shall be approved by the Contracting Authority before the delivery is stated.
 - 1. If requested by the Contracting Authority, representative preliminary samples, of prescribed character and quality, tested in accordance with the methods referred to under samples and tests, shall be submitted by the contractor or producer for examination.
 - 2. All materials proposed to be used may be inspected or tested at anytime during their preparation and use.
 - 3. If, after trial, it is found that sources of supply which have been approved do not furnish a uniform product or if products from any source do not meet the specifications, at any time, the Contractor shall furnish approved material from other approved sources. No material which, after approval has in any way become unfit for use, shall be used in the work.

1106.03 SAMPLES AND TESTS

- A. Each consignment of materials required by the Engineer, shall be tested or inspected before being incorporated into the work and approved by the same Engineer before it is used.
 - 1. The contractor shall afford facilities for collecting and forwarding samples as the Engineer may require.
 - 2. Unless otherwise designated in the standard, supplemental specifications, or instructional memorandums, the inspection, sampling, testing, and basis of acceptance of materials shall be in accordance with the current AASHTO “Standard Specifications for Sampling and Testing of Transportation Materials” including published interim standards.

1106.04 STORAGE OF MATERIALS

- A. The Contractor shall be responsible for care and storage of materials delivered for the work or purchased for use thereon. Material which has been delivered and has become damaged before actual incorporation in the work may be rejected by the Engineer even though it may have been previously acceptable. Stored materials shall be located to facilitate thorough inspections.

1106.05 UNACCEPTABLE MATERIALS

- A. All materials not conforming to requirements of the specifications at the time they are to be used shall be considered unacceptable, and all such materials will be rejected and shall be removed immediately from the work site, unless otherwise instructed by the Engineer. No rejected materials, the defects of which have been corrected, shall be used until approval has been received.

PART 1107. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

1107.01 LAWS TO BE OBSERVED

- A. The Contractor is presumed to be familiar with all laws, ordinances, and regulations that may, in any manner, affect those engaged or employed by the Contractor, the materials or equipment used, or which may in any way, affect the conduct of the Contractor’s work. The Contractor shall conduct his work to avoid conflict with any such laws, ordinances, or regulations, and shall save harmless the Contracting Authority and its representatives against any claim arising from violation thereof.
- B. The Contractor shall give preference to Iowa domestic labor, in accordance with the provisions of Chapter 73A of the Code of Iowa, and this provision is hereby specifically made a part of any contract of which these contract documents are a part. A person shall be deemed a domestic laborer of this state if he/she is a citizen and has resided in this state for more than six months.

- C. The provisions of Chapter 73A of the Code of Iowa concerning preferences for Iowa products and labor shall not apply to contracts involving work financed wholly, or in part, by the federal government.
- D. The Contractor and all subcontractors shall have on file with the Contracting Authority, a valid state of Iowa Contractor's Registration Number, issued by the Iowa Department of Labor Services, in accordance with Chapter 91C of the Code of Iowa.

1107.02 LIABILITY INSURANCE

- A. It shall be the Contractor's responsibility to have liability insurance covering all of the construction operations incident to completion of this contract. The Contractor must have on file, with the Contracting Authority, a current "Certificate of Insurance" prior to award of contract. The certificate shall identify the following: insurance company firm name and address, contractor firm names policy period, type of policy, limits of coverage, and scope of work covered, (single project or statewide).
 - 1. This requirement shall apply with equal forces whether the work is performed by -- (1) persons employed directly by the Contractors (2) by a subcontractor or his employees, or (3) by an independent contractor.
- B. 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.
- C. 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 not be less than required by Chapter 325A, Code of Iowa, for truck operators or contract carriers as defined therein. For all other contractors, subcontractors, and independent contractors, the minimum coverage by such insurance shall be as follows:
 - Public Liability Insurance
 - Per person - \$500,000.00
 - Each occurrence - \$750,000.00
 - Property Damage Insurance
 - Each occurrence - \$500,000.00
- D. Failure on the part of the Contractor to comply with the requirements of this article will be considered sufficient cause to suspend the work, withhold estimates, and to deny the Contractor from receiving further contract awards, as provided in 1103.01.

1107.03 PATENTS AND ROYALTIES

- A. The Contractor shall be responsible for all claims for infringement of patents, or for royalties on tools, machinery, appliances, devices, or materials used in construction and completion of the work, except as are specifically required by the contract documents.
 - 1. The Contractor agrees that the Department may retain out of the money that is or may become due the Contractor an amount to cover all such claims and to retain the same, until all such claims are paid or adjusted.
- B. The Contracting Authority assumes responsibility for payment of claims for damages from patent or copyright infringement or for royalties on material processes, specifications, or types of construction that are required by the contract documents.

1107.04 RESTORATION OF CONSTRUCTION WORK OPENED BY PERMIT

- A. Prior to final acceptance, if any repairs to the work constructed hereunder are made necessary by construction or repair of drains or sewers, laying or repairing of pipes or conduits for telegraphy, telephone or electric wires, or from any other disturbance of said work under permission issued by the Contracting Authority, the Contractor shall, upon notification by the Engineer, immediately make necessary repairs in conformity with the specifications.
 - 1. Such repairs shall be paid for as extra work, however, no compensation will be allowed when such repairs are made necessary by the Contractor's negligence or carelessness.
- B. The Contractor shall not authorize any person or persons to make alterations or additions to the construction work unless a permit duly authorized by the Contracting Authority is presented.

1107.05 FEDERAL PARTICIPATION

- A. The attention of the Contractor is called to the provisions of the Acts of Congress known as the “Land and Water Conservation Fund Act”, the “Federal Aid in Wildlife Restoration Act”, the “Federal Aid in Fish Restoration Act”, the “Boating Safety Act”, the “Superfund Amendments and Reauthorization Act”, the “Clean Water Act” and amendments thereto, and any other acts of congress providing for fish and wildlife of conservation improvements.
 - 1. When the United States Government is to pay for all or any portion of the cost of an improvement or project, the construction work, although it is under the direct supervision of the Contracting Authority and subject to the laws of the State of Iowa, is also subject to the above-mentioned Acts of Congress and all rules, regulations, and reimbursements that may be imposed by the federal authority thereunder. Such construction work will, therefore, be subject to inspection by the duly authorized agents of the federal government, but such inspections will not make the federal government a party to the contract.
- B. On all contracts involving Federal aid, all steel products incorporated into the work must have been manufactured in the United States. The Engineer may allow minimal amounts of these materials from foreign sources, provided the cost does not exceed 0.1 percent of the contract sum or \$2,500, whichever is greater.

1107.06 SAFETY, HEALTH, POLLUTION AND SANITATION

- A. In the performance of his contract, the Contractor shall comply with all applicable laws, rules, regulations, and ordinances governing safety, health, pollution, sanitation, noise control, and disposal of waste materials, and shall make available such additional safeguards, safety devices, protective equipment, and take such actions as are reasonably necessary to protect life and health of employees and the public.
 - 1. The Engineer will not act as an enforcement agent for compliance of rules and regulations governing industrial safety. However, violations of properly promulgated laws, rules, regulations, and ordinances reported to the Engineer by responsible agencies may result in the issuance of a suspension order until such time as the violation is corrected.
- B. The Contractor shall make adequate provisions satisfactory to the Engineer for safety of inspectors, particularly at sampling locations. Provisions shall include guards for moving belts, pulleys, and wheels near the sampling point and a stable platform to be used when sampling is to be done from an elevated location.
- C. There shall be suitable retention dams, in areas where approved liquid asphaltic material, or asphalt cement are stored and used, to minimize pollution of nearby areas from effect of normal rains. The Contractor shall take other necessary precautions to prevent pollution of streams, lakes, ponds, reservoirs, and other areas with fuels, oily bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.
- D. The disposal by open burning of landscape waste originating on the construction site shall be permitted unless prohibited by local ordinances or regulations. However, the burning of landscape waste produced in clearing, grubbing, and construction operations shall be limited to areas located at least one-fourth mile from any inhabited buildings. Rubber tires will not be used to ignite landscape waste.
- E. The Contractor shall be specifically responsible for adhering to all local burning ordinances or regulations, and to ascertain what the local burning restrictions consist of in addition to the regulation stated above and to see that all subcontractors comply with those restrictions.
- F. All internal combustion engines, used for any purpose on the job, or related to the job, should be equipped with a muffler of the type recommended by the manufacturer. No internal combustion engine will be operated without a muffler. Faulty or damaged mufflers must be replaced. Machinery must be properly maintained at all times in order to limit engine noise, as well as other extraneous noise.
- G. When directed by the Engineer, the Contractor shall apply moisture to the construction area and haul routes, as necessary, to prevent the spread of dust, at no expense to the Contracting Authority.

1107.07 PUBLIC CONVENIENCE AND SAFETY

- A. The Contractor shall conduct the work as to assure the least possible obstruction to access by the residents along the project. The Contractor should schedule and conduct the work in such a way as to provide for their safety and convenience.
 - 1. Work and materials required by the Engineer for public convenience and safety in excess of that provided for in the contract, shall be considered as provided for in 1109.03.

1107.08 BARRICADES AND WARNING SIGNS

- A. The Contractor shall take every reasonable precaution to prevent the public from interfering with the work, and to prevent the work from interfering with the public, for providing for safety of the general public traveling to, through, within, along, and across the project, and shall take such precautions, measures, or acts as are required herein and as specifically required by the contract documents or by the Engineer. In addition, the Contractor shall provide such additional safeguards as deemed necessary to protect equipment, the work, and the public at the Contractor's own expense.
- B. The Contractor shall erect and maintain suitable barriers, and at night, such lights, as will prevent accidents to persons or property in and around the area of work.
- C. The Contractor shall provide at his own expense, such security guards as are necessary to protect equipment and to maintain proper lighting. Security guards that may be necessary for the protection of the public shall be provided by the contractor on written order from the Engineer.
- D. Whenever the work is under the Contractor's control, the Contractor shall be held responsible for any damage to the newly completed portions of the work resulting from public misuse.

1107.09 USE OF EXPLOSIVES

- A. When the use of explosives is necessary for the prosecution of the work, the Contractor shall exercise the utmost care not to endanger life or property. The Contractor shall be responsible for all damage resulting from use of explosives.
- B. All explosives shall be stored in a secure manner in compliance with all laws and ordinances and in quantities maintained at a practical minimum. Storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided, satisfactory to the Engineer and, in general, not closer than 1,000 feet from the road or from any building, camping area, or place of human occupancy.
- C. The Contractor shall notify each public utility company, having structures in proximity to the site of the work, of the intent to use explosives. Such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

1107.10 PROTECTION AND RESTORATION OF PROPERTY

- A. The Contractor shall replace or renew fences, sidewalks, or other property damage by reason of the work or the negligence of the Contractor's employees. The Contractor shall take suitable precautions to prevent damage to telephone, telegraphy, and electric transmission lines along the highway and to pipes, conduits, and other underground structures. The Contractor shall carefully protect from disturbance all land monuments and property marks until an authorized agent has witnessed or otherwise referenced their locations and shall not remove them until so directed.
 - 1. The Contractor shall be responsible for damage or injury to property resulting from the prosecution of his work, however, responsibility shall not extend to damage to fences, telephones, telegraph, or electric lines occupying the right-of-way unlawfully, provided due caution has been used in removing them. The Contractor's responsibility shall not be released until the work under the contract is completed and accepted.

1107.12 RESPONSIBILITY FOR DAMAGE CLAIMS

- A. The Contractor shall indemnify and save harmless the state of Iowa, the Contracting Authority and other agencies which have concurred in the award of contract, their officers and employees, from all suits, actions, or claims of any character brought because of any injuries or damage received or sustained by any person, persons, or property because of any act, omissions or neglect in safeguarding or performing the work, or through use of unacceptable materials in constructing the work, and so much of the money due the said Contractor, under and by virtue of the contract, as may be considered reasonable and necessary by the Contracting Authority for such purpose, may be retained for the use of the State, or in case no money is due, the surety may be held until such suit or suits, action or actions, claim or claims for injuries or damages, as aforesaid, shall have been settled and suitable evidence to that effect furnished to the Contracting Authority, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence of adequate protection by public liability and property damage insurance.

1. Notwithstanding the above, it is specifically agreed between the parties executing this contract that it is not intended by any of the provisions of any part of the contract documents to create in the public or member thereof a third-party beneficiary hereunder, or to authorize anyone not a party to this contract to maintain a suit for personal injuries or property damage pursuant to the terms of provisions of this contract.
 2. The duties, obligations, and responsibilities of the parties to this contract with respect to third-parties shall remain as imposed by law. It being the intention of the parties that indemnity herein provided shall not extend to acts of omission, of negligence for which the Contracting Authority is solely responsible. But indemnity shall extend to all claims in which the Contractor and the Contracting Authority are found to be either jointly or concurrently negligent.
- B. Responsibility of the Contractor for providing warning devices, required by 1107.08 to avoid damages or injuries on any portion of the work covered by the contract, shall not cease until the work on such portion has been released by the Engineer.
1. A release shall be construed to mean a written statement by the Engineer to the effect that the Contractor may cease to maintain barriers and lights, that the work may be opened to the public and that the Contractor is relieved of further maintenance of that portion of the work. Such release shall not constitute an acceptance of the work.
- C. The Contractor's responsibility for maintenance of lights on any individual structure shall cease upon final acceptance of such structure, or when specifically released in writing by the Engineer.

1107.13 OPENING OF SECTION OF CONSTRUCTED WORK TO THE PUBLIC

- A. When any substantial portion, part, or feature of a contract is completed to the extent that its stability and integrity is not dependent upon completion of the other item, or work required in the contract, that portion, part, or feature may be released by the Engineers after conferring with the Contractor, and opened to traffic or received for public usage prior to final approval and acceptance of all work involved in the contract.
1. The Contractor will not be responsible for damages due to the elements or the ordinary use of the public to those portions, parts, or features of the work which have been released by the Engineer.
 2. The Contractor will be responsible for any damages which may be caused by defective work or failure to comply with the contract documents.
- B. The above provisions relating to a release by the Engineer will be applicable only to those portions, parts, or features of the contract for which the Engineer has furnished to the Contractor a written release.

1107.14 CONTRACTOR'S RESPONSIBILITY FOR WORK

- A. The Contractor shall be responsible for the care and maintenance of partially completed and furnished work on any portion of the project until released by the Engineer from such responsibility. It will be the Contractor's responsibility to adjust the Contractor's operation or method of operation to prevent any damage of any nature to any portion of the partially completed or completed work. Repair work shall be done promptly upon being so ordered by the Engineer.

1107.15 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES

- A. At points where the Contractor's operations are adjacent to properties of railway, telegraph, telephone, and power companies, or are adjacent to other property, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.
- B. The Contractor shall cooperate with owners of underground or overhead utility lines in their removal and rearrangement operations, in order that these operations may progress in a reasonable manner, that duplication of rearrangement work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted.
- C. In the event of interruption to water or utility services, as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with said authority in restoration of service.
1. If water service is interrupted, repair work shall be continuous until service is restored.
 2. No work shall be undertaken around fire hydrants until provision for continued service has been approved by the local fire authority.

1107.16 PERSONAL LIABILITY OF PUBLIC OFFICIALS

- A. In carrying out any of the provisions of the contract, or in exercising any power or authority granted to any agency or representative of the Contracting Authority thereby, there shall be no liability upon such agent or representatives including the Engineer or authorized agents, either personally or as an official of the Contracting Authority, it being understood that in such matters the agent acts as the agency and representative of the Contracting Authority.

1107.17 NO WAIVER OF LEGAL RIGHTS

- A. The Contracting Authority shall not be precluded or stopped by any measurement, estimate, or certificate made, either before or after the completion and acceptance of the work and payment therefor, from showing the true amount and character of the work performed and materials furnished by the Contractor, or from showing that any such measurement, estimate, or certificate is untrue or incorrectly made, or that the work or materials do not, in fact, conform to the contract.
- B. The Contracting Authority shall not be precluded or stopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor and the Contractor's sureties such damages as it may sustain by reason of the Contractor's failure to comply with the terms of his contract.
- C. Neither acceptance by the Contracting Authority, or any representative of the Contracting Authority, nor any payment for or acceptance of the whole or part of the work, nor any extension of time, nor any possession taken by the Contracting Authority, shall operate as a waiver of any portion of the contract, or for any power herein reserved, or any right to damages herein provided. A waiver of any breach of contract shall not be held to be a waiver of any other or subsequent breach.

PART 1108. PROSECUTION OF PROGRESS

1108.01 SUBLETTING OF CONTRACT

- A. At the time specified by the contract documents or when requested by the Engineer, the Contractor shall submit in writing to the Contracting Authority for approval, the names of the subcontractors proposed for the work. Subcontractors may not be changed except at the request of and with the approval of the Contracting Authority.
 - 1. The Contractor is responsible to the Contracting Authority for the acts and omissions of the subcontractors, and of their direct and indirect employees, to the same extent as the Contractor is responsible for the acts and omissions of its own employees.
 - 2. The contract documents shall not be construed as creating any contractual relation between the subcontractor and the Contracting Authority.
- B. The Contractor shall bind every subcontractor and every subcontractor agrees to be bound by the terms of the contract, the contract documents, the plans, the general conditions of the contract, the supplementary general conditions, the special conditions, and the specifications as far as applicable to the subcontractors' work.
- C. The subcontractor shall be bound to the Contractor by the terms of the contract, the contract documents, the plans, the general conditions and specifications, and to assume toward the Contractor all the obligations and responsibilities that the Contractor, by those documents, assumes towards the Contracting Authority.
 - 1. The Contractor agrees to be bound to the subcontractor by all the same obligations that the Contracting Authority assumes to the Contractor under the terms of said documents, and by all the provisions thereof affording remedies and redress to the Contractor from the Contracting Authority.
- D. The Contractor shall not assign, sublet, or transfer in whole or part any of the work herein specified without the written consent of the Contracting Authority. Any such assignment, subletting, or transfer shall not in any manner relieve the Contractor from any of the responsibilities assumed herein.
- E. For convenience of reference and to facilitate the letting of contracts and subcontracts, the specifications are separated into title sections. Such separations shall not, however, operate to make the Engineer an arbitrator to establish limits to the contracts between Contractor and subcontractors.
- F. This article shall further be applicable to contracts involving Federal-aid participation in construction insofar as they are consistent with the required provisions for Federal-aid contracts attached to the contracts, and shall be additional specifications insofar as they cover matters not covered by the required provisions for Federal-aid contracts.

1108.02 PROSECUTION OF WORK

- A. The proposal form may designate the contract period by either completion date, approximate starting date, of specified starting date.
- B. Intermediate contract periods may be designated for completion of certain portions of the contract. The contract period for each portion and the liquidated damages, if any, will be listed in the Special Provisions.
- C. The return of the signed and executed contract to the Contractor shall serve as notice to the Contractor that the contract bond is acceptable, that the contract is in force, and that the Contractor may complete arrangements for materials and other work in accordance with the contract documents.
- D. Should delay become apparent before or after the work is started, the Engineer will immediately notify the Contractor, in writing, that work on the contract will be delayed and, if possible, the approximate duration of such delay. For delays exceeding 2 weeks, new construction dates may be established by the Engineer after consulting with the Contractor.
 - 1. Specified Starting Date: When a starting date is specified, working days will be charged to the Contractor starting on the specified starting date or 10 days after execution of the contract, whichever is later. Starting work prior to the specified date will be considered upon request, and working days will be charged when work starts.
 - 2. Approximate Starting Date:
 - a. Site available immediately, as determined by the Engineer: Anytime after execution of the contract and on or after the approximate starting date, the Contractor may work, weather and specifications permitting. Working days will be charged any time the Contractor is working on/or after the approximate starting date. Starting work prior to the approximate starting date will be considered upon request. If allowed, working days will be charged.
 - b. Site Availability Date Unknown, as determined by the Engineer: It is expected the site will be available by the approximate starting date. If it appears the site will not be available by the approximate starting date, the Engineer will inform the Contractor of the delay and if possible the duration of the delay. The Contractor may commence work, weather and specifications permitting, any time after execution of the contract and on or after the approximate starting date provided the site has become available. If work is started under these conditions, working days will be charged. Starting work before the approximate starting date and before the site is available, will be considered only after the Contractor has submitted a signed waiver of any right to claim extra compensation for damages due to delays from any cause related to the early commencement. If approved, working days will not be charged when working prior to the date of site availability. If the Contractor is working on the project when the site becomes available, working days will be first charged on the following day.
 - 3. Specified Completion Date: The Contractor may commence work any time after execution of the contract, weather and specifications permitting.
 - a. Working days will begin to be charged whenever the Contractor starts work.
 - 4. Winter Work: The proposal may require winter work on all or portions of the project, and working days will be counted as indicated therein. When not so specified, the Contractor may work, unless advised to the contrary by the Engineers between November 15 and April 1 with no working time charged. If the best interest of the Contracting Authority so dictates, the Engineer may require the Contractor to continue work after November 15.
 - a. Working days will not be charged if working time remains on November 15, and working days may be charged for days worked if no working time remains on November 15.
 - 5. Notice to Proceed: A notice to proceed will be issued when, in the opinion of the Engineer, considering the approximate starting date, site availability, and working days allowed, failure of the Contractor to commence work places the timely completion of the project in jeopardy. The starting date in the notice to proceed will not be less than 15 calendar days after the date of the issuance of the notice. Working days will be charged beginning with the starting date established by the notice or when the Contractor starts work if prior thereto. A notice to proceed will be issued, except:
 - a. It will be assumed when a specified starting date is used.

- b. It will be assumed when a specified completion date is used, the number of working days allowed will be counted back from the specified completion date, exclusive of Saturdays, Sundays, and holidays, to determine the first day working days will be charged.
 - c. It may be included as an agreed starting date at a preconstruction conference for projects with an approximate starting date.
 - d. It will be assumed when the Contractor is working at the time for issuance of the notice.
 - e. It will be assumed, if an early work waiver is approved, as having been issued at the time of site availability, as documented in the project records.
6. Weekly Report of Working Days: Whenever the Contractor is subject to being charged with working days, the Engineer will furnish the Contractor a weekly statement indicating the working days to be charged against the Contractor for that period. Should the Contractor believe the statement to be inaccurate, a statement should be submitted to the Engineer, in writing, stating the objection and reasons, within 10 calendar days after receipt of the statement. If the Contractor fails to submit an objection within that time, the original statement may be considered as accurate and final.
7. Work Progress: The progress of the work shall be at a rate sufficient to complete the contract within the time allowed. If it appears that the rate of progress is such that the contract will not be completed within the time allowed, or if the work is not being executed in a satisfactory and workmanlike manner, the Engineer may order the Contractor to take such steps as necessary to complete the contract within the period of time specified or to prosecute the work in a satisfactory manner.
- a. If the Contractor fails to comply with such order within 2 weeks after receipt of the order, the Contractor may be disqualified from receiving any additional bidding proposals, and the Contracting Authority shall have the right to declare the contract in default and to complete the work in accordance with 1108.11.
 - b. Failure of the Contracting Authority to issue such order shall not alter the Contractor's responsibility under the contract.
 - c. The Contractor's sequence of operations shall be such as to cause as little inconvenience to the general public as possible.
8. Schedule of Staging: On any project, or part of a project, on an existing road where the work may prohibit or restrict public or private access that has been previously available, the Contractor may be required to submit a schedule of staging for the Engineer's approval before work is started.
- a. Preliminary work may be required in stage construction, even though the work involved in these operations is similar, in order to minimize the inconvenience to the public and those to whom access has been previously available. This requirement will apply equally to work that is subcontracted.
9. Accelerated Work Schedule: An accelerated work schedule may be required by a note on the proposal. When required, the Contractor shall marshal the necessary forces, including but not limited to: extra crews, subcontractors, extra work hours, or other acceptable methods to insure completion of the projects or various stages of the projects within the contract period and in compliance with the specifications.
- a. A work plan shall be submitted to the Engineer for review prior to commencement of work. Work will be permitted on a 24-hour-day basis and on Sundays and holidays when traffic interference exists, though work may be restricted during peak traffic periods. No credit will be allowed for delayed or slow delivery of materials. The special provisions may include other requirements or modifications for the accelerated work schedule.
10. Preconstruction Conference: The Engineer shall schedule and conduct a preconstruction conference. The Contractor and intended subcontractors shall participate in this conference. The Engineer will invite utilities and others having responsibilities or interest in the work.

1108.03 LIMITATIONS OF OPERATIONS

- A. The Contractor shall conduct the work so as to create a minimum amount of inconvenience to the public. At anytime, when in the judgment of the Engineer, the Contractor has obstructed, closed, or is conducting his/her operations on a greater portion of the project vicinity than is necessary for the proper prosecution of the work, the Engineer may require the Contractor to finish the section on which work is in progress before work is started on any additional sections.

- B. Whenever work which is being done by other contractors or subcontractors is contiguous to, or a part of the work included in this contract, the Engineer shall in case of dispute, determine and define the respective rights of the various interests involved, in order to secure the completion of all parts of the work in general harmony and with satisfactory results.
- C. Except when an accelerated work schedule is required, no work will be permitted on Sundays, holidays observed by the Department of Natural Resources or within the time frame of dusk until dawn (as observed by current Farmer's Almanac) unless explicit permission from the Engineer has been obtained.
 - 1. The Contractor should request a determination of the holidays to be observed at the beginning of each calendar year.

1108.04 METHODS AND EQUIPMENT

- A. The methods, equipment, and appliances used shall produce a satisfactory quality of work and shall be adequate to maintain the schedule of progress specified. Equipment used on any portion of the project shall be such and its use so regulated that no serious or irreparable damage to the adjacent property, or highways will result from its use. If damage does occur to the highways suitable repairs shall be made.
- B. When the methods and equipment to be used by the Contractor in accomplishing the construction are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the contract work in conformity with the requirements of the contract, as demonstrated to the satisfaction of the Engineer.
- C. When the contract specifies that the construction be performed by use of certain methods and equipment, such methods and equipment shall be used, unless others are authorized by the Engineer. If the Contractor desires to use a method or type of equipment other than specified in the contract, he/she may request approval from the Engineer to do so.
 - 1. The request shall be in writing and shall include a full description of the methods and equipment proposed to be used and an explanation of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing construction work in conformity with contract requirements.
 - 2. If after trial use of the substituted methods or equipment the Engineer determines that the work produced does not meet contract requirements, the Contractor shall discontinue use of the substitute method or equipment and shall complete the remaining construction with the specified method and equipment.
 - 3. The Contractor shall remove the defective work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the construction items involved or in contract time as a result of authorizing a change in methods or equipment under these provisions.

1108.05 CHARACTER OF WORKERS

- A. Any employee of the Contractor who is careless, incompetent, or disorderly, or who refuses or neglects to perform work in accordance with the specifications, or who shall commit trespass upon any public or private property in the vicinity of the work, shall be discharged upon the written request of the Engineer and shall not be reemployed on any of the work unless written permission is given by the Engineer.

1108.06 TEMPORARY SUSPENSION OF WORK

- A. Work shall be suspended, wholly or in part when, in the opinion of the Engineer, weather or other conditions are unfavorable to its satisfactory prosecution.
 - 1. Work shall also be suspended at the direction of the Engineer pending settlement of disputes arising of failure of the Contractor to comply with provisions of the contract. Written notice of suspension of work shall be given by the Engineer.
 - 2. When the conditions causing suspension no longer exists, written notice to resume work will be given to the Contractor by the Engineer. Promptly after such written notices, the Contractor shall resume prosecution of the work as provided in 1106.02.
- B. The start of work may be delayed or work may be suspended upon request of the Contractor and with approval of the Engineer. The Engineer may require the request to be in writing and also may require the Contractor to include with the request a schedule for satisfactory completion of the work.

1108.07 EXTENSION OF CONTRACT PERIOD

- A. An extension of the contract period will be granted by the Engineer for additional work requiring additional construction time and may result from a modification of the plans or extra work.
 - 1. If any delay is caused by active interference by the Contracting Authority, the Contracting Authority will grant such an extension of time for completion of the contract as will, in the opinion of the Engineer, compensate for such delay. An extension of the contract period will be granted by the Contracting Authority for:
 - a. Additional work resulting from a modification of the plans for the project, or
 - b. Other reasons beyond the control of the Contractor which, in the Contracting Authority's judgment would justify such extension.
- B. All claims for extension of the contract period shall be made in writing to the Engineer no more than thirty days after the occurrence of the delays otherwise they shall be waived. In the case of continuing cause of delays only one claim is necessary.

1108.08 LIQUIDATED DAMAGES

- A. Time is an essential element of the contract and it is important that the work be pressed vigorously to completion.
- B. For each calendar day that any work shall remain uncompleted after the end of the contract period, number of working days allowed, or any extension granted under 1108.07, the amount per calendar day specified in the proposal form will be assessed, not as a penalty, but as predetermined and agreed liquidated damages.
 - 1. The Contracting Authority will prepare and forward to the Contractor an invoice for such liquidated damages.
 - 2. The final payment will be withheld until payment shall have been made on this invoice.
- C. Assessment of liquidated damages will be based only on the number of working days required to complete the work in excess of the specified working days allowed, plus authorized extensions thereto.
- D. This provision for the assessment of liquidated damages for failure to complete work within the contract period does not constitute a waiver of the Contracting Authority's right to collect any additional damages other than time delays which the Contracting Authority may sustain by failure of the Contractor to carry out the terms of the contract.

1108.09 FAILURE TO COMPLETE WORK WITHIN CONTRACT PERIOD

- A. If the Contractor fails to complete his work within the contract periods or any extension thereof, as provided in 1108.07, upon written notice to the Contractor and surety, said contract shall be in default. The Contracting Authority may, at its option, permit the Contractor or the Contractor's surety to complete the work included in the contracts or may proceed to complete the work in accordance with 1106.11. In either event, the Contractor or the Contractor's surety shall be responsible for all cost's incident to the completion of the work, and also for the liquidated damages stipulated in the proposal form. The Contracting Authority may waive such portion of the liquidated damages as may accrue after the work is in condition for safe and convenient use by the public.

1108.10 CONTRACTS IN DEFAULT

- A. The Contracting Authority may declare a contract in default for any one of the following reasons:
 - 1. Failure to complete the work within the contract period or any extension thereof,
 - 2. Failure or refusal to comply with an order of the Engineer within a reasonable time,
 - 3. Failure or refusal to remove rejected materials,
 - 4. Failure or refusal to correct any defective or unacceptable work,
 - 5. Bankruptcy or insolvency, or the making of an assignment for the benefit of creditors,
 - 6. Failure to carry on the work in an acceptable manner.

1108.11 COMPLETION OF CONTRACTS IN DEFAULT

- A. If for any reason a contract is declared in default, the Contracting Authority shall have the right, without process or action at law, to take over all or any portion of the work and complete it, at its option, either by day labor or by reletting the work.

1. Written notice shall be given the Contractor by the Contracting Authority that the contract has been declared in default, and upon receiving such notices the Contractor shall peaceably relinquish possession of the said work or the parts thereof specified in the notice.
- B. The Contracting Authority may, at its option and, at a rental which it considers reasonable, retain all material, equipment, and tools on the work until the work has been completed.
- C. Neither the Contracting Authority nor any member or employee thereof shall be in any way liable or accountable to the Contractor or the Contractor's surety for the method by which the completion of said work, or any portion thereof, may be accomplished, or for the price paid therefor.
 1. Should the cost of completing work be in excess of the original contract prices the Contractor and the Contractor's surety shall be held responsible for such excess cost.
 2. Should the cost of such completion, including all proper charges, be less than the original contract price, the amount so saved shall be paid to the Contractor.
 3. Neither by taking over the work nor by declaring the contract in default shall the Contracting Authority forfeit the right to recover damages from the Contractor or the Contractor's surety for failure to complete the entire contract.

1108.12 REMOVAL OF EQUIPMENT

- A. In the case of cancellation of this contract before completion from any cause whatsoever, the Contractor, if notified to do so by the Contracting Authority, shall promptly remove any part or all of his equipment and supplies from the property of the Contracting Authority. In the event of failure of the Contractor to remove such equipment and supplies within thirty days after the issuance of the notification for removal, the Contracting Authority shall have the right to remove such equipment and supplies at the expense of the Contractor.

1108.13 ORDER OF COMPLETION AND USE OF COMPLETED PORTIONS OF THE WORK

- A. The Contractor shall complete any portion or portions of the work in such order of time as the Engineer may require. The Contracting Authority shall have the right to take possession of, and use any completed or partially completed portion of the work at anytime, but such taking possession and use shall not be deemed as acceptance of the work so taken or used or any part thereof. If such prior use increases the cost or delays the work, the Contractor shall be entitled to such extra compensation or extension of time, or both, as determined by the Engineer.

1108.14 METHOD OF SERVING NOTICES

- A. Any notice to be given by the Contracting Authority to the Contractor under this contract shall be deemed to be served if delivered to any office used by the Contractor, or foreman, or agent, at or near the work, or deposited in the post office, postpaid, addressed to the Contractor at the last known place of business.

1108.15 TERMINATION OF CONTRACTOR'S RESPONSIBILITY

- A. The contract shall be considered completed when the work has been accepted in writing by the Contracting Authority.
 1. Such acceptance shall release the Contractor from all further obligation with respect thereto, except as to conditions and requirements set forth in the performance bond, and if, within one year after the final acceptance or a longer period of time, as may be prescribed by law or by the terms of any applicable guarantee required by the contract documents, any of the work is found to be defective or not in accordance with the contract documents, the Contractor shall correct it promptly after receipt of a written notice from the Contracting Authority to do so unless the Contracting Authority has previously given the Contractor a written acceptance of such conditions specifically stating the condition that is accepted.
 2. The Contracting Authority shall give such notice promptly after discovery of the condition. All such defective or non-comforming work shall be removed from the site if necessary, and the work shall be corrected to comply with the contract documents without cost to the Contracting Authority.
- B. The Contractor shall bear the cost of making good, all work destroyed or damaged by such removal or correction of separate contractors.

PART 1109. MEASUREMENT AND PAYMENT

1109.01 MEASUREMENT OF QUANTITIES

- A. The work completed under the contract shall be measured according to United States standard measures. Payment will be based on the actual quantity of work performed under the various work classifications in the contract, unless otherwise provided below, or by the method of measurement for the various classes of work.
- B. By written agreement between the Contractor and the Engineer, final settlement may be made on the basis of contract quantities without final field measurements. Such an agreement may be made before work is started or after work has been completed, if no material deviation from the original plans is involved.
 - 1. Except for those items for which quantities cannot be accurately predetermined⁰, the contract quantities have been accurately and properly estimated, but adjustments will be made for obvious errors or authorized changes.
 - 2. The Engineer shall exercise such controls and make such measurements, as are necessary, to assure that each item of work is done in substantial compliance with the contract documents. The use of this agreement for payment shall not be considered as a change in the contract.

1109.02 SCOPE OF PAYMENT

- A. The Contractor shall accept the compensation herein provided as full payment for furnishing all materials labor, tools, and equipment for performing all work under the contract or any extension thereof allowed under 1108.07, also, for all costs arising from the action of the elements or other natural causes, agreements, and performance, nonperformance, or delays involving other contractors and third parties, or injunctions or lawsuits resulting therefrom, or from any unforeseen difficulties not otherwise provided for in the specifications and which may be encountered during prosecution of the work and up to the time of acceptance thereof, except damage to the work due to acts of war. Nothing herein shall in itself be construed to prejudice or deny any claim filed under provisions 1109.12.
- B. The contract price for any item shall be full compensation for acceptable work and for materials, equipment, tools, and labor for performance of all work necessary to complete the item in accordance with the plans and specifications, except as specifically exempt in the clauses covering the basis of payment for the item.

1109.03 ADJUSTMENT IN CONTRACT PRICE

- A. When the measured quantity of any item varies by more than 20% from the estimated quantity specified in the contracts an adjustment in price may be made for such item of work, and the adjustment will be made on the full variance from the contract quantity. Such adjustment may be requested by either party to the Contract.
 - 1. If the contract sum for an item is less than five thousand (\$5,000.00) dollars, the price of that item will not be subject to adjustment.
- B. If the increase or decrease in quantity is due to an alteration in plans, any price adjustment shall be requested and agreed upon before the work is done. If the increase or decrease in quantity is not the result of an alteration in plans, but results from errors in original estimates, or unforeseen conditions, price adjustments may be requested after the work is completed.
- C. In making price adjustments, consideration shall be given to the portion of the cost of the work that can be classified as fixed costs, independent of the exact quantity of work performed, such as transportation and installation costs on equipment, overhead costs, etc. Any price adjustment shall be arrived from the standpoint that neither party to the contract shall be penalized by the increase or decrease in quantities which occasioned the price adjustment.
- D. If changes or alterations, as outlined in 1105.04, result in a substantial increase or decrease in cost or difficulty of the work, appropriate modifications will be made in the contract by extra work order, regardless of the quantity.
- E. All price adjustments shall be agreed to by the Engineer and the Contractor and shall be subject to the approval of the Contracting Authority.

1109.04 PAYMENT FOR WORK PERFORMED

- A. All contract price adjustments approved by the Engineer shall be subject to the concurrence of the Contracting Authority.
- B. The Contractor will receive and accept payment for work performed under his contract as follows:

1. Items or Work Performed Which Are Covered by Definite Prices Stipulated in the Contract: For all items of acceptable work performed which are covered by definite unit prices or lump-sum amounts specified in the contract, the Contractor shall receive and accept compensation at the rate specified in the contract, except as provided in 1109.03 and for items identified as that of "significant change" as provided in 1109.17.
2. Extra Work: Extra work ordered by the Engineer, of a quality or class not covered by the contract, will be paid for, either at an agreed price or on a force-account basis.
3. Agreed-Price Basis: For extra work ordered by the Engineer and performed on an agreed-price basis, the Engineer and the Contractor shall enter into a written agreement before such work is undertaken. This written agreement shall describe the extra work that is to be done and shall specify the agreed price or prices.
4. Force-Account Basis: Extra work performed on a force-account basis will be paid for in the following manner:
 - a. For laborers, timekeepers, foremen, and superintendents, the Contractor shall receive the rate of wage shown on previous payrolls for the time they are actually engaged in the extra work, to which shall be added an amount negotiated up to 15% thereof, plus the amount of social security tax imposed by law upon the Contractor because of such force-account work, plus the cost of worker's compensation, public liability insurance, and employment security contributions. The percentage shall cover compensation for furnishing of necessary small tools for the work together with all other overhead expense items.
 - b. The wage of the superintendent, timekeeper, or foreman who is employed partly on force-account work and partly on other work shall be prorated between the two classes of work according to the number of persons shown by the payroll, as employed on each class of work.
 - c. For materials used on force-account work, the Contractor shall receive the actual cost of materials delivered on the work, including the freight and handling charges as shown by original receipted bills, to which cost shall be added an amount negotiated to 15% thereof.
 - d. For machinery, tools, or equipment, fuel and lubricants therefor, except small hand tools which may be used, the Engineer shall allow the Contractor a reasonable rental rate to be agreed upon in writing before such work is begun. No profit percentage shall be added to the rate.
 - e. Compensation, as herein provided, shall be accepted by the Contractor as payment in full for extra work done on a force-account basis. It will be assumed that such payment includes the use of tools and equipment for which no rate is allowed, overheads and profit.
 - f. At the end of each day, the Contractor shall prepare payrolls in duplicate for labor furnished on a force-account basis, using the Contracting Authority's standard force-account forms. Both copies shall be signed by the inspector and Contractor's representative. One copy shall be furnished to the Engineer and one to the contractor.
 - g. Claims for extra work performed on a force-account basis shall be submitted to the Engineer in triplicate. To the claims shall be attached such receipt or statements as the Engineer may require in support of such claims. Such claims shall be filed not later than the tenth day of the month following that in which the work was actually performed, and shall include all labor charges, rental charges on machinery, tools, and equipment, and all material charges insofar as they are available.
5. Deficient Work: Payment for work judged by the Engineer to be deficient work shall be made at the reduced rate specified in the contract documents or, if no such rate is specified, at a modification of the contract prices as determined by the Engineer.

1109.05 CANCELLED WORK

- A. The Contracting Authority shall have the right to cancel any or all items from the contract when unforeseen circumstances, failure to secure permits, approvals, loss of funding, unanticipated design changes, or other reasons beyond the control of the Contractor prevent or unreasonably delay completion of the contract, or of certain items of the contract, or when the Contracting Authority determines that cancellation is in the public or national interest.
- B. The Contractor may be prevented from starting work on a contract, or an identified phase of a contract, as a result of a delay caused by the Contracting Authority or others.

- C. When the contract period is defined by approximate starting date and the delay prevents the Contractor's starting work on the contract or an identified phase of the contract for 30 days beyond the date which, by notice to the Engineer, the Contractor proposed to start work, the Contractor may request cancellation by written notice to the Engineer stating the reasons.
- D. In either case, within 30 days from the date of the request, the Engineer will eliminate or minimize, if possible, the cause for the delay and issue a notice to proceed, redefine the basis on which the work is to proceed, or cancel the contract or phase of the contract.
- E. The Contractor shall not use delays that occur prior to starting work or an identified phase of the work as a basis of a claim against the Contracting Authority except for an extension of contract period.
- F. Notices described in this article should be transmitted by certified mail.
- G. For finished portions of items canceled, the Contractor will be paid at the contract unit prices, in accordance with the provisions of 1109.04. For finished portions of major items canceled, the Contractor will be paid as provided in 1109.17. For all items, materials ordered and delivered for the unfinished portion of such canceled, or omitted items, the Contracting Authority will pay cost plus 10% as an overhead charge. The Contractor's expense for work of handling or transporting such material shall be included in computing the cost.
- H. The Contracting Authority will also pay any actual expenses sustained by the Contractor by reason of such cancellation or omission and not represented by work completed or material delivered. In computation of material cost or expenses sustained, no anticipated profit will be included.
 - 1. Material paid for shall become the property of the Contracting Authority and shall be disposed of as directed by the Engineer.

1109.06 PARTIAL PAYMENTS

- A. If the work extends over a period of more than one month, the Engineer may, upon request from the Contractor, prepare monthly estimates based on the amount of work completed in an acceptable manner.
 - 1. On contracts for which the contract sum is \$10,000.00 or more, monthly estimates may be allowed, based on 90% of invoiced value of processed or fabricated materials which have been delivered on the project site, provided the materials are of acceptable quality and the manner of storage is satisfactory to the Engineer.
 - 2. The Engineer's monthly estimates shall be partial payments on the contract, and the allowance of a monthly estimate by the Contracting Authority does not constitute final acceptance of the work upon which the estimates are based. Each estimate shall be filed by the Contractor in the form of a claim against the Contracting Authority and certified to by the Engineer on a payment request form supplied by the Contracting Authority.
- B. Three percent (3%) of each progress estimate shall be deducted and held as a suspended payment. Payments may be made on the remainder of the progress estimate, except under circumstances which would prejudice the rights of those who have filed claims pursuant to Chapter 573, Code of Iowa.
 - 1. The retained percentage will not be due and payable for a period of at least 30 days after the date of final acceptance of the entire contract or following the release or adjudication of claims that may have been filed, or until the Contractor has filed the sworn final estimate and sales and use tax statement with the Contracting Authority.
 - 2. Should a reasonable doubt arise as to the integrity of any part of the completed work, the estimate for that portion shall not be allowed until the cause for such doubt has been removed.
 - 3. The progress estimates and payments are approximate only, and shall be subject to correction in the final estimate and payment.
- C. Failure to make partial payment within 30 days after receipt and approval of the monthly estimate by the Engineer, will cause interest to accrue and additional payment therefor to be made in accordance with provisions of Chapter 573, Code of Iowa, subject to limitations included therein.

1109.07 SUPPLEMENTAL CONTRACT FOR WORK INTERRUPTED

- A. After ninety-five (95%) of the work has been performed to the satisfaction of the Contracting Authority, including consideration of the contract period, and it is apparent that conditions beyond the control of the Contractor will delay the completion of the contract for more than 60 days, the Contractor may request a supplemental contract for the uncompleted portion of work on the same terms as those of the original contract.

1. If the Contracting Authority agrees, and the surety for the Contractors consents to the extension of the bond for the time required to complete the supplemental contract, the supplemental contract will be issued. After the contract has been entered into, full payment will be made for the work completed, except under circumstances which would prejudice the rights of those who have filed claims pursuant to Chapter 573, Code of Iowa.
- B. The unpaid money, held by the Contracting Authority as a retainer of the original contract price, will be due and payable to the Contractor 30 days after the date of the Contracting Authority's approval of the supplemental contract, except as provided for the release and adjudication of claims in 1109.06.

1109.08 CERTIFIED STATEMENT OF SALES TAX AND USE TAX PAID

- A. Unless the Contracting Authority has issue an authorization letter and a Sales Tax Exemption Certificate for this project, before final payment can be made on a contract, the Contractor and subcontractors shall file a certified statement on forms provided by the Contracting Authority, showing the amount of Iowa sales tax and use tax paid by them on all materials which have become a component part of the finished, completed contract and on such supplies for this construction as were actually consumed on this work.
- B. These statements shall be submitted in duplicate to the Contracting Authority at the completion of the contract.

1109.09 ASSIGNMENT OF MONIES

- A. The Contractor shall not assign, by power of attorney or otherwise, any of the monies to become due and payable under this agreement unless the Contractor has received written consent of the Contracting Authority.

1109.10 SUBMITTALS REQUIRED BEFORE FINAL PAYMENT

- A. Before final payment can be made on this contract, the Contractor shall submit to the Engineer the following:
 1. A request for prefinal and final payment.
 2. One copy of any guarantees for products incorporated into the work.
 3. Two copies of the operating instructions on each piece of equipment incorporated into the work.
 4. Statements of Sales Tax from the Contractor and subcontractors, unless in receipt of an authorization letter and a Sales tax Exemption Certificate issued by the Contracting Authority for this project.

1109.11 FINAL ACCEPTANCE AND PAYMENT

- A. Final acceptance is stipulated to mean a written acceptance by the Contracting Authority. The Contracting Authority shall make final acceptance promptly upon the satisfactory completion of the work. Final payment shall be made as soon as possible following the expiration of statutory time for filing claims, or following adjudication or release of claims against the amount withheld.
- B. Failure to make final payment within 70 days after completion of the work, and if all requirements of the contract are completed, will cause interest to accrue and additional payment therefor to be made in accordance with provisions of Chapter 573, Code of Iowa, subject to limitations included therein, however, this provision shall not apply when final payment includes a supplemental contract for work interrupted, as provided for in 1109.07.
- C. Completion of the work will be considered as the date of approval and work acceptance by the Contracting Authority. When interest is to be paid, the date from which interest is to be calculated will be the thirty-first day after all required materials, certifications, and other documentation required to be submitted by the Contractor are received by the Engineer, however, the Contractor will be paid no interest if final payment is made within 70 days from the date of approval and work acceptance. The signed final payment request is not required documentation, but if not returned to the Engineer within 30 days, it will be considered required documentation.
- D. Signing of the final payment request or acceptance of payment based thereon, shall not waive any rights of either party in the resolution of any claim filed in accordance with 1109.12.
- E. The Contracting Authority shall satisfy itself as to the faithful completion of each part of the work, and may reject any portion found to be inconsistent with the terms of the contract.

1109.12 DISPUTED CLAIMS FOR EXTRA COMPENSATION

- A. In any case where the Contractor deems that extra compensation is due for work or material not clearly covered in the contract and not ordered by the Engineer as extra work as defined herein, the Contractor shall notify the Engineer in writing of the intention to make a claim for extra compensation before beginning the work on which the claim is based.
- B. The Contracting Authority shall be responsible for damages attributable to the performance, nonperformance, or delay of any other contractor, governmental agency, utility, firm, corporation, or individual authorized to do work on the project, only when such damage is a result from negligence on the part of the Contracting Authority, Engineer, or any of its officers or employees.
 - 1. In any case where the Contractor deems that extra compensation is due from the Contracting Authority as damages resulting from such performances, nonperformances, or delays, the Contractor shall notify the Engineer in writing at the time the delay occurs.
- C. In either case if such notification is not given, or if after such notification is given, the Engineer is not afforded facilities for keeping strict account of actual cost, as defined for force-account construction, the Contractor thereby agrees to waive the claim for extra compensation for such work. Such notice by the Contractors and the fact that the Engineer has kept account of the cost as aforesaid, shall not be construed as establishing the validity of the claim.
 - 1. The claims, when filed, shall be in writing and in sufficient detail to permit auditing and evaluation by the Contracting Authority. Claims shall be supported by such documentary evidence as the claimant has available and shall be verified by affidavit of the claimant or other persons having knowledge of the facts.
 - 2. In the event the claimant wishes an opportunity to present the claim in person, then the claim shall be accompanied by a written request to do so.
 - 3. Where the claimant asks an opportunity to present the claim in person, the Contracting Authority, within a reasonable period of time after the filing of the claim, shall fix a time and place for a meeting between the claimant and the Contracting Authority or its designated representatives.
 - a. The Contracting Authority shall, within a reasonable time from filing of the claim or the meeting above referred to, whichever is later, rule upon the validity of the claim and notify the claimant in writing, of its ruling together with the reasons therefor. In case the claim is found to be just, in whole or in part, it shall be allowed and paid to the extent so found.
- D. The Contractor shall not institute any court action against the Contracting Authority for the adjudication of any claims until such claim has first been presented to Contracting Authority pursuant to this article and submitted to arbitration or a request for arbitration is denied pursuant to 1109.13.

1109.13 ARBITRATION

- A. If a Contractor's claim, as outlined in 1109.12, has been disallowed, in whole or in part, then the Contractor may, within 30 days from the date of the ruling of the Engineer is mailed to the Contractor, make a written request to the Engineer that the claim or claims be submitted to a board of arbitration.
 - 1. The Engineer shall decide whether the matter is one which is subject to arbitration and shall, within 30 days of the receipt of the request for arbitration, grant or deny the request.
 - 2. The Engineer's decisions shall be final.
- B. Said board of arbitration shall consist of three persons, one to be chosen by the Engineer, one by the Contractor, and the third by the two arbitrators.
- C. The arbitrators selected shall be persons experienced and familiar with construction or engineering practices in the general type of work involved in the contract, but shall not have been a regular employee or an individual retained by either party at the time involved in the controversy, or at the time of arbitration.
- D. The board of arbitration shall make its own rules of procedure and shall have authority to examine records kept by the Engineer and the Contractor.
 - 1. If the desired records are not produced within 10 days after they are requested, the board of arbitration shall proceed without them as best it may.
 - 2. In determining the findings, or awards, or both, the majority vote of the board shall govern. Copies of the findings or awards or both, signed by the arbitrators shall be filed with the Engineer and the Contractor.
 - 3. A majority report or minority report may be filed. The board of arbitration shall fix the cost of the proceedings, including a reasonable compensation to the arbitrators, and shall determine how the total cost shall be borne.

- E. The board of arbitration shall have jurisdiction to pass upon questions involving compensation to the Contractor for work actually performed or materials furnished and upon claims for extra compensation which have not been allowed by the Engineer. Jurisdiction of the board shall not extend to:
 - 1. A determination of quality of workmanship, or materials furnished, or to an interpretation of the intent of the plans and specifications, except as to matters of compensation.
 - 2. Setting aside or modifying the terms or requirements of the contract.
- F. The findings or awards or both, of the arbitration board, if acceptable to both parties to the contract, may become a basis for final payment.
- G. If the findings of the arbitration board are unacceptable to either party to the contract, said findings may become the basis for further negotiations between the parties. If a solution agreeable to both parties has not been reached through the filing of a claims through arbitration, or if arbitration has been denied, either party may resort to whatever other methods for resolving the claim are available.

1109.14 CLAIMS AGAINST CONTRACTOR

- A. The Contractor guarantees the payment of all just claims against him/her or any subcontractor, in connection with the work. If another contractor on the project submits a claim for alleged damages caused by delay due to the Contractor not having completed its work in a timely manner, the Contractor's bond shall remain in effect until payment of such claim is made, or until litigation is started, at which time the bond will be released.

1109.15 TIME LIMITS FOR FINAL ADJUSTMENT

- A. The Contractor shall understand that the Contracting Authority will not be bound to consider applications for correction of estimates and payments after the Contractor has signed the final estimate, or after 30 days from the date when the final estimate is submitted to the Contractor for approval. Should an error be discovered as a result of the Contractor's annual audit, an application for corrections promptly made will be considered.

1109.16 NATIONAL EMERGENCY PROVISIONS

- A. The Contracting Authority may, with written notice, terminate the contract, or a portion thereof, when the Contractor is prevented from proceeding with the construction contract as a direct result of an executive order of the President with respect to the prosecution of war, or in the interest of national defenses as provided in Chapter 573A of the Code of Iowa.
- B. When contracts, or any portion thereof, are terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract unit prices or as mutually agreed for items of work partially completed or not started. No claim for loss of anticipated profits shall be considered.
 - 1. Reimbursement for organization of work (when not included in the contract) and moving equipment to and from the job will be considered where the volume of work completed is too small to compensate the contractor for these expenses under the contract unit prices, the intent being that an equitable settlement will be made with the Contractor.
- C. Acceptable materials, obtained by the Contractor for the work, which have been inspected, tested, and accepted by the Engineer, and which are not incorporated into the work, shall be purchased from the Contractor at actual cost, as shown by receipted bills and actual cost records, at such points of delivery as may be designated by the Engineer.
- D. Termination of a contract, or a portion thereof, shall not relieve the Contractor of its responsibilities for the completed work, nor shall it relieve the Contractor's surety of its obligation for and concerning any just claims arising out of the work performed.

1109.17 STANDARD CONTRACT CLAUSES

- A. Differing site conditions.
 - 1. During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, are encountered at the site, the party discovering such conditions shall

promptly notify the other party, in writing, of the specific differing conditions before they are disturbed and before the affected work is performed.

2. Upon written notification, the Engineer will investigate the conditions, and if he/she determines that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding loss of anticipated profits, will be made and the contract modified in writing accordingly.
 - a. The Engineer will notify the Contractor of his/her determination whether or not an adjustment of the contract is warranted.
 3. No contract adjustment which results in a benefit to the Contractor will be allowed unless the Contractor has provided the required written notice.
 4. No contract adjustment will be allowed under this clause for any effects caused on unchanged work.
- B. Suspension of work ordered by the Engineer.
1. If the performance of all or any portion of the work is suspended or delayed by the Engineer, in writing, for an unreasonable period of time (not originally anticipated, customary, or inherent to the construction industry) and the Contractor believes that additional compensation and/or contract time is due as a result of such suspension or delay, the Contractor shall submit to the Engineer, in writing, a request for adjustment within seven (7) calendar days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.
 2. Upon receipt, the Engineer will evaluate the Contractor's request. If the Engineer agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the Contractor, its suppliers, or Subcontractors at any approved tier, and not caused by weather, the Engineer will make an adjustment, excluding profit, and modify the contract in writing accordingly.
 - a. The Engineer will notify the Contractor of his/her determination, whether or not an adjustment of the contract is warranted.
 3. No contract adjustment will be allowed unless the Contractor has submitted the request for adjustment within the time prescribed.
 4. No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under any other term or condition of this contract.
- C. Significant changes in the character of work.
1. The Engineer reserves the right to make, in writing, at any time during the work, such changes in quantities and such alterations in the work, as are necessary to satisfactorily complete the project.
 - a. Such changes in quantities and alternations shall not invalidate the contract nor release the Surety, and the Contractor agrees to perform the work as altered.
 2. If the alterations or changes in quantities significantly change the character of the work under the contract, whether or not changed by any anticipated profits, adjustments will be made to the contract. The basis for the adjustment shall be agreed upon prior to the performance of the work. If such a basis cannot be agreed upon, an adjustment will be made either for or against the Contractor in such amount as the engineer may determine to be fair and equitable.
 3. If the alterations or changes in quantities do not significantly change the character of the work to be performed under the contracts the altered work will be paid for as provided elsewhere in the contract.
 4. The term "significant change" shall be construed to apply only to the following circumstances:
 - a. When the character of the work as altered, differs materially in kind or nature from that involved or included in the original proposed construction or;
 - b. When a major item of work, as defined elsewhere in the contract, is increased in excess of 125 percent or decreased below 75 percent of the original contract quantity, any allowance for an increase in quantity shall apply only to that portion in excess of 125 percent of original contract item quantity, or in case of a decrease below 75 percent, to the actual amount of work.

1109.18 INTEREST PAYMENTS

- A. Interest on monthly payment estimates.

1. Interests shall be paid to the Contractor on any progress payment approved by the Engineer under paragraph A of paragraph 1109.06 of these General Covenants and Provisions, which remains unpaid after thirty (30) days of the receipt by the Contracting Authority.
 - a. Receipt by the Contracting Authority shall be defined as the date the Contracting Authority's central office mail staff receives the progress payment request and stamp it. All progress payment requests which are delivered directly to the central office by the Contractor or the Inspector of the Contracting Authority shall have a date of receipt entered by the mail room staff.
 - b. Interest shall accrue on the 31st day after receipt by the Contracting Authority, if approved by the Engineer, and shall end on the date the warrant is issued by the Iowa Department of Revenue. The rate of interest shall be the same as the rate of interest in effect under 453.6 of the Iowa Code, as the date interest begin to accrue.
- B. Interest on retainage.
 1. Interest shall be paid on any retained funds held under paragraph B of section 1109.06 of these General Covenants and Provisions. Interest shall be paid as outlined in Iowa Administrative Code section 561, Chapter 8.7.

END OF SECTION 00700

SECTION 00710

(Revised 9/8/95)

SPECIFIC EQUAL EMPLOYMENT OPPORTUNITY RESPONSIBILITIES

Notice of Requirements for Affirmative Action to ensure Equal Employment Opportunity (Executive Order 11246 as amended) and Iowa Executive Orders 15 and 34. This includes employment goals for minorities and women in construction.

60-1.4 EQUAL OPPORTUNITY CLAUSE.

A. Federally assisted construction contracts.

1. Except as otherwise provided, each administering agency shall require the inclusion of the following language as a condition of any grant, contract, loan, insurance, or guarantee involving federally assisted construction which is not exempt from the requirements of the equal opportunity clause.

B. The applicant hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loans insurance, or guarantee, the following equal opportunity clause:

C. During the performance of this contracts the Contractor agrees as follows:

1. The Contractor will not discriminate against any employee, or applicant for employment because of race, colors, religion, sex, national origin, or disability.
 - a. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following; Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.
 - b. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
2. The Contractor will in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, national origin, or disability.
3. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
5. The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labors or as otherwise provided by law.
7. The Contractor will include the portion of the sentence immediately preceding paragraph 1. and the provisions of paragraphs 1-7 in every subcontract or purchase order unless exempted by rules, regulations, or orders of the

Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor.

- a. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance.
- b. Provided, however, that in the event a Contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

I. DEFINITIONS.

A. Definitions as used in these specifications:

1. **Covered Area** means the entire State of Iowa, however, those areas of a Hometown Plan approved by the US Department of Labor will be considered separately.
2. **Director** means Director, Office of Federal Contract Compliance Program, United States Department of Labor or any person to whom the Director delegates authority.
3. **Employer Identification Number** means the Federal Social Security Number used on the Employer's Quarterly Federal Tax Returns US, Treasury Department Form 941.
4. **Designated Geographical Areas.**
 - a. **Standard Metropolitan Statistical Area (SMSA).** These areas represent a reasoned judgement as to how metropolitan areas are defined statistically in a uniform manner, using data items that are:
 - 1) widely recognized as indicative of metropolitan character, (population, urban character, nonagricultural employment, population, density, and commuting ties), and
 - 2) available from a body of Federal statistics which has been uniformly and simultaneously collected in all parts of the country, and processed and tabulated according to consistent standards. Thus, if a project is located within an SMSA, it can be concluded that a reasonable commuting area exists within the SMSA, and that goals based on SMSA statistics are accurate.
 - b. **Economic Area (EA).** These areas are viewed as centers of commerce, and they generally cover areas which include the places of work and residence for most workers. There are 183 such areas, defined along county lines, covering the entire country. Counties were assigned to these economic areas in accordance with commuting patterns based primarily on data gathered by the Bureau of the Census.
5. **Minority** includes:
 - a. **Black** (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - b. **Hispanic** (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish Culture or origin, regardless of race),
 - c. **Asian and Pacific Islander** (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands), and
 - d. **American Indian or Alaskan Native** (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(Note: Minority women from the above referenced groups shall be counted as satisfying both the minority and female employment goals in each geographic area.)

II. GENERAL.

- A. Equal Employment Opportunity requirements not to discriminate and to take affirmative action to assure equal employment opportunity as required by Executive Order 11246 and Executive Order 11375. The requirements set forth in this specification shall constitute the specific affirmative action requirements for project activities under this contract and supplement the equal employment opportunity requirements set forth in the Required Contract Provisions.

III. EQUAL OPPORTUNITY POLICY.

- A. The Contractor will accept as his/her operating policy the following statement which is designed to further the

provision of equal employment opportunity to all persons without regard to their age, race, color, religion, sex, national origin, or disability, and to promote the full realization of equal employment opportunity through a positive, continuing program.

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their age, race, religion, sex, color, national origin, or disability. Such action shall include: employment, upgrading, demotion, and transfer, recruitment and recruitment advertising, layoff, and termination, rates of pay and other forms of compensation, and selection of training, including apprenticeship, preapprenticeship, and/or on-the-job training."

IV. GOALS.

- A. Specific goals for female and minority participation have been established.
- B. The goals for female participation, expressed in percentage terms for the total hours worked by the Contractor's aggregate workforce in each trade on all construction work, is 6.9 percent, with no timetable. This goal applies nationwide.
 - 1. Goals for minority participation in Iowa, expressed in percentage terms for the total hours worked by the Contractor's aggregate workforce in each trade on all construction work, are shown on the map of Iowa that follows. The goals shown apply to each designated geographical area, as shown on the map.
- C. These goals are applicable to all the Contractor's construction work (whether or not it is non-Federal or Federally assisted) performed in the designated area. For each contract and/or subcontract in excess of \$10,000, the goals for minority participation will apply for all work to be performed in geographical areas designated by the Director pursuant to 41 CFR 60-4.6, and the goal for female participation will apply nationwide.
 - 1. The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on his/her implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and his/her efforts to meet the goals established for minority participation for the geographical area where the work is to be performed, or nationwide goal for female participation.
 - 2. The hours of minority and female employment and training must be substantially uniform throughout the time period for the work of the contracts and within each trade, and the Contractor shall make a good-faith effort to employ minorities and women evenly on each of his/her projects.
 - 3. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Orders and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.
- D. The Contractor shall provide written notification to the Department of Natural Resources (on behalf of the Director of the Office of Federal Contract Compliance Programs) within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under this contract.
 - 1. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number, estimated dollar amount of the subcontract, estimated starting and completion dates of the subcontracts and the geographical area in which the contract work is to be performed.
- E. Application of Minority Participation Goals.
 - 1. **Minority Participation.** A single minority participation goal is established for each SMSA and EA. Timetables for the achievement of minority goals are not provided. A separate goal is established for each SMSA and for each EA. When a contract or subcontract to which this specification applies is for work located within a SMSA, the goal for that SMSA applies. When a contract or subcontract to which this specification applies is for work located outside an SMSA, the goal for that EA applies.
 - a. The applicable goal for the Contractor or subcontractors is the goal for each geographical area where the work is being performed, and all the work of the Federal or Federally assisted construction contractor or subcontractor is covered, whether the work is being performed for a contract to which the specification applies or not. Therefore, a contractor with work in SMSA "X" would apply the goal for

SMSA "X" for that work. The same contractors however, would apply the SMSA "Y" goal to all his/her work in SMSA "Y", even though the Contractor's work in SMSA "Y" is neither Federal nor Federally assisted.

2. **Participation of Minority Women.** The Contractor and required subcontractors will be permitted to count minority women belonging to one of the recognized minority groups listed in Article I of this specification as satisfying both the minority goal for each designated geographic area and the overall female goals. Conversely, nonminority women will only count toward satisfying the overall female goal.

V. STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246).

- A. Whenever the Contractor or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, he/she shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation set forth herein.
- B. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the US Department of Labor in the covered area either individually or through an association, his/her affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan.
 1. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or subcontractor participating in an approved Plan is individually required to comply with his/her obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which he/she has employees.
 2. The overall good faith performance by other Contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to make good faith efforts to achieve the Plan goals and timetables.
- C. The Contractor shall implement the specific affirmative action standards provided in paragraphs 6a through p. Article V, of these specifications. The goals set forth in the specifications are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which he/she has employees in the covered area. The Contractor is expected to make substantially uniform progress toward his/her goals in each craft during the period specified.
- D. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
- E. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training program, approved by U.S. Department of Labor.
- F. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluations of the Contractor's compliance with these specifications shall be based upon his/her effort to achieve maximum results from his/her actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
 1. Endure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project.
 - a. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of, and carry out, the Contractor's obligations to maintain such a working environments with specific attention to minority or female individuals working at such sites or such facilities.

2. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
3. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization, and of what action was taken with respect to each such individual.
 - a. If such individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.
4. Provide immediate written notification to the Director, when the union or unions with which the Contractor has a collective bargaining agreement, have not referred to the Contractor a minority person or women sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet his/her obligations.
5. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. Training programs may be specifically required elsewhere in the contract documents. The Contractor's responsibility for training opportunities is not necessarily limited to training programs that are specifically required. The Contractor shall provide notice of these programs to the sources compiled under 6b above.
6. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting his/her EEO obligations, by including it in any policy manual and collective bargaining agreement, by publicizing it in the company newspaper, annual report, etc., by specific review of the policy with all management personnel and with all minority and female employees, at least once a year, and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
7. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions, including specific review of these items with on-site supervisory personnel, such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained, identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
8. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to, and discussion the Contractor's EEO policy, with other Contractors and subcontractors with whom the Contractor does or anticipates doing business.
9. Direct the Contractor's recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment sources the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
10. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after schools summer, and vacation employment to minority and female youths both on the site and in other areas of the Contractor's workforce.
11. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
12. Conduct, at least annually, an inventory and evaluation, of all minority and female personnel, for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
13. Ensure that seniority practices, job classifications, work assignments, and other personnel practices, do not

- have a discriminatory effect, by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
14. Ensure that all facilities and company activities are nonsegregated, except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
 15. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractor and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
 16. Conduct a reviews at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
- G. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (6a through p).
1. The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of the obligations under 6a through p of these specifications, provided the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet his/her individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor.
 2. The obligation to comply, however, is the Contractor's, and failure of such group to fulfill an obligation shall not be a defense for the Contractor's noncompliance
- H. A single overall goal for women and goals for minorities in each designated area are included in Article IV of these specifications. The Contractor is required to provide equal opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved the goal for women generally, the Contractor may be in violation of the Executive Order if a specific minority group or women are underutilized).
- I. The Contractor shall not use the goal, or affirmative action standards to discriminate against any person because of age, race, color, religion, sex, national origin, or disability.
- J. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts, pursuant to Executive Order 11246.
- K. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
- L. The Contractors in fulfilling his/her obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph G of these specifications, so as to achieve maximum results from his/her efforts to endure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
- M. The Contractor shall designate a responsible official to monitor all employment-related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records.
1. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed.
 2. Records shall be maintained in an easily understandable and retrievable form, however, to the degree that existing records satisfy this requirement, Contractor shall not be required to maintain separate records.

PART 0 - GENERAL

0.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

0.01 GENERAL

- A. The General Conditions of the contract are the General Covenants and Provisions bound within.
 - 1. These General Covenants and Provisions are herein modified or supplemented by this Supplementary Covenant and Provisions.
 - 2. Articles of the General Covenant and Provision not directly affected by this section remains in full force as written, unless exceeded in requirements herein or elsewhere in these Specifications.

0.03 DEFINITION OF TERMS

- A. Article 1100.03 "Definition of Terms" is supplemented and modified as follows:
 - 1. General: A substantial amount of specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article. Definitions and explanations of this section are not necessarily either complete or exclusive, but are general for the work to the extent not stated more explicitly in another provision of Contract Documents.
 - 2. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities, which must be fulfilled indirectly by Contractor, or when so noted, by others.
 - 3. Bureau Chief: The individual appointed by the Iowa Department of Natural Resources as the head of the Land and Waters bureau.
 - 4. DNR Construction Inspector: The Department of Natural Resources Construction Inspector will be the direct representative of the department at the project location with the authority to verify compliance with the provisions of each and all divisions of this Project Manual. Contact the DNR Construction Inspector regarding questions on site review, inspections and project coordination.
 - 5. Procurement Supervisor: The Procurement Supervisor will answer all questions regarding Bidding and Contract Procedures.
 - 6. General Requirements: The provisions of requirements of Division-1 sections. General requirements apply to entire work of Contract and, where so indicated, to other elements which are included in project.
 - 7. Indicated: The term "indicated" is a cross-reference to details, notes or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.
 - 8. Directed, Requested,...,: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "directed by Engineer," "requested by Engineer," etc. However, no such implied meaning will be interpreted to extend Engineer's responsibility into Contractor's area of construction supervision.
 - 9. Approve: Where used in conjunction with Engineer's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of the term "approved," will be held to limitations of Engineer's responsibilities and duties as specified in General Covenants and Provisions and Supplementary Covenants and Provisions. In no case will "approval" by Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of contract documents.
 - 10. Project Site: The space available to Contractor for performance of the work, either exclusively or in conjunction with others performing other work as part of the project. The extent of project site is shown on Drawings, and may or may not be identical with description of land upon which project is to be built.
 - 11. Furnish: Except as otherwise defined in greater detail, the term "furnish" is used to mean supply and deliver

- to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
12. Install: Except as otherwise defined in greater detail, term “install” is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
 13. Provide: Except as otherwise defined in greater detail, term “provide” means furnish and install, complete and ready for intended use, as applicable in each instance.
 14. Installer: The entity (person, firm...) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in portions of the work they are to accomplish.

PART 1 - INSTRUCTIONS TO BIDDERS

1.01 GENERAL

- A. Article 1101.101 “General” is supplemented and modified as follows: Add:
- F. All Bidders must complete and return Form 5700-49 with their bids (See 00310).

1.02 DRAWINGS AND SPECIFICATIONS

- A. Article 1101.02 “Drawings and Specifications” is supplemented and modified as follows:
 1. The Drawings and Specifications which are enumerated in the Index of drawings and Table of Content of this project manual are part of this contract.

1.07 ESTIMATE OF QUANTITIES

- A. Article 1101.07 “Estimate of Quantities” is supplemented and modified as follows:
 1. Estimated quantities are minimum quantities required. Bidding contractors shall determine their own quantities as required to complete the work to provide a total bid for a complete and proper project.

1.14 AWARD OF THE CONTRACT

- A. Article 1101.14 “Award of the Contract” is supplemented and modified as follows: Delete paragraph B and C and replace with the following:
- B. The Department of Natural Resources Reserves the right to reject all bids or any proposal or to waive informalities in any proposal or to accept any proposal which will best serve the interests of the program for which Federal assistance is awarded.
- C. If, at the time this contract is to be awarded, the lowest proposal submitted by a qualified, responsible bidder is in the best interest of the program, the contract will be awarded, and the bidder to whom the award is made will be promptly notified after the Department of Natural Resources meeting.

PART 4 - SCOPE OF WORK

4.03 INCREASED OR DECREASED QUANTITIES

- A. Article 1104.03 “Increased or Decreased Quantities” is supplemented or modified as follows:
 1. The Contractor shall be responsible for furnishing all labor, equipment and material necessary to complete all the work required for this project. There will be no additional compensation for any increases of quantities determined to be necessary by the Engineer/DNR Construction Inspector to accomplish the intent of these contract documents.

4.10 PERMITS AND ARRANGEMENTS WITH OTHER GOVERNMENTAL AGENCIES

- A. Article 1104.10 “Permits and Arrangements with Other Governmental Agencies” is supplemented and modified as follows:
 1. Contractor shall take out and pay for any building permit which may be required, secure and pay for all permits, certificates and licenses required to prosecute the work, and shall arrange for and pay for all inspections required by local authorities.
 2. Apply and pay for NPDES Stormwater Discharge Permit (DNR’s General Permit No. 2) for Construction Operation, as required by EPA regulations dated March 10, 2003, for any land-disturbing activity which will

disturb an area of one or more acres, with the Iowa DNR.

- a. Permits are available from the DNR Storm Water Coordinator. (Tel. (515) 217-0875)

4.13 DRAWINGS AND SPECIFICATIONS

- A. Article 1104.13 "Drawings and Specifications" is supplemented and modified as follows:
 1. The Contractor shall be responsible for distributing to all involved in this project, Drawings and Specifications in quantities reasonably necessary for the completion of the portion of work they are responsible for. No additional payment will be made for shortcomings resulting from misunderstanding of Contract Documents due to any shortage of information between General Contractor, Subcontractors, and Material Suppliers.

4.14 THE CONTRACTING AUTHORITY'S RIGHT TO OCCUPY

- A. Article 1104.14 "The Contracting Authority's Right to Occupy" is supplemented and modified as follows: Add:
- B. Personnel of the Iowa Department of Natural Resources, the assisting Federal Agency, and the Iowa Department of Economic Development shall be allowed access to all area of the work site as required for the performance of their official duties.

4.15 CONSTRUCTION STAKES AND BENCH MARKS

- A. Article 1105.07 "Construction Stakes and Bench Marks" is supplemented and modified as follows:
 1. The Contractor will be responsible for setting the necessary stakes to establish centerlines, slopes, alignment, grade and other stakes as required for construction.
 2. The Contractor shall assume full responsibility for the accuracy and correctness thereof.

PART 6 - CONTROL OF MATERIALS

6.03 SAMPLES AND TESTS

- A. Article 1106.03 "Samples and Tests" is supplemented and modified as follows:
 1. All testing required by the contract documents or the DNR Construction Inspector shall be considered a part of the Contract and shall be paid for by the Contractor.

PART 7 - LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

7.05 FEDERAL PARTICIPATION

- A. Article 1107.05 "Federal Participation" is supplemented and modified as follows: Add:
- B. If the project involves federal assistance, comply with the following requirements:
 1. Debarment and Suspension:
 - a. **All Bidders must complete and return Form 5700-49 along with their bid.**
On all federally assisted contracts and subcontracts in excess of \$25,000.00, any bidder or equipment supplier whose firm or affiliate is listed in the GSA publication "List of Parties Excluded from Federal Procurement and Nonprocurement Programs will be prohibited from submitting a bid who is listed in this publication will be determined to be a nonresponsive bidder.
 2. Violation Facilities: On all federally assisted contracts and subcontracts in excess of \$100,000.00, the Contractor shall comply with all applicable standards, orders or requirements issued under section 306 of the Clean Air Act (42 U. S. C. 1857(h)), section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and EPA regulations (40 C.F.R. Part 15) which prohibit the use under nonexempt Federal contracts, grants or loans, of facilities included on the EPA List of Violating Facilities.
 3. Energy Efficiency: On all federally assisted contract and subcontracts, the Contractor shall comply with mandatory standards and policies on energy efficiency contained in the State's energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Pub. L. 94-163).
 4. Where federal assistance for a project involving construction is received, comply with the following additional requirements:
 - a. The Copeland Act: The Copeland (Anti-Kickback) Act, and the regulations of the Department of Labor under 29 CFR Part 3 prohibit Contractors and Subcontractors from inducing any person involved in your project to give up any part of the compensation to which that person is entitled under an employment

contract.

- b. The Contract Work Hours and Safety Standards Act: The Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.) and the regulations for the Department of Labor under 29 CFR Part 5 require Contractors and Subcontractors to pay wages to laborers and mechanics on the basis of an eight hour work day and 40 hour work week and to pay at least time-and-a-half for work performed in excess of these time limitations. Also, the Act prohibits your contractors and subcontractors from requiring laborers and mechanics to work in hazardous, unsanitary, or dangerous conditions (see 29 CFR Part 1926).
 - c. Convict labor: You may not use convict labor unless the convicts are on work release, parole, or probation (see 18 U.S.C. 436).
5. Minority Business Enterprise/Women's Business Enterprise: Each contractor must fully comply with the requirements, terms, conditions of the Environmental Protection Agency's policy to award a fair share of subagreements to minority and women's businesses. The description of the affirmative steps to be taken are attached (See Region VII Procedures for Implementation of 40 CFR Part 33.240 attached).
6. Anti-Lobbying Act of 1990: The contractor which is awarded the low bid for a federally assisted contract and subcontract in excess of \$100,000.00, will need to complete the attached certification (See Recipient Certification - Anti-Lobbying Act of 1990).
- C. Additional Requirements under DNR Federal Grant Agreements regarding Termination of Contracts: Where construction contracts are being funded in whole or in parts by federal government monies, the following shall apply:
- 1. Termination for Cause: The Department may terminate this Contract in whole or in part, at any time before the expiration date, whenever the Department has determined that the Contractor has materially failed to comply with the conditions of the Contract.
 - a. The Department shall promptly notify the Contractor in writing of the determination and reasons for the termination, together with the effective date.
 - b. Payments made to the Contractor or recoveries by the Department under Contract terminated for cause shall be in accord with the legal rights and liabilities of the parties.
 - 2. Termination for Convenience: The Department or the Contractor may terminate the Contract in whole or in part when both parties agree that continuation of the Contract would not produce beneficial results commensurate with future expenditure of funds.
 - a. The two parties shall agree upon the termination conditions, including the effective date and, in the case of partial termination, the portion to be terminated.
 - b. The Contractor shall not incur new obligations for the terminated portion after the effective date and shall cancel as many outstanding obligations as possible.
 - c. The Contractor shall prepare and deliver to the Department copies of the final report summarizing the work performed and the results obtained to date.
- E. Records:
- 1. Access to Records: The Department, the Federal Grantor Agency, the Comptroller General of the United States, or any of their duly authorized representatives shall have access to any books, documents, papers, and records of the Contractor which are directly pertinent to this Contract for the purpose of making audit, examination, excerpts and transcription.
 - 2. Retention of Records: All records in the possession of the Contractor pertaining to this Contract shall be retained by the Contractor for a period of three (3) years beginning with the date upon which the final payment under this Contract is issued.

PART 9 - MEASUREMENT AND PAYMENTS

9.01 MEASUREMENT OF QUANTITIES

- A. Article 1109.01 "Measurement of Quantities" is supplemented and modified as follows:
 - 1. For the purpose of this project, Contract Quantities will be quantities determined by Contractor and

submitted to Engineer as price breakdown within 30 days after the award of contract.

9.03 ADJUSTMENT IN CONTRACT PRICE

- A. Article 1109.03 "Adjustment in Contract Price" is supplemented and modified as follows:
 - 1. No adjustment in contract price shall be made unless the increase or decrease of quantity is due to an alteration of Contract Documents after the Contract is awarded.
 - 2. Changes in contract resulting in a decrease in the Scope of the Work shall be computed on the basis of Contractor's price breakdown, and rebated to the Contracting Authority.
 - 3. Additional work determined to be necessary but not covered by the Contract shall be computed on the basis of the price breakdown or as outlined in 1109.04, as applicable, and paid for by the Owner.

9.10 SUBMITTAL REQUIRED BEFORE FINAL PAYMENT

- A. Article 1109.10 "Submittals Required Before Final Payment" is supplemented and modified as follows:
 - 1. Submit to the Engineer or the DNR Construction Inspector all submittals required in Section 01300 before final payment can be made, unless otherwise specified.
 - 2. Other submittals may be required in other sections.

END OF SECTION 00811A

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions, and General Requirements.

1.02 GENERAL:

- A. Special Condition:

1. Build America, Buy America Act:

This project shall comply with section 70914 of the Infrastructure Investment and Jobs Act, Public Law Number 117-58, which includes the Build America, Buy America Act. Section 70914 of this act requires the following Buy America Preference:

- a. All iron and steel used in the project are produced in the United States. This means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
- b. All manufactured products used in the project are produced in the United States. This means the manufactured product was manufactured in the United States, and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation.
- c. All construction materials are manufactured in the United States. This means that all manufacturing processes for the construction material occurred in the United States.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of or permanently affixed to the structure.

Any waivers from these requirements must be in writing and meet the requirements of section 70914(b) of the Build America, Buy America Act.

The fabricator/supplier of all iron, steel, manufactured products, and construction materials shall provide a letter certifying all of the materials are in compliance the Build America, Buy America Act, and the necessary supporting documentation will be retained by the fabricator/supplier for a minimum of seven years from the time the products are shipped for incorporation into the project.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions and the Supplementary Covenants and Provisions.

1.02 SUMMARY OF WORK:

- A. Work Covered by Contract Documents:
 - 1. Name of the project is "Phase 2", Project Number 25-06-82-02. Drawings and Specifications are dated February 2026.
 - 2. Briefly and without force and effect upon contract documents, work of the contract can be summarized as follows:
 - a. This project includes construction of a new wood framed building for the commercial shooting complex building, including offices, range control, sales, classroom, and supporting spaces. The structure consists of concrete foundations and flatwork, wood framed walls and pre-engineered trusses, standing seam metal roofing, engineered wood siding, aluminum windows, and hollow metal doors and frames. Interior work includes wood stud framing, closed cell spray foam insulation, fiberglass batt insulation, blown cellulose insulation, installation of drywall, installation of fluid applied flooring, painting, installation of kitchen and bathroom fixtures and finishes, and installation of wood doors with hollow metal frames. Mechanical work includes the installation of heating and cooling ductwork and appliances for the building in two zones. Electrical work includes installation of lighting and electrical equipment. Site work consists of earth removal, concrete flatwork, re-grading, concrete paving, well installation, and septic system installation.

The project also includes alterations to two (2) existing pole barn buildings consisting of selective demolition as described in the contract documents, includes removal of overhead sectional doors, removal of hollow metal doors, and removal of siding. Installation of new operable sectional doors, new hollow metal doors and framing, new siding.

The project also includes installation of a new portal sign.

This project has 2 Alternates:

Add alt #1 equipment on technology plans.

Add alt #2 in equipment spec 110500.

- B. Occupancy:
 - 1. Owner: The DNR shall have the right to enter the building or work site and store or attach such fixtures or furniture as it may elect, or to do other work providing that such storage or work will not interfere with the completion of the Contractor's work. Such occupancy by the DNR shall in no way imply final acceptance of any portion of the Contractor's work.

1.04 MEASUREMENT AND PAYMENTS:

- A. Measurements and payments shall be in accordance with Section 01250 of these specifications.
- B. Before ordering any fabricated material or doing any work, verify all measurements at the project site. No additional compensation will be allowed because of difference between actual dimensions and the measurements indicated on the drawings. Report any difference immediately to the DNR for instructions before proceeding with the work.

1.06 COORDINATION:

- A. Project Coordination:
 - 1. Take out and pay for any building permit which may be required, secure and pay for all permits, certificates and licenses required to prosecute the work, and arrange and pay for all inspections required by local authorities.

2. Visit the site, compare the Drawings and Specifications with any work in place, and verify all conditions, including other work, if any, being performed. Failure to visit the site will in no way relieve the Contractor from necessity of furnishing any materials or performing any work that may be required in accordance with Drawings and Specifications.
- B. Job Site Administration: Take complete charge of work under this contract. Coordinate the work of all trades and all phases of general, structural, plumbing, mechanical, and electrical work.

1.07 FIELD ENGINEERING:

- A. Provide such field engineering services as are required for a proper completion of the work.
 1. Immediately upon entering project site for the purpose of beginning work:
 - a. Establish actual project location, set back and side yards, if any, with the DNR Construction Inspector.
 - b. Establish and maintain all lines and levels.
- B. Additional requirements for field engineering may also be described in other sections of these specifications.
- C. Verify all figures shown on Drawings before laying out work and report all discrepancies to the DNR Construction Inspector. Contractor will be held responsible for any error resulting from failure to do so.

1.09 ABBREVIATIONS AND SYMBOLS:

- A. Reference to a technical society, institution, association, or government authority is made in the Specifications in accordance with the following abbreviations:

AAMA	Architectural Aluminum Manufacturers Association
AASHO	American Association of State Highway Officials
ACI	American Concrete Institute
AIA	American Institute of Project Engineers
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ALS	American Lumber Standards
APA	American Plywood Association
ATI	Asphalt Tile Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Project Architectural Wood Work Institute
AWPA	American Wood Preservers' Association
AWS	American Welding Society
CS	Commercial Standard, U.S. Department of Commerce
FGJA	Flat Glass Jobbers Association
FS	Federal Specification
GA	Gypsum Association
IES	Illuminating Engineering Society
MIA	Marble Institute of America
MLMA	Metal Lath Manufacturers Association
MS	Military Specification
MSTD	Military Standard
NAAMM	National Association of Metal Manufacturers, The
NHLA	National Hardwood Lumber Association
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electric Code of NBFU
NFPA	National Fire Protection Association
NLMA	National Lumber Manufacturers Association
NTMA	National Terrazzo and Mosaic Association, Inc.,
NWMA	National Woodwork Manufacturers Association

SDI	Steel Deck Institute
SSPC	Steel Structures Painting Council
SCPI	Structural Clay Products Institute
SPR	Simplified Practice Recommendations, U.S. Department of Commerce
TCA	Tile Council of America
UL	Underwriters' Laboratories, Inc.
USA	United States of America Standards Association

1.13 PROJECT MEETINGS:

- A. Preconstruction Conference: Soon after award of contract and prior to the start of construction, attend a preconstruction conference with the representative of the Owner to define the requirements for contract administration and construction operation.
 - 1. Contact the DNR Construction Inspector who will determine the time, date and place of the conference.
- B. Progress Meetings: The Contractor or the Contractor's representative shall be available at the job site to meet with the DNR Construction Inspector, as frequently and as arranged during the preconstruction conference, to discuss work progress.
 - 1. Give verbal report of progress, discuss work schedule, and present all conflicts, discrepancies and other difficulties for resolution.

1.16 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS:

- A. Definitions: Specific administrative and procedural minimum actions are specified in this section, as extension of provisions in other contract documents. These requirements have been included for special purposes as indicated. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this section will be recognized as an indication by Project Engineer that such temporary activity is not required for successful completion of the work and compliance with contract documents.
- B. General: Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the work. Terminate use and remove facilities at earliest reasonable time, when no longer needed or when permanent facilities have replaced the need.
- C. Temporary Utilities: The types of services required may include, but not by way of limitation, water, sewerage, surface drainage, electrical power and telephones. Where possible and reasonable, connect to existing franchised utilities for required services; comply with service companies recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
 - 1. Sanitary Facilities:
 - a. Temporary Toilets: When such or permanent facilities do not exist, provide and maintain toilets for use by workers. Keep toilets in sanitary condition.
 - b. Temporary toilet facilities shall meet OSHA requirements.
- D. Security:
 - 1. Protection of Work and Property:
 - a. Place and maintain such barricades as may be necessary to prevent public access to the project site at no cost to the Owner.
- E. Options and Substitutions:
 - 1. Bid shall include all equipment, materials, and services as specified, noted on the Drawings or required for a complete and proper installation.

1.19 CONTRACT CLOSEOUT:

- A. Final Cleaning:
 - 1. Remove waste material and rubbish caused by the Work and leave all work clean and free of debris of any kind.
 - 2. Keep the site and access road reasonably clean and free of rubbish or waste material in order that the work may progress efficiently. Remove such rubbish or waste material entirely from the premises at each time of such cleaning.

3. When the Work is completed and ready to turn over to the Owner, leave such work clean. This applies to all areas affected by contract work.
 4. On completion of the Work, thoroughly police and clean-up the premises surrounding the building.
- B. Final Inspection:
1. Request a final inspection in writing, at least ten days prior to the anticipated date of completion, from the DNR Construction Inspector.
 2. Work will not be considered ready for final inspection until all the work has been completed and the Contractor has certified that all items are properly operating and in strict compliance with the Contract Documents.
 3. The Contractor or project supervisor shall be at the job site during the final inspection.
 4. After the inspection, the DNR Construction Inspector will present the Contractor a list of items not meeting contract requirements which must be made acceptable before final payment is made.

END OF SECTION 01000

Section 01030
ALTERNATES/ALTERNATIVES

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: General requirements pertaining to:
 - 1. The Work specified for accepted alternate bids, the materials and methods referenced in other sections to achieve specified work, and the coordination and modification of related work and surrounding construction to complete the project under each accepted bid.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 DESCRIPTION OF ALTERNATE BIDS:

- A. ADD Alternate No. 1: Equipment as shown on Technology plans
- B. ADD Alternate No. 2: Equipment outlined in specification 110000

1.03 ALTERNATE BID REQUIREMENTS:

- A. Bidder must submit alternate bids. Bids submitted without alternate bid will be rejected as unresponsive.
- B. Alternate bids, if awarded, will be considered as a basis for award. The low bid will be analyzed on the base bid and any combination of alternate bids. The Owner reserves the right to award the base bid and all alternates, that in the Owner's opinion, will provide the most cost-effective end product. The Owner's decision is final.
- C. Provide alternate bid for the cost of the service requested in each alternate, either as an addition or as a reduction in the total bid.
- D. The Owner may award any alternate bid or bids at the time of contract award. Any alternate bids awarded as part of the original contract will not extend the project completion time beyond that specified.

END OF SECTION 01030

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 DESCRIPTION OF WORK:

- A. Provide such field engineering services as are required for proper completion of the work including, but not necessarily limited to:
 - 1. Establishing and maintaining lines and levels;
 - 2. Structural design of shores, forms, and similar items provided as part of the Contractor's means and methods of construction;
 - 3. Establishing finish grade stakes (including blue tops) as necessary;
- B. Additional requirements for field engineering may also be described in other sections of these specifications.

1.03 REFERENCES:

- A. Refer to Section 1105.07 "Construction Stakes and Bench Marks" of the General Covenants and Provisions for assignment of responsibilities for the Owner and Contractor.

1.04 SUBMITTALS:

- A. Comply with pertinent provisions of Section 01300, if applicable.

1.05 PROCEDURES:

- A. In addition to procedure directed by the Contractor for proper performance of the Contractor's responsibilities:
 - 1. Locate and protect control points before starting work on the site.
 - 2. Preserve permanent reference points during progress of the work.
 - 3. Do not change or relocate reference points or items of the work without specific approval from the DNR Construction Inspector.
 - 4. Promptly advise the DNR Construction Inspector of a lost, destroyed, or reference point-requiring relocation due to other changes in the work.
 - a. When directed by the DNR Construction Inspector, replace referenced stakes at no additional cost to the Owner.
- B. Meet with DNR Construction Inspector to establish actual building location, set backs, and side yards, if required.

END OF SECTION 01050

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 LUMP SUM / UNIT PRICE BID:

- A. Bid each item on a Unit Price basis or Lump Sum basis as required, including furnishing all labor, equipment and materials necessary to complete all the work indicated in the Contract Documents.

1.03 QUANTITIES:

- A. Various estimated quantities are furnished within the Contract Documents to assist the Contractor in reviewing the Project prior to bidding. The estimated quantities are not intended to be used by the Contractor as sole basis for determining the scope and volume of the work. The Contractor is responsible for verifying all quantities necessary to submit bids for the construction of a proper and complete project.

1.04 MEASUREMENT:

- A. The contractor is responsible for constructing the project to the final lines and grades shown. Owner will measure construction units only to ensure that at least minimum quantities have been properly installed.

1.05 SCOPE:

- A. Each item in the Bidder's Proposal Schedule of Prices will be paid at the unit or lump sum price. The price for each item shall be considered full compensation for furnishing superintendence, overhead, bonds, insurance, mobilization, testing and profit necessary to complete the construction of the item of the project listed in the Bidder's Proposal.
- B. It is not the intent of the Bidder's Proposal to itemize each and every item and system required. Items required for project completion and not specifically mentioned in Bidder's Proposal shall be included with items which they would be considered subsidiary.

1.06 ESTIMATED QUANTITIES:

- A. The items and quantities described above, as well as others listed throughout the Contract Documents, are provided for the bidder's review and consideration. The quantities listed herein are not guaranteed by the owner or the Project Engineer to be totally accurate nor to include all items of work. They are provided for the bidder's convenience to assist in the preparation of the bid. The bidder is responsible for preparing his own quantity takeoff and bid preparation.

END OF SECTION 01250

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 SUMMARY:

- A. Provide submittals required in this Section, refer to technical specification for submittal requirements for each section of the work to be performed.

1.03 PROGRESS SCHEDULE:

- A. Submit a project schedule to the Project Engineer for approval within 30 days after award of contract, but not later than the contract start date. The type of schedule required is at Contractor's option.
- B. Prepare an approved, reproducible form and include the following:
 - 1. Breakdown of work activities in categories so approved and segmented as necessary to allow close monitoring of progress of the work during construction.
 - 2. Order of the work necessary to meet time for completion.
 - 3. Breakdown of the work schedule of all subcontractors scheduled in cooperation with Contractor's work.
 - 4. Anticipated monthly value for work completed.
 - 5. Space for the additional display of actual performance on the schedule.
- C. After necessary revisions have been made and approved, present one print of schedule to each subcontractor and three copies to the Owner.
- D. Upon request, update the schedule to reflect changes required by actual conditions and indicate actual work completed. Provide same number of copies as required for original submission.
- E. Payment will be withheld until progress schedule in acceptable form has been received by Project Engineer.

1.04 PRICE BREAKDOWN:

- A. Within 30 days after award of contract, but not later than the contract start date, submit to the Project Engineer for approval a price breakdown of major lump sum bid items into smaller components for the purpose of determining monthly progress payments.
- B. Include profit and overhead prices in each item.
- C. Payment will be withheld until receipt of price breakdown.
- D. Provide breakdown as follows:
- E. Items listed above include, but are not limited to, the following:

1.05 SHOP DRAWINGS AND MANUFACTURER'S LITERATURE:

- A. Prior to installation of any item specified as requiring submittal, submit two (2) copies for Owner's use plus the number required for return to the Contractor, of manufacturer's literature containing detailed specifications and performance data, or shop drawings fully describing the items showing fabrication, layout, setting or erection details, including erection plan and details as required.
- B. Number all submittals consecutively . Resubmittals shall bear the original submittal number plus a letter suffix: Example - #30A is the first resubmittal of item #30; #30B is the second resubmittal, etc.
- C. Shop drawings used at site must be approved by the Project Engineer.
- D. Do not construe the approval of shop drawings to be a complete check. This approval will indicate only that the general method of construction and detailing is satisfactory. Approval of such drawings will not relieve the Contractor of the responsibility to comply with all terms and conditions of the plans and specifications. The Contractor shall be responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work.

1.06 SAMPLES:

- A. Submit in Duplicate:
- B. Provide samples of sufficient size to permit an accurate appraisal of color, texture, finish, workmanship, and other appropriate characteristics.

- C. Submit samples with shop drawings when both are required.
- D. Field Samples and Mock-Ups:
 - 1. Erect mock-ups at location acceptable to the DNR Construction Inspector, at project site.
 - 2. Construct each sample or mock-up complete to the dimension indicated, including work of all crafts required in finish work.

1.07 QUALITY ASSURANCE:

- A. Coordination of Submittals:
 - 1. Prior to submitting required material, carefully review and coordinate all aspects of each item being submitted.
 - 2. Verify that each item and its submittal conform in all respects with the specified requirements.
 - 3. Prior to sending submittals to Project Engineer, the stamp and sign each submittal, certifying that they conform in all respects with the specified requirements.
- B. Substitutions:
 - 1. The contract is based on the standards of quality established in the Contract Documents. Substitutions will be considered only when listed with the Project Engineer prior to the bid date, and when substantiated by Contractor's submittal of required data within 35 calendar days after award of contract.
 - 2. The following products do not require further approval except for interface within the work:
 - a. Products specified by reference to standard specifications such as ASTM or similar standards.
 - b. Products specified by manufacturer's name and catalog model number for which another product is not substituted.
 - 3. Do not substitute materials, equipment or methods unless such substitutions have been specifically approved in writing.
- C. Or Equal:
 - 1. Where the phrase "or equal," or "or equal as approved by the Project Engineer," occurs in the Contract Documents, do not assume that the materials, equipment or methods will be approved as equal unless the item has been specifically approved for this work by the Project Engineer.
 - 2. The Project Engineer's decision shall be final.

1.08 RESUBMISSION REQUIREMENTS:

- A. Shop Drawings:
 - 1. Revise initial Drawings as directed and resubmit in accordance with submittal procedures.
 - 2. Indicate on Drawings all changes which have been made in addition to those requested by the Project Engineer.
- B. Product Data and Samples: Resubmit new data and samples as specified for initial submittal.
- C. Make all resubmittals within 7 calendar days after date of Project Engineer's previous review.

1.09 DISTRIBUTION OF SUBMITTALS AFTER REVIEW:

- A. Project Engineer will distribute copies of shop drawings and product data, after review, to:
 - 1. DNR Construction Inspector (1 copy)
 - 2. Project Engineer's File (1 copy)
 - 3. General Contractor (remaining copies)
- B. Project Engineer will distribute samples in accordance with requirements.

1.10 CONTRACTOR RESPONSIBILITIES:

- A. Review shop drawings, product data, and samples prior to submission to the next level of control.
- B. Verify:
 - 1. Field dimensions.
 - 2. Field construction criteria.
 - 3. Catalog numbers and similar data.
- C. Coordinate each submittal with requirements of:
 - 1. The work.
 - 2. The contract documents.

3. The work of other contractors.
- D. Contractor's responsibility for errors and omissions in submittals is not relieved by Project Engineer's review of submittals.
- E. Notify Project Engineer, in writing, of proposed deviations in submittals from contract requirements, prior to or at the time of submission.
- F. Contractor's responsibility for deviations in submittals from contract document requirements is not relieved by Project Engineer's review of submittals.
- G. Do not begin any work which requires submittals without having Project Engineer's stamp and initials or signature indicating approval.

1.11 REQUIRED SUBMITTALS:

- A. Include, but do not limit to, the following submittals:

<u>Spec. Section</u>	<u>Item Description</u>	<u>Shop Drawing</u>	<u>Product Data</u>	<u>Samples, Test Results, Certification</u>
N/A				

1.12 RECORD DRAWINGS:

- A. Provide and maintain at the project site, one complete set of prints of the project drawings. The drawings shall be kept in good, clean and readable condition.
- B. The project site drawings shall have neatly inscribed all changes in work including relocation of lines, valves and fixtures, change in type of materials, etc. Changes shall be noted with red pencil or red ink.
- C. Submit these corrected prints at time of final acceptance and prior to final payment. Note all data and changes on these record drawings in sufficient detail and clarity and provide information necessary for preparation of "as-built" drawings.
- D. Final payment will be withheld until a set of corrected prints of the record drawings has been received by the Project Engineer/DNR Construction Inspector.

1.13 GUARANTEES, WARRANTIES AND CERTIFICATES:

- A. Submit all guarantees, warranties and certificates prior to final payment.
- B. Refer to Section 01700 of these specifications.

1.14 OPERATING AND MAINTENANCE INSTRUCTIONS:

- A. Submit all operating and maintenance instructions to the DNR Construction Inspector prior to final payment.
- B. Refer to Section 01700 of these specifications.

1.15 CHANGE ORDER PRICE QUOTES:

- A. In the event of the need for change order, the DNR Construction Inspector will request a price quote from the Contractor for proposed changes to the contract.
- B. For evaluation purposes, the Contractor's quote shall be broken down to show the costs of labor and materials for each proposed category of work included with the change, along with the total cost for Contractor's overhead, profit and bond for the proposed change.
- C. All contract time extensions required as a result of a proposed change must be justified and supported in detail at the time of the proposal.

1.16 TEST REPORTS:

- A. Refer to Section 01400 of these specifications.

1.17 DELIVERY TICKETS:

- A. Submit to the DNR Construction Inspector one legible copy of each delivery ticket for all material delivered to the construction site.

- B. The delivery ticket shall show brand name, catalog number and number of items received.

END OF SECTION 01300

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 SCOPE:

- A. Supplementary tests and reports required in this section with any tests, reports, and other information that may be required additionally in any section of the specifications.
- B. Inspection, sampling, and testing is required, but not limited to, the following:
 - 1. Section 03300 – Cast In Place Concrete
- C. Sampling and testing frequencies and requirements are to comply with IDOT IM-204.

1.03 TESTS BY INDEPENDENT TESTING LABORATORY:

- A. Testing Laboratory:
 - 1. Contractor to select and pay for an independent testing laboratory, acceptable to the Project Engineer, to perform specified services required by the contract.
 - 2. Employment of testing laboratory will in no way relieve Contractor's obligations to perform work in accord with the contract.
 - 3. Include in lump sum bid the cost for all testing services required. No separate payments will be made for testing. Include all associated costs in the various appropriate bid items. Project Engineer/DNR Construction Inspector will direct all tests. The Contractor shall pay the testing firm.
- B. Contractor Shall:
 - 1. Make available at no cost, all material to be tested.
 - 2. Provide labor necessary to supply samples and assist in making tests.
 - 3. Advise laboratory of the identity of material sources and instruct suppliers to allow inspections by laboratory.
- C. Testing laboratory shall:
 - 1. Submit written report promptly, covering each inspection and test to the Project Engineer, including:
 - a. Date issued.
 - b. Project title and number.
 - c. Testing laboratory name and address.
 - d. Name and signature of laboratory technician.
 - e. Date of inspection and sampling.
 - f. Record of temperature and weather.
 - g. Date of test.
 - h. Identification of product and specification section.
 - i. Location of project.
 - j. Type of inspection or test.
 - k. Observations regarding compliance with Contract Documents.
 - 2. Promptly notify Project Engineer of irregularities or deficiencies of work which are observed during performance of testing services.
 - 3. Perform additional services required by the Project Engineer/DNR Construction Inspector.
- D. Laboratory is not authorized to:
 - 1. Release, revoke, alter or enlarge on, contract requirements.
 - 2. Approve or accept any portion of work.
 - 3. Perform any duties of the Contractor.
- E. Conduct tests in accordance with the requirements of the designated specifications or, where not specified, the latest appropriate standard of the American Society for Testing and Material.

1.04 LABORATORY SERVICES AND TESTS REQUIRED:

- A. Concrete:
 - 1. Secure samples of aggregates Contractor proposes to use and test for compliance with specifications.

2. Certify compliance with specification of cement proposed for use by the Contractor.
 3. Review concrete design mix proportions for the required concrete strengths using materials Contractor proposes to use on the project. Incorporate specified admixtures and not less than amount of cement specified. Perform appropriate laboratory tests, including compression tests of cylinders and slump test to substantiate mix designs. Submit one copy of report to the Project Engineer, one copy to the DNR Construction Inspector, and one copy to the Contractor, clearly indicating the results of the mix design review.
 4. When requested by the DNR Construction Inspector, inspect and test material during concrete work to substantiate compliance with specifications and mix requirements.
 5. Slump Test: The DNR Construction Inspector will require slump tests to be performed as he desires in accordance with the provisions of these specifications.
 6. Test Cylinders:
 - a. Each test shall consist of a set of three cylinders provided by the Contractor. Sampling and testing frequencies and requirements are to comply with IDOT IM-204.
 - b. Provide a minimum of one set of test cylinders each day concrete is placed.
 - c. The Contractor shall make and cure test cylinders in conformity with ASTM C-31.
 - d. Note on record drawings placement locations represented by test cylinders.
 7. Perform compression tests in accordance with applicable sections of IDOT specifications.
 8. Identify all test cylinders with symbols to indicate location on the job where concrete tests were made. Note on record drawings.
- B. Aggregate gradation and compaction as per applicable specifications.

1.05 CONTRACTOR'S RESPONSIBILITIES:

- A. Furnish product mix design to meet or exceed Contract Documents.
- B. Cooperate with laboratory personnel and provide access to work, as well as to manufacturer's operations.
 1. Monitor each inspection, sampling and test.
- C. Provide to laboratory, preliminary representative samples of material to be tested, in specified quantities.
- D. Furnish copies of mill test reports.
- E. Furnish verification of compliance with contract requirements for material and equipment.
- F. Furnish casual labor and facilities:
 1. To provide access to work to be tested.
 2. To obtain and handle samples at site.
 3. To facilitate inspections and tests.
 4. For laboratory's exclusive use for storage and curing of test samples.
- G. Notify laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Notify DNR Construction Inspector when work is ready for testing. Schedule testing after approval of the DNR Construction Inspector. The Department of Natural Resources will not pay for any testing scheduled without the DNR Construction Inspector's specific authorization.
- H. Correct work which is defective or which fails to conform to the Contract Documents in accordance with the general condition. Do not delay the project schedule or the work of other contractors with corrective work.
- I. Pay all costs of re-testing when test results indicate non-compliance with contract requirements.
- J. Patch all surfaces and areas disturbed by testing operations.

END OF SECTION 01400

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 WEATHER PROTECTION:

- A. General:
 - 1. Provide necessary protection against weather to maintain all materials, apparatus, fixtures, and work free from damage whether in shipment, in storage, or in place.
 - 2. Do not perform wet work when temperature is below 40 degrees Fahrenheit or is forecast to be below 40 degrees Fahrenheit within the ensuing 48 hours, except when work is properly protected and sufficient heat is provided.
- B. Heat Provision:
 - 1. When heat is required for proper weather protection, provide temporary enclosures of work and acceptable means to provide sufficient heat to maintain a temperature of not less than 50 degrees Fahrenheit. Provide higher temperatures when required by these specifications.
 - 2. Use only heating apparatus and fuels of approved safe types. Keep equipment and surroundings in a clean, safe condition. Use flame resistant tarpaulins and other materials for temporary enclosure of space. Use vented heaters only.

1.03 TEMPORARY UTILITIES:

- A. Electricity, Lighting and Heating:
 - 1. Provide such temporary service as may be required for construction purposes with required distributing facilities and meter.
 - 2. Pay the cost of all electrical energy used on this part of the project until completion of the contract. If partial occupancy by the Owner occurs prior to completion, the Owner will pay proportional share of electrical energy used.
 - 3. Provide light bulbs required for all temporary construction lighting and replace when necessary.
 - 4. Use no temporary service material in permanent system without written approval of the Owner. When temporary electrical lines are no longer required, remove them and restore any parts of buildings or grounds damaged by such removal to original condition.
 - 5. Provide and maintain temporary lighting at barricades as required for safety.
 - 6. Provide any heating required by these specifications.
- B. Telephone:
 - 1. Provide and pay all charges for telephone service.
- C. Water:
 - 1. Provide, protect, and maintain an adequate water supply for use on the project for construction purposes, either by means of the permanent water supply line or by installing a temporary waterline as may be required.
 - 2. Install, valve, maintain, and protect such water supply lines as may be required.
 - 3. Remove temporary lines when they are no longer required. Restore to original condition any part of grounds or buildings damaged by removal.
 - 4. Pay the cost of all water used on this portion of the project until final completion of the contract.
- D. Toilets:
 - 1. Provide and maintain suitable, weather tight, painted sanitary toilet facilities for all workers during construction period. When toilet facilities are no longer required, promptly remove from site. Disinfect, clean or treat the area as required.
 - 2. Provide and maintain facilities in accordance with requirements of applicable local and state health authorities and OSHA.
 - 3. Keep all toilet facilities clean and supplied with toilet paper at all time.

1.04 OPERATION AND STORAGE AREAS:

- A. All operations of the Contractor (including storage of materials) upon premises shall be confined to areas authorized or approved by the DNR.
- B. Premises adjacent to the construction will be made available for use by the Contractor without costs whenever such use will not interfere with other uses or purposes.
- C. Do not enter on or occupy with personnel, tools, equipment, or material any ground outside the DNR's property without the written consent of the owner of such ground.
- D. Other contractors and employees or agents of the DNR may for all necessary purposes enter upon the work and premises used by the Contractor, and the Contractor shall conduct his work so as not to impede unnecessarily any work being done by others on or adjacent to the site.
- E. Provide and maintain weather tight storage sheds for own use.
- F. Provide storage sheds with substantial floors raised a minimum of six (6) inches above the ground.
- G. Locate all storage sheds as approved by the DNR Construction Inspector.
- H. Completely remove from site after completion of work.

1.05 PROTECTION AND RESTORATION:

- A. General: Protect all structures, including walks, pipelines, trees, shrubbery, and lawns during the progress of the work; remove from the site all debris and unused materials; and, upon completion of the work, restore the site as nearly as possible to its original condition, including the replacement, at the Contractor's sole expense, of any facility or landscaping which has been damaged.

1.06 ACCESS ROADS:

- A. Temporary Roads and Storage Areas:
 - 1. Construct and maintain all temporary access roads and storage areas required. Locate and construct all roads, ramps, mats, storage areas, and similar items in a manner approved by the Owner and provide overall management of available site areas.
- B. Laws and Regulations:
 - 1. Observe all laws and regulations of the local, county, and state authorities in the use of all public roads and highways for the transportation of materials and equipment in connection with work on the project. Observe all overhead construction, bridges, cables, and the like. Repair damage to roads, highways, overhead construction and similar off-site items, resulting from operations in connection with this project.

1.07 WATER CONTROL:

- A. Carry on construction work in a manner that will direct surface water away from the structures and away from adjoining property.
- B. Provide own means of pumping, well pointing or otherwise maintaining excavations free from ground water encountered. Provide means of properly conveying such water off the construction site.

1.08 PARKING:

- A. Make necessary provisions for parking of all employees on the project within the site limits. Include necessary access roads and maintenance of all roads and parking areas during construction period.
- B. Park vehicles to avoid interference with normal construction activities and to avoid interference with Owner's operation.

1.10 SAFETY:

- A. Provide at least one non-freezing-type fire extinguisher in each workshop and shed used for storage of materials on the premises. Place in readily accessible location.
- B. Provide and maintain a basic first aid kit.
 - 1. Provide first aid supply commensurate with size of project with items necessary for first aid treatment of all injuries.
 - 2. Advise workers of the location of first aid supplies.
 - 3. Post telephone numbers of nearest hospital or ambulance service and fire station in conspicuous location. Advise all workers of location of telephone numbers.

END OF SECTION 01500

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work consists of furnishing all labor, material and equipment for the control and prevention of environmental pollution and damage as the result of construction operations under this Contract and for those measures set described herein, as indicated on the Drawings, specified herein, and as required for the construction of all work of this contract.
 - 1. Scope: The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.
 - 2. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract.
 - a. Confine activities to areas defined by the Drawings and Specifications.
- B. Related Sections: Drawings and General Provisions of the Contracts, including the General Covenants and Provisions, Supplementary Covenant and Provisions and General Requirements.

1.02 REFERENCES:

- A. Provide protection of Air Resources in accordance with the following state and local codes and rules: Iowa Department of Environmental Quality Act, Oh. 455B of the 1977 Code of Iowa; Iowa Department Rules, 1973 I.D.R. 267 et seq.

1.03 DEFINITIONS:

- A. Environmental pollution and damage: For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes.

1.04 QUALITY ASSURANCE:

- A. Quality Control: Establish and maintain quality control for environmental protection of all items set forth herein.
 - 1. Record on daily reports any problems in complying with laws, regulations and ordinances and corrective action taken.
 - 2. Assure compliance of subcontractors with this section.
- B. Regulatory Requirements:
 - 1. Notification: The Project Engineer/DNR Construction Inspector will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, state or local laws, or regulations, permits and other elements of the Contractor's environmental protection plan.
 - 2. After receipt of such notice, inform the Project Engineer/DNR Construction Inspector of proposed corrective action and take such action as may be approved.
 - 3. If the Contractor fails to comply promptly, the Project Engineer/DNR Construction Inspector may issue an order stopping all or part of the work until satisfactory corrective action has been taken.
 - a. No time extensions shall be granted such suspension.
- C. National Pollutant Discharge Elimination System (NPDES): Contractor to provide a Notice of Intent (Form 1415) for application of a General Permit for Storm Water Discharge, file all necessary Forms and Drawings with the applicable Bureau of the DNR, and pay necessary application fees.(Required for sites of one acre or more)
 - 1. For Storm Water General Permit Assistance: Contact (515)281-7017 or (515)281-8693 for information.
- D. Pollution Control Training: Train personnel in all phases of environmental protection.
 - 1. Include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities to insure adequate and continuous environmental pollution control.

1.05 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements:

1. Protection of Land Resources: Prior to beginning construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area.

1.06 Maintenance of Pollution Control Facilities:

- A. Maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

PART 2 - PRODUCTS

2.01 MATERIAL AND EQUIPMENT:

- A. Provide and maintain material and equipment necessary to perform the specified work.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Verification of Conditions: Prior to beginning construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area.
- B. Limits of Work Area:
 1. Mark the areas that are not required to accomplish work to be performed under this contract.
 2. Mark or fence isolated areas within the general work area which are to be saved and protected.

3.02 PROTECTION OF LAND RESOURCES:

- A. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without special permission from the Contracting Authority.
- B. Do not fasten nor attach ropes, cables, or guys to any trees for anchorage unless specifically authorized.
- C. Where such special emergency use is permitted, provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

3.03 PROTECTION OF MONUMENTS AND MARKERS:

- A. Protect monuments and markers before and during construction operations.
- B. Where construction operations are to be conducted during darkness, the markers shall be visible.
- C. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

3.04 PROTECTION OF LANDSCAPE:

- A. Clearly identify trees, shrubs, vines, grasses land forms and other landscape features to be preserved by marking, fencing, or wrapping with boards, or any other approved techniques.

3.05 Location of Field Offices, Storage and Other Contractor Facilities:

- A. Place field offices, staging areas, stockpile storage, and temporary buildings in areas approved by the Project Engineer/DNR Construction Inspector.
- B. Do not temporarily move or relocate Contractor facilities unless approved by the Engineer/DNR Construction Inspector.

3.06 Disposal of Solid Wastes:

- A. Place solid wastes in containers to be emptied on a regular schedule.
 1. Conduct handling and disposal to prevent contamination.
 2. Transport all solid waste off state property and dispose of in compliance with Federal, state, and local requirements for solid waste disposal.

3.07 Disposal of Chemical Waste:

- A. Store chemical waste in corrosion resistant containers; remove from the work area and dispose of in accordance with Federal, state and local regulations.

3.08 Disposal of Discarded Materials:

- A. Handle discarded materials other than those which can be included in the solid waste category as directed by the Contracting Authority.

3.09 Preservation and Recovery of Historical, Archeological and Cultural Resources:

- A. Existing historical, archeological and cultural resources within the Contractor's work area will be so designated by the Department and precautions taken to preserve all such resources as they existed at the time they were pointed out to the Contractor.
- B. Install protection and assume responsibility for the preservation of these resources as designated on the Drawings, or if not designated as necessary for their preservation.
- C. Report any unusual items that might have historical or archeological value, found or observed during construction activities as soon as practicable to the DNR Construction Inspector.

3.10 Protection of Water Resources:

- A. Keep construction activities under surveillance, management and control to avoid pollution of surface and ground waters.
- B. Implement applicable management techniques to control water pollution in accordance with the listed construction activities which are included in this contract.
- C. Installation, maintenance and removal of water pollution control methods and materials to be incidental to other items of work on the project, unless a specific Bid Item for Erosion Control exists.
- D. Comply with detailed Project Plans for temporary erosion control procedures to be performed on this project.

3.11 Protection of Fish and Wildlife Resources:

- A. Keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife.
- B. List species that require specific attention along with measures for their protection prior to beginning of construction operations.

3.12 Protection of Air Resources:

- A. Keep construction activities under surveillance, management and control to minimize pollution of air resources. Perform or operate activities, equipment, processes, and work to accomplish the specified construction in strict accordance with the State of Iowa and all Federal emission and performance laws and standards.
- B. Implement special management techniques as set out below to control air pollution by construction activities.
 - 1. Control of Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities at all times, including weekends, holidays and hours when work is not in progress.
 - a. Maintain all work areas within or outside the project boundaries free from particulates which would cause the applicable air pollution standards to be exceeded or which would cause a hazard or a nuisance.
 - b. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area.
 - c. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times, The Contractor must have sufficient competent equipment available to accomplish this task.
 - d. Perform control of particulates as the work proceeds and when ever a particulate nuisance or hazard occurs.
 - 2. Control hydrocarbons and carbon monoxide emissions from equipment in accordance with Federal, State and local allowable limits at all times.
 - 3. Control odors at all times for all construction activities.
 - 4. Assume responsibility for monitoring of air quality throughout the entire areas affected by the construction activities.

3.13 Protection of Sound Intrusions:

- A. Keep construction activities under surveillance and control to minimize damage to the environment by noise.

3.14 Mosquito Control:

- A. During dredging and due to large areas of shallow water in the disposal area, mosquito breeding must be controlled.
- B. Deposit dredge material to minimize stagnant water pools.
- C. Conduct non-aerial spraying or other methods of application of EPA approved chemicals to control mosquito breeding.

3.15 CLEANING:

- A. Post Construction Clean Up: Cleanup all areas used for construction.
- B. Restoration of Landscape Damage: Restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas, in accordance with the plan submitted for approval by the Contracting Authority.

END OF SECTION 01560

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 MATERIAL:

- A. All materials, equipment, and other items incorporated in the work of this project must be new, and both materials and workmanship of best grade of their respective kinds.
- B. To assure ready availability of materials, parts, or components for repair, replacement or future expansion purposes, all materials, equipment, and related components must be obtained from sources which maintain a regular, domestic stock.
- C. Throughout all sections of these specifications, provide other material not specifically described but required to provide Owner with a complete and proper installation of all phases of the work of this contract. Select these materials subject to the approval of Project Engineer/DNR Construction Inspector.

1.03 ITEMS NOT IN CONTRACT:

- A. All items indicated "N.I.C." on drawings or specifications are items not included in this contract.
- B. Provide necessary provisions in the work of this project to permit proper installation of "N.I.C." items.

1.04 TRANSPORTATION AND HANDLING:

- A. Provide protection against damage for all materials during delivery to and storage at the site.
- B. Handling of all materials and equipment shall be such as will prevent damage to such material and/or equipment.
- C. Replace or repair to the satisfaction of the DNR Construction Inspector, all items damaged because of Contractor's failure to properly protect during transportation and handling, when on or off the project site, at no additional cost to the Owner.

1.05 STORAGE AND PROTECTION:

- A. Protect all materials, work, and equipment against damage at all times.
- B. Refer to Section 01500 for requirements for storage sheds. Store all materials that might be damaged within storage sheds.

END OF SECTION 01600

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 CLEANING UP:

- A. Keep premises free of accumulation of surplus materials and rubbish from contractor and subcontractor operations.
 - 1. Remove all rubbish from premises.
- B. Remove rubbish weekly and at other times as required by the DNR Construction Inspector. Keep interior of building free at all times of unattended combustible rubbish.
- C. Immediately prior to final inspection:
 - 1. Clean all surfaces to condition acceptable for immediate occupancy.
 - 2. Remove all marks, stains, fingerprints, paint droppings, and other foreign matter from all finished items.

1.03 GUARANTEES, BONDS AND AFFIDAVITS:

- A. Submit all written guarantees, bonds and affidavits required to the Owner prior to final payment.
- B. Guarantees shall extend the full period of the required guarantee period after:
 - 1. Replacement of work found defective during guarantee period.
 - 2. Repair of inoperative items or adjustments to proper working conditions of items not operating properly at time of inspection at final completion.

1.04 RECORD DRAWINGS:

- A. Required prior to final payment. Refer to Section 01300 of these specifications. Submit to DNR Construction Inspector.

1.05 SHOP DRAWINGS:

- A. Refer to Section 01300 of these specifications.

1.06 TESTS:

- A. Complete all tests required to prove actual operating performance of equipment and systems incorporated into the project. Refer to Section 01400 of these specifications.
- B. Submit reports of all tests to the Owner prior to final payment.

1.07 MAINTENANCE AND OPERATING:

- A. Refer to Section 01730 of these specifications, if applicable.

1.08 DAMAGE TO EXISTING STRUCTURES:

- A. Prior to final acceptance by the Owner, repair or otherwise return to original condition any parts of the existing facilities which have been damaged during construction.

1.09 FINAL INSPECTION:

- A. Request a final inspection in writing, at least ten days prior to the anticipated date of completion, from the DNR Construction Inspector.
- B. Work will not be considered ready for final inspection until all the work has been completed and the Contractor has certified that all items are properly operating and in strict compliance with the contract documents.
- C. The Contractor or his project supervisor shall be present at the job site during the final inspection.
 - 1. The DNR Construction Inspector will present the Contractor, after the final inspection, a list of any items not meeting contract requirements. This list will be confirmed in writing and all items listed must be made acceptable before final payment will be made.

END OF SECTION 01700

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: To aid the instruction of operating and maintenance personnel, and to provide a source of information regarding the systems incorporated into the Work, furnish and deliver the data described in this section and in pertinent other sections of these specifications.
 - 1. Additional data requirements may be described in individual sections.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 SUBMITTALS:

- A. Comply with pertinent provisions of Section 01300.
- B. Submit two copies of a preliminary draft of the proposed manual or manuals to the Engineer for review and comments.
- C. Unless otherwise directed in other sections, or in writing by the Engineer, submit two copies of the final manual to the DNR Construction Inspector.

1.03 QUALITY ASSURANCE:

- A. In preparing required data, use only personnel thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with this section's requirements, and sufficiently skilled in technical writing to communicate the essential data.

PART 2 - PRODUCTS

2.01 INSTRUCTION MANUALS:

- A. Where instruction manuals are required to be submitted under other sections of these specifications, prepare in accordance with the provisions of this section.
- B. Format:
 - 1. Size: 8-1/2" x 11"
 - 2. Paper: White bond, at least 20 lb. weight
 - 3. Text: Neatly written or printed
 - 4. Drawings: 11" in height preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within the manual and provide a drawing pocket inside rear cover or bind in with text.
 - 5. Flysheets: Separate each portion of the manual with neatly prepared flysheets briefly describing contents of the ensuing portion; flysheets may be in color.
 - 6. Binding: Use heavy-duty plastic or fiberboard covers with 3-ring binders. All binding is subject to the Owner's approval.
 - 7. Measurements: Provide all measurements in U.S. standard units: feet-and-inches, lbs., and cfm.
- C. Provide front and back covers for each manual, using durable Owner's approved material, clearly identified on or through the cover with at least the following information:
 - OPERATING AND MAINTENANCE INSTRUCTIONS
 - (name and address of work)
 - (name of contractor)
 - (general subject of this manual)
 - (space for approval signature of)
 - (the owner and approval date)
- D. Contents include at least the following:
 - 1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.
 - 2. Detailed list of subcontractors, including address, phone number and product or equipment installed.
 - 3. Complete instructions regarding operation and maintenance of all equipment involved, including lubrication, disassembly, and reassembly.

4. Complete nomenclature of all parts of all equipment.
5. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
6. Copy of all guarantees and warranties issued.
7. Manufacturers' bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
8. Such other data as required in pertinent sections of these specifications.

PART 3 - EXECUTION

3.01 INSTRUCTION MANUALS:

- A. Preliminary:
 1. Prepare a preliminary draft of each proposed manual.
 2. Show general arrangement, nature of contents in each portion, probable number of drawings and their size, and proposed method of binding and covering.
 3. Secure the Architect's approval prior to proceeding.
- B. Final: Complete the manuals in strict accordance with the approved preliminary drafts and the Architect's review comments.
- C. Revisions:
 1. Following the instruction of operation and maintenance personnel, review all proposed revisions of the manual with the DNR Construction Inspector.

END OF SECTION 01730

SECTION 024100 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 312200 - Grading: Rough and fine grading.
- G. Section 312323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 DEFINITIONS

- A. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- B. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

PART 3 EXECUTION

2.01 DEMOLITION

- A. Remove paving and curbs required to accomplish new work.
- B. Remove other items indicated, for salvage, relocation, recycling, and demolition.
- C. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 312200.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 7. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from DNR.
- C. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Hazardous Materials:
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and DNR; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

2.03 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to DNR.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to DNR.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation only.
1. Verify construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and required to accomplish new work.
1. Remove items indicated on drawings.
- C. Protect existing work to remain.
1. Prevent movement of structure. Provide shoring and bracing as required.
 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch to match new work.

2.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, 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.

END OF SECTION 024100

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Form accessories.
- C. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

- A. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- B. PS 1 - Structural Plywood; 2023.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

2.02 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, C Grade, Group 2.

2.03 REMOVABLE PREFABRICATED FORMS

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

2.04 FORMWORK ACCESSORIES

- A. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
- A. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
 - 1. Do not use materials containing diesel oil or petroleum-based compounds.
 - 2. Composition: Colorless, reactive, water-based compound.
- B. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

- C. Filler Strips for Chamfered Corners: Rigid plastic type; 3/4 x 3/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slot: Galvanized steel, at least 22 gauge, 0.0299 inch (0.76 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- E. Flashing Reglets: Galvanized steel, at least 22 gauge, 0.0299 inch (0.76 mm) thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork..
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- G. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Coordinate this section with other sections of work that require attachment of components to formwork.

3.03 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- B. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.05 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean and protect permanent insulated concrete foam panel formwork per manufacturer's recommendations.
- C. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.06 FORMWORK TOLERANCES

3.07 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.08 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

**SECTION 032000
CONCRETE REINFORCING**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 031000 - Concrete Forming and Accessories.
- B. Section 033000 - Cast-in-Place Concrete.

1.03 PRICE AND PAYMENT PROCEDURES

- A. See Section 012200 - Unit Prices, for additional unit price requirements.

1.04 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.
- C. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement; 2024.
- D. ASTM A1035/A1035M - Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement; 2023a.
- E. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2021.
- F. CRSI (DA4) - Manual of Standard Practice; 2024.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Plain billet-steel bars.
 - 2. Unfinished.
- B. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Provide stainless steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces.

2.02 RE-BAR SPLICING:

- A. Coupler Systems: Mechanical devices for splicing reinforcing bars.
 - 1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression. Notify Engineer prior to use.
- B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for splicing reinforcing bars.
 - 1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression. Notify Engineer prior to use.

- C. Taper Tie Hole Plug: Mechanical device for plugging tie holes; anchors optional flush or recessed grout.
- D. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.
- D. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as follows:

END OF SECTION

**SECTION 033000
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Joint devices associated with concrete work.
- B. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 032000 - Concrete Reinforcing.
- C. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

- A. ACI PRC-213 - Guide for Structural Lightweight-Aggregate Concrete; 2014 (Reapproved 2023).
- B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.
- D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- E. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
- F. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- H. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2024.
- I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- J. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- K. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2024a.
- L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.
- M. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2025.
- N. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2023.
- O. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
- P. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2025.
- Q. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- R. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2023.
- S. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.
- T. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

- U. 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; 2024.
- V. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).
- W. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops; 1974.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
- D. Samples: Submit samples of underslab vapor retarder to be used.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Section 031000.

2.02 REINFORCEMENT MATERIALS

- A. Comply with requirements of Section 032000.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
- C. Lightweight Aggregate: ASTM C330/C330M.
- D. Fly Ash: ASTM C618, Class C or F.
- E. Calcined Pozzolan: ASTM C618, Class N.
- F. Silica Fume: ASTM C1240, proportioned in accordance with ACI PRC-211.1.
- G. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
- H. Structural Fiber Reinforcement: ASTM C1116/C1116M.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder:
 - 1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
 - 2. Products:
 - a. Henry, a Carlisle Company; Moistop Ultra 15: www.henry.com/#sle.
 - b. Stego Industries, LLC: www.stegoindustries.com/#sle.
 - c. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

- A. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.
- B. Slab Isolation Joint Filler: 1/2-inch (13 mm) thick, height equal to slab thickness, with removable top section forming 1/2-inch (13 mm) deep sealant pocket after removal.
- C. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
- D. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

2.07 CURING MATERIALS

- A. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.
 1. Comply with ASTM C309 standards for water retention.
 2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 14-day water cure when tested in accordance with ASTM C39/C39M.
 3. VOC Content: Zero.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI PRC-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 SPEC-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 PRC-211.1 and at rates recommended or required by manufacturer.
- D. Fiber Reinforcement: Add to mix at rate of 4 pounds per cubic yard (0.89 kg per cu m), or as recommended by manufacturer for specific project conditions.
- E. Normal Weight Concrete:
 1. Design mixes to provide normal weight concrete with the following properties unless otherwise indicated on Structural Drawings and Schedules:
 2. General; All concrete except as specified below:
 - i. Compressive Strength: 4,000 p.s.i.
 - ii. Maximum Aggregate Size: 3/4-inch.
 - iii. Slump Limits: 3 – 4-inches.
 - iv. Air Content: 0%.
 - v. Water-Cement Ratio: 0.46.
 3. Concrete exposed to weather, foundation walls and retaining walls:
 - vi. Compressive Strength: 4,500 p.s.i.
 - vii. Maximum Aggregate Size: 3/4-inch.
 - viii. Slump Limits: 3 – 4-inches.
 - ix. Air Content: 6 +/- 1%.
 - x. Water-Cement Ratio: 0.46.
 4. Interior Slabs-On-Grade:
 - xi. Compressive Strength: 3,500 p.s.i.
 - xii. Maximum Aggregate Size: 3/4-inch.
 - xiii. Slump Limits: 3 – 4-inches.
 - xiv. Air Content: 2-3%.
 - xv. Water-Cement Ratio: 0.45 max
 5. Spread and Continuous Footings:
 - xvi. Compressive Strength: 3,000 p.s.i.
 - xvii. Maximum Aggregate Size: 1-1/2-inch.
 - xviii. Slump Limits: 3 – 5-inches.

- xix. Air Content: 0%.
- xx. Water-Cement Ratio: 0.55 max

6. Exterior Sidewalks, Stoops, Stairs, Ramps and Curbs:

- xxi. Compressive Strength: 4,500 p.s.i.
- xxii. Maximum Aggregate Size: $\frac{3}{4}$ -inch.
- xxiii. Slump Limits: 3 – 4-inches.
- xxiv. Air Content: 6 +/- 1%.
- xxv. Water-Cement Ratio: 0.46.

Fly Ash Use: Where permitted by Structural Engineer, provide as follows:

Concrete exposed to weather including foundation walls and retaining walls: Fly ash replacement of cement shall not exceed 15 percent by weight.

2.09 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
 - 1. Fiber Reinforcement: Batch and mix as recommended by manufacturer for specific project conditions.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- B. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
- C. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Place concrete for floor slabs in accordance with ACI PRC-302.1.
- C. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- D. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 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 mix designs.
- F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.04 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

3.05 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
 - 2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
 - 3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

- A. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:
 - 1. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:

1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Final Curing: Begin after initial curing but before surface is dry.

3.09 DEFECTIVE CONCRETE

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

3.10 PROTECTION

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

END OF SECTION

**SECTION 061000
ROUGH CARPENTRY**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes carpentry work not specified as part of other Sections and which is generally not exposed, except as otherwise indicated. Types of Work in this Section include the following
 1. Framing with dimension lumber.
 2. Framing with engineered wood products.
 3. Shear wall panels.
 4. Wood blocking, cants, and nailers.
 5. Wood furring.
 6. Wood sleepers.
 7. Plywood backing panels.
 8. Wall and roof sheathing.
 9. Subflooring.
 10. Installation of wood trusses.
 11. Installation of vapor & air barriers.
 12. Installation of sill sealer.
- B. Related Requirements:
 1. Section 06 1326 – HEAVY TIMBER TRUSSES.
 2. Section 07 2100 – THERMAL INSULATION for wall batt insulation.
 3. Section 07 4600 – SIDING ACCESSORIES for gutters and downspouts, and decorative siding elements.
 4. Section 07 4646 – FIBER REINFORCED CEMENT SIDING.
 5. Division 26 – Electrical for coordination of recessed fixtures with UL rated fixture enclosures.

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 06 1700 – SHOP-FABRICATED STRUCTURAL WOOD for prefabricated wood trusses for roof and floor framing.

1.03 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches (50.8 mm) nominal size in least dimension.
- B. Exposed Framing: Framing not concealed by other construction.
- C. Dimension Lumber: Lumber of 2 inches (50.8 mm) nominal or greater but less than 5 inches (127 mm) nominal in least dimension.
- D. Exposed Framing: Framing not concealed by other construction.
- E. OSB: Oriented strand board.
- F. Timber: Lumber of 5 inches (127 mm) nominal or greater in least dimension.
- G. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of pre-servative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Shear panels.
 - 3. Power-driven fasteners.
 - 4. Post installed anchors
 - 5. Metal framing anchors.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
 - 1. For lumber and plywood pressure treated with water borne chemicals, sticker between each course to provide air circulation.
- B. Handle fire-rated fixture enclosures to prevent damage to edges, ends, or surfaces. Protect metal flange from being bent or damaged.

1.08 PROJECT CONDITIONS

- A. Coordination: Fit carpentry work to other work, scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachments of other work.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- 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 of Review. Provide lumber graded by an agency certified by the ALSC Board of 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, mark grade stamp on end or back of each piece.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

4. Provide dressed lumber, S4S, unless otherwise indicated.
5. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 WOOD-PRESERVATIVE TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- D. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. Application: Treat items indicated on Drawings, and the following:
 1. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 2. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 3. Wood framing members that are less than 18 inches (457.2 mm) above the ground in crawlspaces or unexcavated areas.
 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing and Load Bearing Walls: See Structural Drawings.
- B. 2"x2" through 4"x4" framing:
 1. Fire-stopping, furring, blocking: Standard and better or stud grade Spruce Pine Fir, Hem Fir or Douglas Fir Larch.
 2. Plates and caps: Studs, bucks, - No. 2 Spruce Pine Fir.
- C. Headers, lintels, joists: See Structural Drawings.
- D. Joists, Rafters, and Other Framing Not Listed Above: Any species of machine stress-rated dimension lumber with a grade of not less than 1650f-1.5E

2.04 ENGINEERED WOOD PRODUCTS

- A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

- B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
1. Acceptable Manufacturers:
 - a. Truss Joist MacMillan.
 - b. Boise Cascade.
 - c. Louisiana-Pacific.
 - d. Georgia-Pacific;
 - e. Willamette Industries
 2. Extreme Fiber Stress in Bending, Edgewise: 2600 PSI for 12-inch nominal- depth members.
 3. Modulus of Elasticity, Edgewise: 1,900,000 psi (6205284.00 kPa)
 4. Horizontal Sheer Perpendicular to Glue Line: 285 psi (1965.01 kPa).
 5. Compression Parallel to Grain: 2310 psi (15926.90 kPa).
 6. Compression Perpendicular to Grain Parallel to Glue Line: 750 psi (5171.07 kPa).
 7. Tension Parallel to Grain: 1850 psi (12755.31 kPa).

2.05 PANEL PRODUCTS

- A. Sheathing:
1. Wall Sheathing: APA Rated Sheathing.
 - a. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing with exterior glue.
 - 1) Span Rating: Not less than 32/16.
 - 2) Thickness: Not less than 1/2-inch.
 - b. Wall Sheathing: Oriented strand board structural wood panel with factory laminated rigid plastic insulation board, and water-resistive barrier layer.
 - 1) Thickness: 1-1/2 inches (38.1 mm).
 - 2) Thermal Resistance, R-Value (RSI-Value): 6.6 (1.16), minimum.
 - 3) Insulation Board: Polyisocyanurate (ISO) insulation board; comply with ASTM C1289, Type II, Class 2 - Faced with coated polymer-bonded glass fiber mat facers on both major surfaces of the core foam.
 - 4) Integral Water-Resistive Barrier: Sheet material qualifying as a Grade D water-resistive barrier; complying with ICC-ES AC308. Water Vapor Permeance of Water-Resistive Barrier: 12 to 16 perms (689 to 918 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure B.
 - 5) Maximum Allowable Air Leakage of Assembly: Complying with ASTM E2357, 0.04 cfm/sq ft (0.2 L/s sq m) at a pressure differential of 1.57 psf (75 Pa). Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.
 - 6) Edge Profile: Square. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.
 - 7) Warranty: Manufacturer's standard 30 year limited system warranty.
 - (a) Performance: Panel and tape resistance to water penetration; tape adhesion.
 - (b) Material: Free from manufacturing defects and panel delamination.
 - 8) Products:
 - (a) Huber Engineered Woods, LLC; ZIP System R-Sheathing: www.huberwood.com/#sle.
 - (b) Substitutions: See Section 016000-Product Requirements.
 2. Roof Sheathing: APA Rated Sheathing.:
 - a. Plywood Roof Sheathing: Exterior, Exposure 1 sheathing with exterior glue.

- 1) Span Rating: Not less than 40/20.
 - 2) Thickness: Not less than 3/4-inch.
- B. Subfloor and Underlayment:
1. Oriented-Strand-Board APA Rated Sheathing Subfloor-Underlayment: Exposure 1 single-floor panels with exterior glue.
 - a. Span Rating: Not less than 48/24
 - b. Thickness: Not less than 3/4-inch at flat roof and 5/8" at pitched roof
 - c. Edge Detail: Tongue and Groove .
 2. Plywood Backing Panels: Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch thick.
 3. Miscellaneous Concealed Panels: Same as required for plywood sheathing, except fire-retardant treated, where indicated, in thickness indicated or, if not indicated, not less than 1/2-inch thick.

2.06 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- D. Bolts: Steel bolts complying with ASTM A307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- E. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- F. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on as appropriate for the substrate.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.07 METAL FRAMING ANCHORS

- A. Allowable Design Loads as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.
1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; 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 (0.91 mm) thick.
1. Use for wood-preservative-treated lumber and where indicated.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
1. Use for exterior locations and where indicated.

- E. Hangers, post bases, post caps, tension ties, hold-downs, etc. Drawing show Simpson Strong Tie products. Alternate products shall have equal or greater strength. Install all per Manufacturer's written instructions.
 - 1. Acceptable Manufacturers
 - a. USP Lumber Connectors
 - b. Simpson Strong-Ties
 - 2. All products shall have current ICBO approval.
 - 3. Galvanized metal framing connectors exposed to moisture in accordance with ASTM A123.

2.08 TEMPORARY ENCLOSURES

- A. Provide enclosures for all openings while temporary heating is on. Glass may be installed in permanent window frames if protected from damage.

2.09 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.79 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.35 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.64 mm).
- D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.
- F. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.
 - 1. Thickness: 68 mil, 0.068 inch (1.7 mm).
 - 2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
 - 1. Framing members must be installed within the following limits:
 - a. Layout of walls and partitions: 1/4 inch (6.35 mm) from indicated position.
 - b. Plates and runners:
 - 1) Gypsum wallboard or plaster finishes; 1/4 inch (6.35 mm) in 8 feet (243.84 cm) from a straight line.
 - 2) Ceramic tile finishes; 1/8 inch (3.18 mm) in 8 feet (243.84 cm) from a straight line.
 - c. Studs:
 - 1) Gypsum wallboard or plaster finishes; 1/4 inch (6.35 mm) in 8 feet (243.84 cm) out of plumb, not cumulative.

- 2) Ceramic tile finishes; 1/8 inch (3.18 mm) in 8 feet (243.84 cm) out of plumb, not cumulative.
- d. Face of framing members:
 - 1) Gypsum wallboard or plaster finishes; 1/4 inch (6.35 mm) in 8 feet (243.84 cm) from a true plane.
 - 2) Ceramic tile finishes; 1/8 inch (3.18 mm) in 8 feet (243.84 cm) from a true plane.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.
- F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406.4 mm) o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 1. Fire block furred spaces of walls, at ceiling, and at not more than 96 inches (2438.4 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438.4 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
 3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (609.6 cm) o.c.
- K. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 2. ICC-ES evaluation report for fastener.

- O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with approved fastener patterns where applicable.
 - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.02 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide nonstructural framing and blocking to support the following:
 - 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. Other wall- or ceiling-mounted items indicated on drawings.

3.03 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring vertically at 16 inches (406.4 mm) o.c.

3.04 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated on Structural Drawings.
 - 1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches (406.4 mm) o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide 2-by-6-inch nominal or 2-by-4-inch nominal size wood studs spaced 16 inches (406.4 mm) o.c. unless otherwise indicated on plans.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438.4 mm) high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.

- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

END OF SECTION 061000

**SECTION 061326
HEAVY TIMBER TRUSSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop-fabricated heavy timber trusses, including preservative treatment and factory-applied penetrating stain.
- B. Bridging, bracing, and anchorage.
- C. Connection hardware.
- D. Preservative treatment of wood.

1.02 REFERENCE STANDARDS

- A. AITC 108 - Standard for Heavy Timber Construction
- B. AITC - Timber Construction Manual
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
- G. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2023.
- H. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- J. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2019.

1.03 SUBMITTALS

- A. Submit under provisions of Section 013000 - Administrative Requirements.
- B. Shop Drawings: Indicate framing system, sizes and spacing of trusses, loads, and truss cambers.
 - 1. Submit PE-sealed truss design calculations and PE-sealed truss placement/shop drawings
 - 2. Indicate wood species and grades.
 - 3. Indicate wood treatment.
 - 4. Indicate component profiles, bearing and anchor details, bridging and bracing, framed openings, drilled holes, fasteners, connectors, erection details, and field splices.
 - 5. Samples (Exposed/Stained Work): Submit full width and depth samples, 24 inches long, showing the range of variation expected in appearance of wood products, including surface texture; apply a coat of penetrating sealer to samples.
 - 6. Certificates of Inspection: For exposed timber not marked with grade stamp, submit certificates of inspection issued by the lumber grading agency.
 - 7.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 016000 - Product Requirements.

- B. Store trusses in vertical position resting on bearing points and braced to prevent damage.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for loading, seismic zoning, and other governing load criteria.

2.02 HEAVY TIMBER TRUSSES

- A. Trusses and Components: Fabricate with joints neatly fitted and accurately spaced.
- B. Surface Texture of Timber: Rough sawn; on four sides.
- C. Connectors: Prime except where cast in concrete or in contact with cementitious materials.
- D. Supporting Roofs: Design for dead load of 20 lbs/sq ft excluding self weight. Snow load as per construction documents with deflection limited to 1/240 of span total load and 1/360 for snow load.
- E. Grade Stamps – Exposed/Stained: Apply grade stamps only to surfaces that will not be exposed to view or omit grade stamps and provide certificates of inspection by grading agency

2.03 WOOD MATERIALS

- A. Wood fabricated from old growth timber is not permitted.
- B. Lumber Grading Rules: WWPA
- C. Lumber: cedar or Douglas fir species, number 1 grade or better; maximum moisture content of 19 percent and minimum moisture content of 12 percent.
- D. Wood Blocking, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, maximum moisture content of 19 percent.

2.04 SEALERS (FOR STAINED/EXPOSED WORK)

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer effective in retarding moisture transmission at cross-grain cuts; compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer compatible with indicated finish.

2.05 STAINS

- A. Factory applied exterior timbers (two coats): Sherwin Williams, Benjamin Moore or similar, oil based stain with UV inhibitors and water repellents, color selected by design professional from manufacture's full range. Kiln-dry after treatment to maximum moisture content of 19 percent

2.06 PRESSURE-PRESERVATIVE TREATMENT (PPT)

- A. Factory-treat wood members in accordance with AWP A U1 and use category indicated.
- B. Use Category UC3B above ground, exterior exposed, Commodity Specification A.
 - 1. Kiln-dry after treatment to maximum moisture content of 19 percent.
- C. Fabricate to maximum extent possible before treatment.
- D. Label preservative-treated wood with marking by an approved inspection agency as required by AWP A U1 and ICC (IBC). Marking shall include the phrase AWP A U1, accredited inspection agency's mark, and shall identify treating plant, type of preservative, retention, and end use.
- E. Field Treatment for Cuts and Holes in Preservative Treated Wood: Comply with AWP A M4.

2.07 CONNECTOR MATERIALS

- A. Perform welding in accordance with AWS D1.1/D1.1M.
- B. Shop prime all connectors except leave surfaces bare where intended to be in contact with concrete or cementitious materials.
- C. Steel Connectors: Structural steel, ASTM A36/A36M; galvanized in accordance with ASTM A123/A123M; size and thickness as indicated.
- D. Steel Connector Plates: Hot-dipped galvanized, ASTM A653/A653M SS Grade 33/230, with G90/Z275 coating; size and thickness as indicated.
- E. Truss Bridging: Type, size and spacing recommended by truss manufacturer.
- F. Bolts, Nuts, Washers, Lags, and Screws, Untreated Wood: Medium carbon steel; galvanized coating per ASTM A153/A153M; size and type to suit application.
- G. Bolts, Nuts, Washers, Lags, and Screws, Preservative-Treated Wood: Stainless steel; size and type to suit application.

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.
- C. Verify sufficient bearing surface area.

3.02 INSTALLATION

- A. Field Cuts: All field-drilled holes and cut ends must be retreated with a copper naphthenate solution or the specified factory stain to maintain the preservative barrier.
- B. Moisture Management: Protect timbers from standing water and ground moisture during staging. Use "stickers" (spacers) between bundles to allow for air circulation.

3.03 FINAL TOUCH-UP

- A. Repairs: Touch up any marred surfaces or field cuts with the original factory stain to ensure a uniform appearance.

3.04 ERECTION

- A. Install trusses in accordance with manufacturer's instructions.
- B. Install trusses level and plumb, in correct position.
- C. Do not field cut or alter structural members without approval of Architect.
- D. Install permanent bridging, bracing, and anchors.

3.05 SITE-APPLIED PRESERVATIVE TREATMENT

- A. Apply preservative treatment to field-cut surfaces in accordance with manufacturer's instructions wherever cuts, holes, sawing, or other fabrication of wood members is required after pressure-preservative treatment.

END OF SECTION 061326

**SECTION 061700
SHOP-FABRICATED STRUCTURAL WOOD**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes
 - 1. Wood roof trusses
 - 2. Plywood web joist
 - 3. Bridging, accessories, bracing and anchorage.
 - 4. Glue-laminated timbers.
- B. Related Sections include the following:
 - 1. Section 06 1000 – ROUGH CARPENTRY for roof sheathing and subflooring and dimension lumber for supplementary framing and permanent bracing.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: Unless otherwise indicated on Structural Drawings
 - a. Roof Trusses: Maximum spacing of 24-inches o.c.
 - 1) Live load: 25 psf., plus snow drift and unbalanced loads.
 - 2) Dead Load: 25 psf.
 - 2. Maximum Deflection Under Design Loads: Unless otherwise indicated on Structural Drawings.
 - a. Roof Trusses: Vertical deflection of 1/360 of span, for snow load and 1/240 for total load.

1.3 SUBMITTALS

- A. Product Data: For metal-plate connectors, metal framing anchors, bolts, and fasteners.
- B. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- B. Wood Floor and Roof Trusses: 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 Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
 - 4. Wood Structural Design Standard: Comply with applicable requirements in AFPS's "National Design Specifications for Wood Construction" and its "Supplement".

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with TPI recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.
- C. Handle and store prefabricated wood members in accordance with manufacturer's instructions. Avoid loads due to bending, overturning, or other causes for which member is not designed to resist or endure.
- D. Protect all materials from damage due to moisture, weather, and construction work.
- E. Store materials in dry, well-ventilated areas free of extremely high or low temperatures and humidities and extreme variations in temperature and humidity.
- F. **Do not lay trusses flat.**
- G. Time delivery and erection to avoid extended on site storage and to avoid delaying work of other trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Trusses shall be prefabricated by an approved wood truss fabricator complete with all items necessary to construct and install wood trusses of the configurations shown and in quantities as required.

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive natural or stained finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.3 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:
- B. Hot-Dip Galvanized Steel Sheet: ASTM A 653, G60 coating designation; Designation SS, Grade 33, and not less than 0.036 inch thick.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153 .
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

2.5 METAL FRAMING ANCHORS

- A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
 1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.
- C. Truss Tie-Downs: Use Simposin Strong-Tie products or equal. See Structural Drawings.
- D. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- long seat; formed from metal strap 0.062 inch thick with tabs bent to extend over and be fastened to supporting member.

2.6 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. 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.
 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.7 SOURCE QUALITY CONTROL

- A. For metal plate connected wood trusses identify lumber with grade stamp of an approved inspection agency. Mark plates 3-inch wide or larger with manufacturer's name or symbol.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. Before installing, splice trusses delivered to Project site in more than one piece.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated on the Structural Drawings; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.
- H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
- I. Install wood trusses within installation tolerances in TPI 1.
- J. Do not cut or remove truss members.
- K. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.
- L. Allowed web openings in plywood web I-joist shall be in strict accordance with manufacturer's specifications.
- M. Nailing into wood plugs is not acceptable for any work. Where shot anchors are used they shall be of type and size recommended by manufacturer for conditions of use.
- N. Preservative Treated Wood: Cutting to length may be done in field. Apply several swab coats of preservative to field cut ends after cutting.

*** END OF SECTION 06 1700 ***

SECTION 062013
EXTERIOR FINISH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Exterior trim.
 - 2. Engineered wood siding.

1.02 DEFINITIONS

- A. MDO: Plywood with a medium-density overlay on the face.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ANSI A135.6 - Engineered Wood Siding; 2012 (Reaffirmed 2020).
- C. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.
- D. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position; 2018.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. PS 1 - Structural Plywood; 2023.
- G. PS 20 - American Softwood Lumber Standard; 2025.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
 - 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. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples: For each exposed product and for each color and texture specified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 - 1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 - 2. Provide for air circulation around stacks and under coverings.

1.06 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.07 WARRANTY

- A. Engineered Wood Manufacturer's Warranty: Manufacturer agrees to repair or replace components of engineered wood siding and trim that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.
 - 2. Warranty Period for Factory-Applied Finish: Five years from date of Substantial Completion.
 - 3. Warranty Period: Siding and Trim (Excluding Finish), 25 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece.
- B. Softwood Plywood: DOC PS 1.
- C. Hardboard: ANSI A135.4.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Water-Repellent Preservative Treatment by Nonpressure Process: AWWA N1; dip, spray, flood, or vacuum-pressure treatment.
 - 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC).
 - 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
 - 3. Application: Exterior trim and.

2.03 EXTERIOR TRIM

- A. MDO Trim: Exterior Grade B-B MDO plywood.
- B. Primed Hardboard Trim: ANSI A135.6, primed with manufacturer's standard exterior primer. Recommended by manufacturer for exterior use.
- C. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, recommended by manufacturer for exterior use, made from UV- and heat-stabilized rigid material.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide AZEK or comparable product by one of the following:
 - a. AZEK Building Products, Incorporated
 - b. CertainTeed; SAINT-GOBAIN
 - c. Kleer Lumber
 - d. VERSATEX Building Products, LLC
 - e. Architect Approved Equal
 - 2. Density: Not less than 31 lb/cu. ft..
 - 3. Heat Deflection Temperature: Not less than 130 deg F, in accordance with ASTM D648.
 - 4. Coefficient of Thermal Expansion: Not more than 4.5×10^{-5} inches/inch x deg F.
 - 5. Water Absorption: Not more than 1 percent, in accordance with ASTM D570.
 - 6. Flame-Spread Index: 75 or less, in accordance with ASTM E84.

2.04 ENGINEERED WOOD SIDING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide LP Smartside or comparable product by one of the following:
 - 1. Collins Products LLC
 - 2. Georgia-Pacific Gypsum LLC
 - 3. Louisiana-Pacific Corporation
- B. Engineered Wood Siding: ANSI A135.6, primed with manufacturer's standard exterior primer.
 - 1. Type:
 - a. 3/8-inch- thick by 6-inch- wide lap siding, 4.75" exposure
 - 2. Texture: Wood grain.
- C. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range.

2.05 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
 - 1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails unless otherwise indicated.
 - 2. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
 - 3. For pressure-preservative-treated wood, provide stainless steel fasteners.
 - 4. For applications not otherwise indicated, provide stainless steel fasteners.
- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
- C. Adhesive for Cellular PVC Trim: Product recommended by trim manufacturer.
- D. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
 - 1. Horizontal Joint Flashing for Panel Siding: Preformed, prefinished-aluminum, Z-shaped flashing.
- E. Insect Screening for Soffit Vents: Aluminum, 18-by-16-inch black mesh.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.
 - 1. Cut to required lengths and prime ends.
 - 2. Comply with requirements in Section 099113 "Exterior Painting."

3.03 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.

- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut exterior finish carpentry to fit adjoining work.
 - 3. Refinish and seal cuts as recommended by manufacturer.
 - 4. Install to tolerance of 1/8 inch (3.18 mm) in 96 inches (2438.4 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
 - 6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.04 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install cellular PVC trim to comply with manufacturer's written instructions.
- B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (609.6 mm) long, except where necessary.
 - 1. Use scarf joints for end-to-end joints.
 - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water.
 - 1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
 - 2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.05 INSTALLATION OF SIDING

- A. Install siding to comply with manufacturer's written instructions and warranty requirements.
- B. Engineered Wood Siding:
 - 1. Install engineered wood siding to comply with manufacturer's written instructions.
 - 2. Install panels with edges over framing or blocking.
 - 3. Leave 3/16-inch gap at perimeter, openings, and horizontal panel joints unless otherwise recommended by panel manufacturer.
 - 4. Seal butt joints at inside and outside corners and at trim locations.
 - 5. Install continuous metal flashing at horizontal panel joints.
 - 6. Apply battens and corner trim as indicated.
 - 7. Conceal fasteners to greatest practical extent by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.
- C. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.
- D. Finish: Apply finish within two weeks of installation.

3.06 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements.
 - 1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.07 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.

3.08 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062013

SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood casework with laminate cladding.
- B. Shop finishing.
- C. Cabinet and drawer hardware.
- D. Solid surface countertops
- E. Solid surface sills

1.02 RELATED REQUIREMENTS

- A. Section 088000 - Glazing.

1.03 ABBREVIATIONS AND ACRONYMS

- A. AWI: Architectural Woodwork Institute.
- B. MDF: Medium-density fiberboard.
- C. TFL: Thermally-fused laminate.

1.04 REFERENCE STANDARDS

- A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ANSI/AWI 0400 - Factory Finishing; 2022.
- D. ANSI/AWI 0620 - Finish Carpentry/Installation; 2018.
- E. ANSI/AWI 0641 - Architectural Wood Casework; 2019.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- H. AWI 200 - Care & Storage; 2018.
- I. AWI 300 - Materials; 2018.
- J. BHMA A156.9 - Cabinet Hardware; 2020.
- K. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- L. PS 1 - Structural Plywood; 2023.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data for Wood Casework for Transparent Finish: Submit manufacturer's published, product descriptive data.
 - 1. Panel Cores for Wood Veneer, HPDL, and TFL Panels: For each type, include thickness.
 - 2. TFL Panels: For each type, indicate materials and color.
 - 3. Transparent Finish Systems: For each system, include manufacturer's name.
- C. Shop Drawings:
 - 1. Plans and Elevations: Plan and elevation views of each assembly type.
 - a. Include rough opening dimensions and casework assembly dimensions

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original packaging materials bearing product identification.
- B. Store products prior to installation on flat, level, clean surfaces; elevate products above floors and protect from sunlight.

PART 2 PRODUCTS

2.01 ARCHITECTURAL WOOD CASEWORK

- A. Casework Finish: Wood casework with laminate cladding.
- B. Provide casework and casework components in sizes and profiles as indicated on drawings.
- C. Adjustable Shelves, Number of Shelves Per Cabinet Unit:
 - 1. Base Cabinets: One shelf for each cabinet unit.
 - 2. Wall Cabinets: Two shelves for each cabinet unit.

2.02 PERFORMANCE REQUIREMENTS

- A. Architectural Woodwork Institute (AWI) Performance Requirements:
 - 1. Comply with AWI 300, ANSI/AWI 0641, ANSI/AWI 0400, and ANSI/AWI 0620 as applicable for specified casework finish, aesthetic grade, and performance duty level.
 - a. Product Performance Duty Level: Duty Level 3.
 - 2. Panel and Material Thicknesses: Provide panels and materials as required to meet specified performance duty level, subject to minimum thickness requirements of AWI 300 and ANSI/AWI 0641 and flatness requirements indicated below.
 - 3. Panel Flatness: Provide panels with maximum variation from flat in 12 inches (300 mm) as measured diagonally across panel.
 - 4. Cabinet Door Flatness:
 - a. Provide cabinet doors with 1/4 inch (6.4 mm) maximum variation from flat.

2.03 WOOD CASEWORK WITH LAMINATE CLADDING

- A. Casework Construction:
 - 1. Frameless Cabinet and Door Interface: Flush overlay.
 - 2. Door and Drawer Front Profile: Flush.
- B. Wood Drawer Boxes with Laminate Cladding:
 - 1. Cladding: TFL.
- C. Custom Grade - Laminate-Clad Wood Casework:
 - 1. Exposed Exterior Surfaces, Panels to Receive Laminate Cladding:
 - a. TFL Panels; Surface Finish: As specified.
 - 2. Exposed Interior Surfaces at Door and Drawer Fronts:
 - a. Same laminate materials and thicknesses as exposed exterior surfaces.
 - 1) Color to match exposed interior or face.
 - 3. Exposed Interior Surfaces Except Door and Drawer Front Surfaces:
 - a. TFL: Compatible laminate in color and pattern to exposed exterior surfaces.
 - 4. Semi-Exposed Surfaces; Panels to Receive Laminate Cladding:
 - a. Fabricator's Option:
 - 1) TFL Panels; Surface Finish: As specified.
- D. Edgebanding Applications for Laminate-Clad Wood Casework:
 - 1. Drawer Box Top Edges:
- E. Edgebanding Materials for Laminate-Clad Wood Casework:
 - 1. Thickness: 0.02 inch (0.50 mm) minimum; 0.12 inch (3.0 mm) maximum.
 - 2. Materials: Edgebanding at option of fabricator.

2.04 THERMALLY FUSED LAMINATE PANELS

- A. Description: Thermally Fused Laminate (TFL) panels with one or multiple resin-impregnated sheets of decorative paper thermally fused to panel cores, producing balanced construction.
- B. Backs:
 - 1. Same materials, thicknesses, and colors as laminate faces.
- C. Panel Cores:
 - 1. Medium Density Fiberboard Core (MDF).
- D. Exposed Exterior Surfaces, Color: As selected by owner.
- E. Exposed Interior Surfaces, Color: White.
- F. Semi-Exposed Surfaces, Color: As selected by owner.

2.05 PANEL CORES

- A. Medium Density Fiberboard (MDF):
 - 1. Description: Composite panel composed of cellulosic fibers, additives, and bonding system cured under heat and pressure; comply with ANSI A208.2.
 - 2. Panel Thickness: 3/4 inch (19 mm).

2.06 CONCEALED CABINET BASE COMPONENTS

- A. Cabinet Base Toe-Kick Subfronts:
 - 1. Materials: Plywood.
- B. Cabinet Base Blocking and Stretchers:
 - 1. Materials: Plywood.
 - 2. Height Above Subfloor: 4 inches (100 mm).
- C. Cabinet Base Sleepers:
 - 1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.
 - 2. Materials: Plywood.
 - 3. Height Above Subfloor: 4 inches (100 mm).

2.07 WOOD AND WOOD-BASED MATERIALS

- A. AWI 200 Wood Moisture Content Requirements:
- B. Plywood: Comply with PS 1.

2.08 CABINET AND DRAWER HARDWARE

- A. Hinges, Number of Hinges for Each Cabinet Door:
 - 1. Door Heights Under 48 inches (1200 mm): Not less than two hinges per door.
- B. Hinges, Self-Closing, Integrated Damper Hinges:
 - 1. Description: Self-closing hinges with integrated damper mechanisms.
 - 2. Features: Provide soft-closing integrated damper hinges.
 - 3. Opening Range: Between 115 to 150 to degrees.
 - 4. Material and Finish: Satin anodized aluminum.
- C. Cabinet Door Pulls:
 - 1. Description: Surface-mounted pulls.
 - 2. Provide one pull for each drawer 24 inches (610 mm) or less in width.
 - 3. Design: U-shape wire pulls.
 - 4. Length: 4 inches (100 mm).
 - 5. Material and Finish: Satin anodized aluminum.
- D. Cabinet Door and Drawer Knobs:
 - 1. Description: Projecting metal shape used to operate door or drawer.
 - 2. Provide one knob for each swinging door.

- E. Adjustable Shelf Support Systems, Standards and Shelf Rests:
 - 1. Description: Slotted vertical standards with shelf rests for supporting shelves; standards mounted in evenly spaced, cleanly bored holes.
 - 2. Load Capacity: 300 lb (136 kg) minimum, per pair of standards and brackets.
 - 3. Adjustment Increment: 1-1/4 inches (32 mm).
 - 4. Material and Finish: Satin stainless steel.
- F. Drawer Slides:
 - 1. Description: Hardware units that suspend drawers and provide controlled drawer sliding.
 - 2. Comply with BHMA A156.9, Standard Duty Grade 1.
 - 3. Features: Soft-closing.
 - 4. Travel: Full extension.
 - 5. Material and Finish: Satin anodized aluminum.

2.09 STORAGE CABINETS

- A. Storage Cabinets: Plywood casework with laminate cladding
 - 1. Adjustable shelving metal pilaster and clip system, evenly spaced.
 - 2. Load Capacity: 300lb (136kg) minimum per pair of clips
 - 3. Material and finish: satin stainless steel

2.10 SLAT WALL

- A. Slat wall panel, fiberboard wall panel with aluminum slat wall inserts.
- B. Size: 4 feet x 8 feet (1219mm x 2438mm).
- C. Color: As selected by owner from manufacturer's full range
- D. Aluminum inserts: as recommended by manufacturer.
- E. Mounting: mounted to wall studs with fasteners as required by manufacturer.
- F. Accessories: Upper Shelf, 8 inch (203 mm).

2.11 CASEWORK ACCESSORY COMPONENTS

- A. Glass and Glazing Applications:
 - 1. Glass: Clear, tempered, safety glass.
 - a. ASTM C1036, Type I transparent flat; Class I clear.
 - b. ASTM C1048, Kind FT fully tempered; Condition A uncoated; Quality Q3.
 - c. Safety glass complying with ANSI Z97.1 Class A.
 - d. Thickness: 1/4 inch nominal (6 mm), minimum.

2.12 ACCESSORIES

- A. Fasteners: Size and type to suit application.
- B. Concealed Joint Fasteners: Threaded steel.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Adhesives: Type recommended by fabricator to suit application.

2.13 COUNTERTOP BRACKETS

- A. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
 - 1. Materials: Steel; T-shape cross-section.
 - a. Support Length: 9 inches (230 mm).
 - b. Height: 9 inches (230 mm).
 - c. Width: 1 inch (25 mm).
 - d. Finish: Manufacturer's standard, factory-applied, powder coat.

- e. Color: Black.

2.14 FABRICATION

- A. Shop-fabricate casework to dimensions, profiles, and details indicated on drawings.
- B. Fabricate to maximum extents plausible, including doors, drawers, and hardware; fabricate units in sizes transportable through building openings.
- C. Wood Casework with Laminate Cladding: Apply laminates in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
- D. Edgebanding: Apply where specified; do not use more than one piece for any single length.
- E. Hardware: Install hardware in accordance with hardware manufacturer's written instructions; use fasteners supplied by hardware manufacturer.

2.15 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - 3. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - 4. Color/Pattern Family: Solid color, light colors.
 - 5. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.
 - 6. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
 - 7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.16 SOILD SURFACE SILLS

- A. Window Sills: solid surface (1/2"), as selected from manufacturer's standard line

2.17 SHOP FINISHING

- A. Surface Preparation: Comply with:
 - 1. ANSI/AWI 0400 for specified aesthetic grade.
- B. Shop Finishing: Shop finish architectural wood casework.
 - 1. Comply with ANSI/AWI 0400 for specified aesthetic grade.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify casework and materials required for installation have been delivered, handled and stored as specified.
- B. Verify wood blocking that provides casework backing is installed as indicated on drawings.
- C. Verify location and sizes of rough-in plumbing and rough-in electrical associated with work of this section.
- D. Verify location and sizes of cutouts for appliances and special equipment to be mounted in or adjacent to casework.

3.02 INSTALLATION

- A. Install work of this section rigid, plumb, and level and in accordance with fabricator's documented instructions; secure casework as indicated on drawings.
- B. Install cabinet hardware in accordance with hardware manufacturer's documented instructions using hardware manufacturer's furnished fasteners.
- C. See Section 088000 for site-glazing of glass applications installed in casework components.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/8 inch in 96 inches (3.2 mm in 2440 mm).
- B. Maximum Variation From Level: 1/8 inch in 96 inches (3.2 mm in 2440 mm).

3.04 ADJUSTING

- A. Adjust hardware for smooth operation in accordance with hardware manufacturer's documented instructions.

3.05 PROTECTION

- A. Protect installed casework from subsequent construction operations.

SECTION 072100 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at underside of floor slabs.
- B. Batt insulation for interior acoustic wall applications.

1.02 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.
- C. Insulation in interior acoustic Wood Framed Walls: Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - 2. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 3. Thickness: 5 1/2 inch (138 mm).
 - 4. Products:
 - a. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.owenscorning.com/en-us/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

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 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.

3.03 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- D. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches (152 mm) on center. Lap and seal sheet retarder joints over face of member.
- E. Tape seal tears or cuts in vapor retarder.
- F. 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.

3.04 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 072100

SECTION 072119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
 - 1. In exterior framed walls.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2025.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Thermal Resistance: R-value (RSI-value) of 7.1 (1.25), minimum, per 1-inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
 - 2. Water Vapor Permeance: Vapor retarder; 2 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
 - 3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
 - 4. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
 - 5. Closed Cell Content: At least 90 percent.
 - 6. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.02 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION 072119

**SECTION 072126
BLOWN INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Attic: Blown insulation pneumatically placed into truss spaces.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation; 2025.
- C. ASTM C1015 - Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation; 2017 (Reapproved 2025).

PART 2 PRODUCTS

2.01 MATERIALS

- A. Applications: Provide blown insulation in attic as indicated on drawings.
- B. Thermal Resistance [R-value (RSI-value)]: Provided minimum values in accordance with applicable edition of ASHRAE Std 90.1 I-P for envelope requirements of building location and climate zone.
- C. Blown Insulation: ASTM C739, cellulosic fiber type, nodulated for pour and bulk for pneumatic placement.
 - 1. Thermal Resistance (R-value (RSI-value)): 11.0 sq ft hr deg F/BTU inch (1.9372 sq m K/W inch), minimum.

2.02 ACCESSORIES

- A. Roof Ventilation Baffles: Prefabricated ventilation channels for placement under roof sheathing with baffles to prevent wind-washing.
 - 1. Material: Polyvinyl chloride (PVC).
 - 2. Roof Joist/Truss Spacing: 16 inch (406 mm) on center, nominal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install insulation and ventilation baffle in accordance with ASTM C1015 and manufacturer's instructions.
- B. Completely fill intended spaces leaving no gaps or voids.

END OF SECTION 072126

SECTION 072729
AEROSOL APPLIED AIR LEAK SEALING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aerosol-applied, waterborne acrylic sealant to seal leaks in the building envelope from the interior.
 - 1. Envelope Tightness: Air tightness down to 0.6 ACH 50 or lower

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: For each product include manufacturer's written instructions for site preparation and installation. Include sample Seal Report or Envelope Sealing Report with pressurization test results, product data sheet, and safety data sheet.
- C. Test Reports: Seal Report or Envelope Sealing Report with pre- and post-seal leakage (pressurization test) results.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Protect from freezing

1.04 FIELD CONDITIONS

- A. Application Temperature: Above 40 degrees F (5 degrees C).
 - 1. Protect substrates from environmental conditions that affect sealant performance
 - 2. Do not apply to damp or wet substrates.
- B. Coordination: Coordinate air leak sealing requirements with progress of related and adjacent work in progress.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for aerosol or similar product. Complete forms in DNR's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Substitutions: See Section 016000 - Product Requirements.

2.02 APPLICATIONS

2.03 MATERIALS

- A. Basis of Design: AeroBarrier X1
 - 1. Aerosol-applied, waterborne Acrylic Sealant: Stable, non-toxic, sealant installed by an air sealing system utilizing a computerized process to pressurize an interior space, inject aerosolized sealant as a mist into the interior, and use the higher pressure air escaping to the outside through leaks in the exterior envelope to carry sealant to and through the leaks, sealing them as it passes through. Particles shall deposit at leak sites and build to form a complete and tight seal.
 - 2. Sealing: seals leaks up to 1/2 inch (13mm)
 - 3. Adhesion: Sealant shall not stick to vertical surfaces such as walls, windows, or doors.
 - 4. Certification: UL GreenGuard Gold certified. Safe to use in any type of building.
 - 5. Ultra-Low VOC: 12 grams per liter. No off gassing.

6. Solids: 18.5 to 21.5 percent.
 7. Sealant Base: Acrylic.
 8. Color: White.
 9. Dispersion: Water.
 10. Application: Aerosol.
 11. Substitutions: See Section 016000-Product Requirements.
- B. Performance Requirements: Sealant shall enhance the primary air barrier capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits. Sealant to have a 50 year endurance rating based on 50 cycles at extreme temperatures for times specified in test.
1. UL GreenGuard Gold Certification.
 2. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric
 3. Joint Sealants Under Cyclic Movement (adapted for aerosolized sealants).
 4. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air
 5. Barrier Assemblies.
 6. UL 723 Test for Surface Burning Characteristics of Building Materials.
 7. S102 Test for Surface Burning Characteristics of Building Materials and
 8. Assemblies.
 9. UL 263 Standard for Safety of Fire Tests of Building Construction Materials.
 10. S101 Standard Methods of Fire Endurance Tests of Building Construction and

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Substrates, areas, and conditions, for conditions affecting performance of the work.

3.02 PREPARATION

- A. Surface Preparation:
1. Prepare internal area by covering any openings that are not intended to be sealed. This includes taping or covering any designed or intentional openings and any finished horizontal surfaces within the space.
 - a. Set up Manufacturer's supplied and approved application equipment: includes modified blower door with frame, fan, lay flat tubing, sealing stations, hoses, main control unit and laptop computer.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Install using equipment supplied by the manufacturer, including:
1. Manually seal leaks greater than 1/2" in size.
 2. Ambient interior temperature of the space being sealed must be at 40 degrees F (5 degrees C). If installing with an interior ambient temperature below 40 degrees F (5 degrees C) contact the manufacturer.
 3. Pressurize: Apply positive pressure to the interior using a modified blower door. Fan shall be calibrated to meet ASTM Standard E779, E1554, CGSB-149.10-M86, EN 13829, ATTMA Technical Standard 1, NFPA 2001, RESNET and USACE
 4. Application: Inject the sealant into the interior using Sealing Stations. Measure and control the process by computer including temperature, pressure, humidity, and distribution of sealant within the interior space during the process. Continue the application process until desired level of air tightness required is achieved.

5. Sealing and Monitoring: Control application air leakage rates and monitor in real time with air leakage results reported every 60 seconds. Results displayed shall be based on a pressurization test.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Air Seal Test: At the end of the application process; conduct a post seal test for each building space sealed to verify the sealing results. Installer and manufacturer shall provide a Seal Report or Envelope Sealing Report for each building space sealed that shows pre and post seal leakage.
 1. All penetrations have been sealed to the level reported in the post seal test.
 2. Envelope Tightness: Air tightness down to 0.6 ACH 50 or lower

3.05 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Protect materials and installed sealant from damage during application and remainder of construction period, according to manufacturer's written instructions.
- C. Clean any excess sealant from surrounding building materials as needed and remove and dispose of all protective tapes or covering used in seal preparation.

END OF SECTION 072729

**SECTION 074113
METAL ROOF PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal roof panel system of preformed steel panels.
- B. Aluminum Soffits

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Roof sheathing.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
- C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2025).
- E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- G. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Specimen warranty.
- C. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- D. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in DNR's name and are registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in DNR's name and register with warrantor.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
 - 1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed $L/180$ of span length(L) when tested in accordance with ASTM E1592.
 - 2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
 - 3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).

2.02 METAL ROOF PANELS

- A. Metal Roof Panels: 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. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
 - b. Steel Thickness: Minimum 24 gauge, 0.024 inch (0.61 mm).
 - 2. Profile: Standing seam, with minimum 2-inch (51 mm) seam height; concealed fastener system for field seaming with special tool.
 - 3. Texture: Smooth.
 - 4. Width: Maximum panel coverage of 24 inches (610 mm).

2.03 ATTACHMENT SYSTEM

- A. 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.

2.04 FABRICATION

- A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.05 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer's standard line.

2.06 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide flashings, 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.

- D. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
 - 1. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
 - 2. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.
 - 3. Fasteners: As specified by manufacturer and building code qualification report or approval.
- E. Self-adhering sheet membrane: severe climate application
 - 1. Material: Cold applied, self-adhering membrane composed of high strength polyethylene film coated on one side with a layer of rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene
 - 2. Membrane Thickness: 40 mil (1.02mm) ASTM D3767 procedure A (section 9.1).
 - a. Tensile Strength: 250 psi (1720 kN/m²) ASTM D412.
 - b. Elongation: 250% ASTM D412
 - 3. Low Temperature Flexibility: Unaffected at -20°F (-29°C) ASTM D1970/D1970M.
 - 4. Adhesion to Plywood: 3.0 lbs/in. width (525 N/m) ASTM D903.
 - 5. Permeance (Max): 0.05 perms (2.9 ng/m²s Pa) ASTM E96/E96M .
 - 6. Primer: As recommended by manufacturer.
 - 7. ICC ESR-1677 approval according to AC-48 Acceptance Criteria for Self-Adhered underlayments used as Ice Barriers.
- F. Ridge Vents: Factory fabricated, formed panels with integral attachment flanges and snap-on cover.
 - 1. Vent Material: 22-gauge, 0.0299-inch (0.76mm) steel.
 - 2. Perforated Screen: 0.050-inch (1.27mm) thick aluminum.
 - 3. Brackets: Manufacturer's standard 20 gauge, 0.0359-inch (0.91mm).
- G. Snow Guards: Individual projecting polycarbonate shapes, set between roofing panels and mechanically fastened to roof deck.
 - 1. Projecting Polycarbonate Shapes: Clear polycarbonate plastic with UV stabilizers, semi-circular design.
- H. Aluminum Soffit: Formed and coated aluminum soffit, 0.019-inch nominal; AAMA 1402.
 - 1. Panel Size: 12-inch (304mm) exposed with double 6 inch panels with one intermediate ribs.
 - 2. Soffit size: Center Vented.
 - 3. Texture: Smooth.
 - 4. Finish: 2 coat acrylic.
 - 5. Color: As selected from manufacturer's full color line.
 - 6. Accessories: drip edges, start strips, "J" and "F" channels
 - a. Texture: Smooth
 - b. Color: Match soffits.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.
- B. Coordinate installation of waterproof membrane over roof sheathing with Section 061000.
- C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

- D. At locations 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.

3.02 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place 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. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.
- B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
- C. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

3.03 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.

END OF SECTION 074113

**SECTION 074213
METAL WALL PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured metal panels for exterior wall panels, with related flashings and accessory components.

1.02 REFERENCE STANDARDS

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2025.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

1.03 SUBMITTALS

- A. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
 - 1. Physical characteristics of components shown on shop drawings.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions and recommendations.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

PART 2 PRODUCTS

2.01 METAL WALL PANEL SYSTEM

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior wall panels.
 - 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. Design Pressure: In accordance with applicable codes.
 - 4. Maximum Allowable Deflection of Panel: $L/180$ for length(L) of span.
 - 5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - 6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
 - 7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
 - 8. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.
- B. Exterior Wall Panels:
 - 1. Profile: Vertical; style as indicated.
 - 2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
 - 3. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.

- 4. Panel Width: 36 inches (914 mm).
- 5. Color: As selected by Architect from manufacturer's standard line.
- C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- D. Expansion Joints: Same material, thickness and finish as exterior sheets; 22 gauge, 0.0299 inch (0.76 mm) thick; manufacturer's standard brake formed type, of profile to suit system.
- E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- F. Anchors: Galvanized steel.

2.02 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.

2.03 FINISHES

- A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.
- B. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.

2.04 ACCESSORIES

- A. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
- B. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

- A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

3.03 INSTALLATION

- A. Install panels on 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 wall panel installation.
- C. Locate joints over supports.
- D. Lap panel ends 2 inches (51 mm), minimum.
- E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.
- D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION 074213

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 077123 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

- A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch (0.40 mm) thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); 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 (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 GUTTERS AND DOWNSPOUTS

- A. See Section 077123 for manufactured gutters and downspouts.
- B. Seal metal joints.

2.04 FLASHING

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.05 ACCESSORIES

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

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. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Secure gutters and downspouts in place with concealed fasteners.

END OF SECTION 076200

**SECTION 077123
MANUFACTURED GUTTERS AND DOWNSPOUTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum gutters and downspouts.

1.02 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aluminum Sheet: ASTM B209/B209M; 0.032 inch (0.8 mm) thick.
 - 1. Finish: Mill.

2.02 COMPONENTS

- A. Gutters: SMACNA rectangular style profile.
- B. Downspouts: SMACNA round profile.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- D. Fasteners: Galvanized steel, with soft neoprene washers.

2.03 FABRICATION

- A. Form gutters and downspouts of profiles and sizes 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.

2.04 FINISHES

- A. Class I Clear Anodized Finish: AAMA 611 AA-M12C22A41, clear anodic coating not less than 0.7 mil, 0.0007 inch (0.018 mm) thick.

2.05 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Slope gutters 1/8 inch per foot (3 mm/m) .

END OF SECTION 077123

SECTION 079200 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2024.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- G. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Backing material recommended by sealant manufacturer.
 - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 5. Substrates the product should not be used on.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. QUIKRETE Companies: www.quikrete.com/#sle.
 - 2. Sika Corporation: usa.sika.com/#sle.
 - 3. W. R. Meadows, Inc: www.wrmeadows.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints:
 - a. Seal the following joints:
 - 1) Wall expansion and control joints.
 - 2) Joints between doors, windows, and other frames or adjacent construction.
 - 3) Joints between different exposed materials.
 - 2. Interior Joints:
 - a. Do not seal gaps and openings in gypsum board and suspended ceilings
 - b. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.

- c. Seal the following joints:
 - 1) Joints between door frames and window frames and adjacent construction.
 - 2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
 - 3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
- 3. Do Not Seal:
 - a. Joints where sealant installation is specified in other sections.
 - b. Joints between suspended ceilings and walls.
- B. Exterior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
- C. Interior Joints: Use nonsag silicone sealant, unless otherwise indicated.
- D. Interior Joints: Use Acrylic Latex Elastomeric Sealant (DAP Dynaflex 230 or similar) where paintability is needed.
 - 1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
 - a. Architectural Sealants: 250 g/L
 - b. Sealant Primers for Nonporous Substrates: 250 g/L
 - c. Sealant Primers for Porous Substrates: 775 g/L
- E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

- A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M, A, G, and O; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 - 5. Color: Match adjacent finished surfaces.
- B. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
 - 1. Adheres to wet surfaces.
 - 2. Color: White.
 - 3. Products:
 - a. Adfast USA Inc; ADSEAL DWSP 1940 Series: www.adfastcorp.com/#sle.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Match adjacent finished surfaces.
- D. Nonsag Traffic-Grade Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Hardness Range: 20 to 30, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.

2.05 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 1. Movement Capability: Plus and minus 25 percent, minimum.
- B. Self-Leveling Polysulfide Sealant: ASTM C920, Type M, Grade P, Class 25, Use T and NT; multicomponent.
 1. Movement Capability: Plus and minus 25 percent.
- C. Flexible Polyurethane Foam: Single component, gun grade, and low-expanding.
- D. High Quality Latex-Based Sound Sealant: ASTM C834, Type OP an opaque sealant, and Grade 0, 32 degrees F (0 degrees C), meets requirements for low-temperature flexibility.

2.06 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION 079200

SECTION 081113
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.
- C. Sound-rated hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2025.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2024.
- H. 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; 2023.
- I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- J. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- L. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM

- A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
- 3. Door Edge Profile: Manufacturers standard for application indicated.
- 4. Typical Door Face Sheets: Flush.
- 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
- 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.

2.02 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
 - 2. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
 - 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 - 4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
 - 5. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 39, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
 - 6. Door Finish Color: Bronze

2.03 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Same as hollow metal door.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Weatherstripping: Separate, see Section 087100.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
- E. Sound-Rated Door Frames: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.

2.04 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
 - 1. Color: Bronze.

2.05 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

- B. Low-Expanding Foam Insulation for installation.

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 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. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 087100.
- D. Touch up damaged factory finishes.

3.03 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION 081113

**SECTION 081416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

PART 2 PRODUCTS

2.01 DOORS AND PANELS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.

2.02 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.03 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Any option allowed by quality standard for grade.
- B. Facing Adhesive: Type I - waterproof.

2.04 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

2.05 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 1, Lacquer, Nitrocellulose.
 - b. Sheen: Flat.

2.06 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 081113.
- B. Glazed Openings:
 - 1. Glazing: Single vision units, 1/4 inch (6.4 mm) thick glass.
 - 2. Tint: Clear.
- C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION 081416

**SECTION 083100
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Draft-stop, partition-mounted access units.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Size - Other Ceilings: Diameter of 20 by 30 inches (Diameter of 508 by 762 mm).
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- B. Draft-Stop, Partition-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Panel Material: Steel.
 - 3. Finish: Powder-coated primer.
 - 4. Size: 24 by 36 inches (610 by 914 mm).
 - 5. Door/Panel: Hinged, self-latching, standard duty.
 - a. Ingress Side Operation: Tool-key operated latch.
 - b. Egress Side Operation: Manufacturer's standard release mechanism.
 - 6. Gasketing: Manufacturer's standard neoprene gasket.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION 083100

SECTION 083313
COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated coiling counter doors and operating hardware.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Coiling Counter Doors:
 - 1. C.H.I. Overhead Doors; Model 6522 (steel): www.chiohd.com/#sle.
 - 2. Overhead Door Corporation; Counter Door - Model 650: www.overheaddoor.com/#sle.
 - 3. Raynor Garage Doors: www.raynor.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 COILING COUNTER DOORS

- A. Coiling Counter Metal Doors, Non-Fire-Rated: Galvanized steel slat curtain.
 - 1. Mounting: Between jambs, within prepared opening.
 - 2. Nominal Slat Size: 1-1/4 inches (32 mm) wide.
 - 3. Slat Profile: Flat, perforated.
 - 4. Finish, Galvanized Steel: No additional finish.
 - 5. Guides: Formed track; same material and finish unless otherwise indicated.
 - 6. Manual push up operation.

2.03 COMPONENTS

- A. Metal Curtain Construction: Interlocking, single-thickness slats.
 - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 3. Steel Slats: ASTM A653/A653M galvanized steel sheet, with minimum G90/Z275 coating; minimum thickness 16 gauge, 0.06 inch (1.5 mm).
- B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
- C. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for door installation.

- B. Verify that door opening is plumb, header is level, and dimensions are correct.
- C. Notify Architect of any unacceptable conditions or varying dimensions.
- D. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).
- C. Maximum Variation From Level: 1/16 inch (1.5 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION 083313

SECTION 083613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
- B. DASMA 102 - American National Standard Specifications for Sectional Doors; 2018.
- C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- D. NEMA MG 00001 - Motors and Generators; 2024.
- E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Show component construction, anchorage method, and hardware.

1.04 WARRANTY

- A. Extended Correction Period: Correct defective work within a 2-year period commencing on Date of Substantial Completion.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for electric operating equipment. Complete forms in DNR's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sectional Doors:
 - 1. C.H.I. Overhead Doors; Model 3217 Flush Sandwich Steel Insulated Doors: www.chiohd.com/#sle.
 - 2. Overhead Door Corporation; Model 430 - Sectional Steel Door: www.overheaddoor.com/#sle.
 - 3. Raynor Garage Doors; EnergyCore Series, Model EC2242: www.raynor.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 STEEL DOORS

- A. Type SSD-1 - Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 - 1. Door Panels: Steel construction; outer steel sheet of 24 gauge, 0.0239 inch (0.61 mm) minimum thickness, flush profile; inner steel sheet of 26 gauge, 0.016 inch (0.41 mm) minimum thickness, flat profile; core reinforcement sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; expanded polystyrene (EPS) insulation.

2. Door Nominal Thickness: 2 inches (51 mm) thick.
3. Exterior Finish:
 - a. Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
4. Interior Finish:
 - a. Factory finished with powder coated finish; color as selected from manufacturer's standard line.
5. Electric Operation: Electric control station.

2.03 COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch (2.3 mm) minimum thickness; 2 inch (50 mm) wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) thick.
- B. Track: Hot-dipped galvanized steel, ASTM A 653; 2 inch (50 mm) wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) thick.
- C. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- 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 (110 N) 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.
- J. Counterbalance Mechanism: Torsion spring, adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted with manufacturer's standard ball-bearing bracket at each end of torsion shaft, provide one additional midpoint bracket for shafts up to 16ft long and two additional brackets at one-third points to support shafts more than 16 ft long unless closer spacing is recommended by the manufacturer. .
 1. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door lifting cables as door is raised.
 2. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
 3. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks. Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft.
 4. Bumper: Provide spring bumper at each horizontal track to cushion door at

2.04 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
- B. Insulation: Expanded polystyrene (EPS), bonded to facing.
 1. R-value of 10 (RSI-value of 1.76).

2.05 ELECTRIC OPERATION

- A. Electric Operators:
 - 1. Mounting: Side mounted on cross head shaft.
 - 2. Motor Enclosure:
 - a. Exterior Doors: NEMA MG 00001, Type 4; open drip proof.
 - 3. Motor Rating: 1/3 hp (250 W); continuous duty.
 - 4. Motor Voltage: 120 volts, single phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA EN 10250, Type 1.
 - 7. Opening Speed: 12 inches per second (300 mm/s).
 - 8. Brake: Adjustable friction clutch type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. See Section 260583 for electrical connections.
- B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- C. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
 - 1. 24 volt circuit.
 - 2. Surface mounted, at interior door jamb.
 - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

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 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).
- B. Maximum Variation from Level: 1/16 inch (1.5 mm).
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.04 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.05 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.

END OF SECTION 083613

SECTION 084313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Acoustic Infill Panels, U-channel frame and glass.

1.02 RELATED REQUIREMENTS

- A. Section 088000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Thermally broken factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Glazing Position: Centered (front to back).
 2. Finish: Superior performing organic coatings.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 3. Finish Color: Dark bronze.
 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 6. 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.
 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 2. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
 3. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - a. Thermal Transmittance (U-factor):
 - 1) Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.45 Btu/sq.ft.xhxdegree F as determined in accordance with NFRC 100.
 - b. Solar Heat Gain Coefficient (SHGC): Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.40 as determined in accordance with NFRC 200.

2.02 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Glazing Stops: Flush.
- B. Glazing: See Section 088000.
- C. Acoustic Infill Panel: Installed interior side of storefront, to be installed between studs of .
1. Frame: CRL Wide U-Channel with Top Load Roll-in Glazing Gasket for 1/2" glass
 2. Color: Match storefront
 3. Glazing: ASTM C1036, Type I transparent flat; Class I clear.
 - a. 1/2" tempered, safety glazing
 4. Accessories: aluminum shims
 5. Substitutions: See Section 016000 - Product Requirements

2.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.04 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 088000.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.04 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

3.05 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 084313

**SECTION 085113
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 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022, with Errata (2023).
- B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- C. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- H. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2017 (Reapproved 2023).

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
- C. Manufacturer's Window Schedule.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.
 - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.04 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.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum Window Manufacturers:
 - 1. Quaker Window Products Company; C600: www.quakercommercialwindows.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.02 ALUMINUM WINDOWS

- A. Thermally Broken 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 inch (102 mm).
 - 2. Provide factory-glazed units.
 - 3. Provide Frosted glazing where indicated on drawings.
 - 4. 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.
 - 5. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - 6. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 7. 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.
- B. Fixed, Non-Operable Type:
 - 1. Construction: Thermally broken.
 - 2. Glazing: Single; clear; transparent.
 - 3. Exterior Finish: Class I natural anodized.
 - 4. Interior Finish: Class I natural anodized.
- C. Outswinging Casement Type:
 - 1. Construction: Thermally broken.
 - 2. Provide screens.
 - 3. Glazing: Single; clear; low-e.
 - 4. Glazing: Single; clear; low-e, frosted where indicated on drawings.
 - 5. Exterior Finish: Class I natural anodized.
 - 6. Interior Finish: Class I natural anodized.

2.03 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - 1. Performance Class (PC): AW.
- B. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
- C. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf (580 Pa).

- D. Air Leakage: 0.1 cfm/sq ft (0.5 L/sec sq m) maximum leakage per unit area of outside window frame dimension when tested in accordance with ASTM E283/E283M.
- E. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.
- F. Forced Entry Resistance: Tested to comply with ASTM F588 requirements for performance level of Grade 10 for specific window style required.

2.04 COMPONENTS

- A. Frames: ; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.
- B. 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.
- C. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to achieve effective weather seal.
- D. Spray Polyurethane Foam for Perimeter Airsealing: Low Expanding Type
- E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 HARDWARE

- A. Sash lock: Lever handle with cam lock.
- B. Operator: Lever action handle fitted to projecting sash arms with limit stops.

2.06 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41, clear anodic coating not less than 0.7 mil (0.018 mm) thick.
- B. High Performance Organic Coating: Primer and topcoat coatings system based on super durable polyester resin powder; with minimum dry film thickness (DFT) of 2 to 3.5 mil, 0.0020 to 0.0035 inch (0.051 to 0.089 mm) over aluminum extrusions and panels; meeting requirements of AAMA 2604.
- C. Fluoroethylene Vinyl Ether (FEVE) Coating: Superior performing resin based organic powder coatings system complying with AAMA 2605; single coat applications when applied to aluminum with dry film thickness (DFT) of 2 to 3 mil, 0.002 to 0.003 inch (0.051 to 0.076 mm); color and gloss as scheduled.
 - 1. Apply coating to exposed metal surfaces with proper preparation and pretreatment in accordance with resin manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 072500.

3.02 PRIME WINDOW INSTALLATION

- A. Install windows in accordance with manufacturer's 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 sill and sill end angles.
- E. 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.
- F. Install operating hardware not pre-installed by manufacturer.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.

END OF SECTION 085113

**SECTION 087100
DOOR HARDWARE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for wood and hollow metal doors.
- B. Thresholds.
- C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 087113 - Power Door Operators.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.1 - Standard for Butts and Hinges; 2021.
- C. BHMA A156.3 - Exit Devices; 2025.
- D. BHMA A156.4 - Door Closers and Pivots; 2024.
- E. BHMA A156.6 - Standard for Architectural Door Trim; 2021.
- F. BHMA A156.7 - Template Hinge Dimensions; 2022.
- G. BHMA A156.8 - Door Controls - Overhead Stops and Holders; 2021.
- H. BHMA A156.13 - Mortise Locks and Latches; 2022.
- I. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.
- J. BHMA A156.18 - Standard for Materials and Finishes; 2020.
- K. BHMA A156.21 - Thresholds; 2025.
- L. BHMA A156.22 - Standard for Gasketing; 2021.
- M. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2024.
- N. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- O. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.
- P. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- Q. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

1.05 SUBMITTALS

- A. See Section 013000 - 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, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.

2.02 HINGES

- A. Hinges: Comply with BHMA A156.1, Grade 1.
 - 1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 - 2. Provide hinges on every swinging door.
 - 3. Provide ball-bearing hinges at each door with closer.
 - 4. Provide non-removable pins on exterior outswinging doors.
 - 5. Provide following quantity of butt hinges for each door:
 - a. Doors up to 60 inches (1.5 m) High: Two hinges.
 - b. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.

2.03 EXIT DEVICES

- A. Exit Devices: Comply with BHMA A156.3, Grade 1.
 - 1. Lever design to match lockset trim.
 - 2. Provide cylinder with cylinder dogging or locking trim.
 - 3. Provide exit devices properly sized for door width and height.
 - 4. Provide strike as recommended by manufacturer for application indicated.
 - 5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.04 ELECTRIC STRIKES

- A. Electric Strikes: Comply with BHMA A156.31, Grade 1.
 - 1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
 - 2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.

2.05 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 - 1. Provide cylinders from same manufacturer as locking device.
 - 2. Provide cams and/or tailpieces as required for locking devices.

2.06 MORTISE LOCKS

- A. Manufacturers:
 - 1. BEST, dormakaba Group; 45H Series: www.bestaccess.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 - 1. Latchbolt Throw: 3/4 inch (19 mm), minimum.
 - 2. Deadbolt Throw: 1 inch (25.4 mm), minimum.
 - 3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.

4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.

2.07 DOOR PULLS AND PUSH PLATES

- A. Door Pulls and Push Plates: Comply with BHMA A156.6.
 1. Pull Type: Straight, unless otherwise indicated.
 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
 - a. Edges: Beveled, unless otherwise indicated.
 3. Material: Aluminum, unless otherwise indicated.
 4. On solid doors, provide matching door pull and push plate on opposite faces.

2.08 CLOSERS

- A. Closers: Comply with BHMA A156.4, Grade 1.
 1. Type: Surface mounted to door.
 2. Provide door closer on each exterior door.
 3. At corridor entry doors, mount closer on room side of door.
 4. At outswinging exterior doors, mount closer on interior side of door.

2.09 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
 1. Provide stop for every swinging door, unless otherwise indicated.

2.10 POWER DOOR OPERATORS

- A. See Section 087113.

2.11 KICK PLATES

- A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
 1. Size: 8 inch (203 mm) high by 2 inch (51 mm) less door width (LDW) on push side of door.

2.12 FLOOR STOPS

- A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 1. Type: Manual hold-open, with pencil floor stop.
 2. Material: Aluminum housing with rubber insert.

2.13 ASTRAGALS

- A. Astragals: Comply with BHMA A156.22.
 1. Type: Split, two parts, and with sealing gasket.
 2. Material: Aluminum, with neoprene weatherstripping.
 3. Provide non-corroding fasteners at exterior locations.

2.14 THRESHOLDS

- A. Thresholds: Comply with BHMA A156.21.
 1. Provide threshold at each exterior door, unless otherwise indicated.
 2. Provide threshold with Sound Transmission Class (STC) of 25-30 at locations indicated.
 3. Type: Flat surface.
 4. Material: Aluminum.
 5. Threshold Surface: Fluted horizontal grooves across full width.
 6. Field cut threshold to profile of frame and width of door sill for tight fit.
 7. Provide non-corroding fasteners at exterior locations.

2.15 WEATHERSTRIPPING AND GASKETING

- A. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 - 1. Head and Jamb Type: Adjustable.
 - 2. Door Sweep Type: Encased in retainer.
 - 3. Material: Aluminum, with brush weatherstripping.
 - 4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 - 5. Provide door bottom sweep on each exterior door, unless otherwise indicated.
 - 6. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

2.16 SIGNAGE

- A. Signage (Room Name Plates and Numbers): Provide on doors for individuals to easily identify room names and/or numbers.
 - 1. Text Required: "RESTROOM" with symbols and braille text.
 - 2. Material: In plastic or metal with paint used to create necessary text, adhered to door.

2.17 SILENCERS

- A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
 - 1. Single Door: Provide three on strike jamb of frame.
 - 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 - 3. Material: Rubber, gray color.

2.18 FIRE DEPARTMENT LOCK BOX

- A. Fire Department Lock Box:
 - 1. Capacity: Holds 10 keys.
 - 2. Finish: Manufacturer's standard dark bronze.

2.19 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
 - 1. Primary Finish: 625; bright chromium plated over nickel, with brass or bronze base material (former US equivalent US26); BHMA A156.18.
 - 2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
 - a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of 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. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.

1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
 2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
- D. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

- A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

3.05 PROTECTION

- A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

3.06 DOOR HARDWARE SCHEDULE

- A. SET #01 - Exterior Entry Front
 1. 3 HW Hinges
 2. 1 Electric Strike
 3. 1 Latch Protector
 4. 1 Closer
 5. 1 Power Operated Automatic Opener w/ ADA push button
 6. 1 Kick Plate
 7. 3 Silencers
 8. 1 Exterior Threshold
 9. 1 Door Sweep
 10. Gasketing, Head and Jamb
- B. SET #02 - Exterior Entry STC
 1. 3 HW Hinges
 2. 1 Electric Strike
 3. 1 Latch Protector
 4. 1 Closer
 5. 1 Power Operated Automatic Opener w/ ADA push button
 6. 1 Kick Plate
 7. 3 Silencers
 8. 1 Exterior Threshold STC
 9. 1 Door Sweep STC
 10. Gasketing, Head and Jamb STC
- C. SET #03 - Exterior Entry Panic Hardware
 1. 3 HW Hinges
 2. 1 Exit Device with Lever
 3. 1 Mortise Lock
 4. 1 Latch Protector
 5. 1 Closer
 6. 1 Kick Plate

7. 1 Push/Pull plate
 8. 3 Silencers
 9. 1 Exterior Threshold
 10. 1 Door Sweep
 11. Gasketing, Head and Jamb
- D. SET #04 - Interior Entry, Vestibule
1. 3 HW Hinges
 2. 1 Closer
 3. 1 Kick Plate
 4. 3 Silencers
 5. 1 Power Operated Automatic Opener w/ ADA push button
 6. 1 Lever handel
- E. SET #05 - Interior Entry, Vestibule to Range Control
1. 3 HW Hinges
 2. 1 Mortise Office Lockset
 3. 1 Closer
 4. 1 Kick Plate
 5. 3 Silencers
 6. 1 Sign
 7. 1 Power Operated Automatic Opener w/ ADA Push Button
- F. SET #06 - Interior Door Office Lockset
1. 3 HW Hinges
 2. 1 Mortisel Office Lockset
 3. 1 Kick Plate
 4. 3 Silencers
 5. 1 Sign
 6. 1 Floor Stop
- G. SET #07 - Interior Door Privacy Lockset
1. 3 HW Hinges
 2. 1 Closer
 3. 1 Push/Pull Plate
 4. 1 Kick Plate
 5. 3 Silencers
 6. 1 Sign
- H. SET #08 - Interior Door Storage Lockset
1. 3 HW Hinges
 2. 1 Mortise Storeroom Lockset
 3. 1 Kick Plate
 4. 3 Silencers
 5. 1 Kick Plate
 6. 3 Silencers
 7. 1 Sign
 8. 1 Floor Stop
- I. SET #09 - Interior Double Door Storage Lockset
1. 6 HW Hinges
 2. 1 Mortise Storeroom Lockset
 3. 1 Kick Plate
 4. 6 Silencers

- 5. 1 Astragal
- 6. 1 Sign
- 7. 2 Floor Stop
- J. SET #10 - Interior Door Secure Storage Lockset
 - 1. 3 HW Hinges
 - 2. 1 Mortise Storeroom Lockset
 - 3. 1 Kick Plate
 - 4. 3 Silencers
 - 5. 1 Sign
- K. SET #11 - Interior Door Passage Lockset
 - 1. 3 HW Hinges
 - 2. 1 Mortise Passage Lockset
 - 3. 1 Kick Plate
 - 4. 3 Silencers
 - 5. 1 Sign
- L. SET #12 - Interior Door Corridor with Panic Hardware
 - 1. 3 HW Hinges
 - 2. 1 Exit Device with Lever
 - 3. 1 Closer
 - 4. 1 Mortise Passage Lockset
 - 5. 1 Kick Plate
 - 6. 3 Silencers
 - 7. 1 Sign
- M. SET #13 - Interior Door Corridor with Closer Hardware
 - 1. 3 HW Hinges
 - 2. 1 Closer
 - 3. 1 Mortise Passage Lockset
 - 4. 1 Kick Plate
 - 5. 3 Silencers
 - 6. 1 Sign
- N. SET #014 - Attic access Door
 - 1. 1 Closer
 - 2. 1 Sign

END OF SECTION 087100

SECTION 087113 POWER DOOR OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Operators for swinging doors.
- B. Controllers, actuators, and safety devices.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.10 - Power Operated Pedestrian Doors; 2024.
- C. ITS (DIR) - Directory of Listed Products; Current Edition.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL (DIR) - Online Certifications Directory; Current Edition.
- G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate power door operators with balance of door hardware and electrical work required for each affected door opening.
 - 1. Templates: Check other sections' shop drawings to confirm that adequate provisions are in place for locating and installing power door operators.
 - 2. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies, remote activation devices, and electric door latching hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Operators for Swinging Doors:
 - 1. BEST, dormakaba Group, ED100LE: www.bestaccess.com/#sle.
 - 2. dormakaba; ED100 Series: www.dormakaba.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 POWER DOOR OPERATORS - GENERAL

- A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.
- B. Comply with ADA Standards for egress requirements.
- C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.
- D. Exterior and Vestibule Doors: Provide equipment suitable for ambient operating temperature range of minus 20 to plus 140 degrees F (minus 29 to plus 60 degrees C).
- E. Exterior Doors: Provide units capable of operating, closing, and holding doors closed under positive and negative differential pressure; if necessary, provide power closing.
- F. System Integration: Integrate operator functionality with other systems as required for a complete working installation.

2.03 OPERATORS FOR SWINGING DOORS

- A. Door Operator: Hydraulic.
 - 1. Applications: Include operators for single doors.
 - 2. Hydraulic Operators: 1/8 hp (92 W) minimum, self-contained, electrically driven.
 - 3. Speed Control: Variable, field-adjustable opening and closing cycles.
 - 4. Functionality: Full-power open, spring close operation.
 - a. Full-Power Operators: Comply with BHMA A156.10; safeties required.
 - 1) Comply with UL 325; acceptable evidence of compliance includes UL (DIR) or ITS (DIR) listing or test report by testing agency acceptable to authorities having jurisdiction.
 - 2) Signage: Provide signage in accordance with BHMA A156.10.
 - 5. Mounting: Surface mounted overhead.
 - 6. Power Supply Units: Self-contained, electrically operated, and independent of door operator.
 - 7. Actuators: Manufacturer's standard.
 - a. Push-Side Actuator: Mat switch.
 - b. Pull-Side Actuator: Mat switch.
 - 8. Pull-Side Safety: Door mounted.
 - 9. Hold Open: Toggle switch at inside head of doors; deactivate hold-open on activation of fire alarm system, see Section 28 4600.

2.04 CONTROLLERS, ACTUATORS, AND SAFETY DEVICES

- A. Actuators: Manufacturer's standard for products specified and as specified below.
 - 1. Push Button Actuator: Standard, momentary contact type, wall mounted, surface; stainless steel escutcheon plate.
- B. Safety Devices: Manufacturer's standard units recommended for project applications and conditions.
 - 1. Swinging Door Safety Device: Door-mounted proximity detector device arranged to prevent operation of door when persons or obstructions are in the swing zone.

2.05 FINISHES

- A. Aluminum Finishes: Manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify installation conditions including, but not limited to the following: opening sizes, floor conditions, plumb and level mounting surfaces.
- B. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.02 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.

3.03 ADJUSTING

- A. Adjust door equipment for correct function and smooth operation.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate to DNR's representative equipment operation, operating components, adjustment features, and lubrication requirements.

END OF SECTION 087113

**SECTION 088000
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing compounds.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- B. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- D. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- E. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.
- F. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- G. GANA (SM) - GANA Sealant Manual; 2008.
- H. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- I. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
- J. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Low-E Clear Insulating Glass - Clear, low-reflective exterior appearance or comparable product
 - 1. Vitro, Architectural Glass
 - 2. Guardian Glass
 - 3. Substitutions: See Section 016000 - Product Requirements

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
3. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
 1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Guardian Glass, LLC: www.guardianglass.com/#sle.
 2. Vitro Architectural Glass (formerly PPG Glass); Solarban 70: www.vitroglazings.com/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Color: Black.
 6. Purge interpane space with dry air, hermetically sealed.
- C. Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Low-E (passive type), on #2 surface.
 4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Clear.
 - b. 1/4 inch (6.4mm) starphire glass, Solarban 70 solar control (sputtered) on second surface (2), 1/2 inch (1mm) air space, 1/4 inch (6mm) clear glass or approved equal.
 5. Sound Transmission Class (STC) rating of 30 minimum, with special acoustical spacer and edge seal.
 6. Total Thickness: 1 inch (25.4 mm).
 7. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.26, nominal.
 8. Visible Light Transmittance (VLT): 64 percent, nominal.

- 9. Shading Coefficient: .32, exterior.
- 10. Solar Heat Gain Coefficient (SHGC): 0.27, nominal.

2.05 ACCESSORIES

- A. Setting Blocks: EPDM, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- B. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

END OF SECTION 088000

**SECTION 092116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal Resilient Channels
- C. Acoustic insulation.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2024.
- F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- K. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- L. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, P5: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

- B. Nonstructural Framing System Components: AISI S220; 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/120 at 5 psf (L/120 at 240 Pa).
 - 1. Resilient Furring Channels: Single leg configuration; 1/2 inch (13 mm) channel depth.
 - a. Products:
 - 1) ClarkDietrich; RC Deluxe Resilient Channel: www.clarkdietrich.com/#sle.
 - 2) MarinoWARE; RC Max: www.marinoware.com/#sle.
 - 3) Substitutions: See Section 016000 - Product Requirements.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 4. USG Corporation: www.usg.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required at surfaces behind tile in wet areas, tub and shower surrounds, and shower ceilings.
 - 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - a. Ceilings
 - 4. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).

2.04 GYPSUM BOARD ACCESSORIES

- A. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
 - 1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 2. Tape Thickness: 1/4 inch (6 mm).
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 - 1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
 - 2) ClarkDietrich; Strait-Flex OS-300: www.clarkdietrich.com/#sle.
 - 3) Substitutions: See Section 016000 - Product Requirements.

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. Studs: Space studs at 16 inches on center (at 406 mm on center).

1. Extend partition framing to structure where indicated and to ceiling in other locations.
- B. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- C. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- D. Blocking: Install wood blocking for support of:
 1. Wall-mounted cabinets.
 2. Plumbing fixtures.
 3. Toilet partitions.
 4. Toilet accessories.
 5. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.
- C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 1. Place one bead continuously on substrate before installation of perimeter framing members.
 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 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. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- C. Installation on Wood Framing: For nonrated assemblies, install as follows:
 1. Single-Layer Applications: Screw attachment.

3.05 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, using longest practical lengths.

3.06 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.08 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION 092116

**SECTION 095100
ACOUSTICAL CEILINGS**

PART 2 PRODUCTS

1.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Acoustic Ceiling Products, Inc: www.acpideas.com/#sle.
 - 3. Acoustics First Corporation: www.acousticsfirst.com/#sle.
 - 4. USG Corporation: www.usg.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

1.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. VOC Content: Certified as Low Emission by one of the following:
 - a. Product listing in UL (GGG).
 - b. Product listing in CHPS (HPPD).
- B. Acoustical Panels, Type 01: Mineral fiber with membrane-faced overlay, with the following characteristics:
 - 1. Classification: ASTM E1264 Type A.
 - a. Form: A2.2, wet formed.
 - b. Pattern: G - smooth.
 - 2. Size: 24 by 24 inches (610 by 610 mm).
 - 3. Thickness: 7/8 inch (22 mm).
 - 4. Noise Reduction Coefficient (NRC) Range: 0.60 to 0.85, in accordance with ASTM E1264.
 - 5. Articulation Class (AC): 170, in accordance with ASTM E1264.
 - 6. Panel Edge: 15/16" Square Tegular.
 - 7. Suspension System: Exposed grid.
 - 8. Products:
 - a. Armstrong World Industries, Inc; Calla: www.armstrongceilings.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- C. Acoustical Panels, Type 02: Mineral fiber with membrane-faced overlay, washable, with the following characteristics:
 - 1. Classification: ASTM E1264 Type A.
 - a. Form: A2.2, wet formed.
 - b. Pattern: G - smooth.
 - 2. Size: 24 by 24 inches (610 by 610 mm).
 - 3. Thickness: 7/8 inch (22 mm).
 - 4. Noise Reduction Coefficient (NRC) Range: 0.60 to 0.80, in accordance with ASTM E1264.
 - 5. Articulation Class (AC): 170, in accordance with ASTM E1264.
 - 6. Panel Edge: 15/16" Square Tegular.
 - 7. Suspension System: Exposed grid.
 - 8. Products:
 - a. Armstrong World Industries, Inc; Calla Health Zone: www.armstrongceilings.com/#sle..
 - b. Substitutions: See Section 016000 - Product Requirements.

1.03 SUSPENSION SYSTEMS

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dip galvanized steel grid with steel cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch (24 mm) face width.
 - 3. Products:
 - a. Armstrong World Industries, Inc; Prelude XL: www.armstrongceilings.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

1.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

2.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

2.03 INSTALLATION - SUSPENSION SYSTEM

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Locate system on room axis according to reflected plan.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- D. Suspension System, Non-Seismic: 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.
- E. 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.
- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- H. Do not eccentrically load system or induce rotation of runners.

2.04 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 acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- F. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

2.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

2.06 CLEANING

END OF SECTION 095100

**SECTION 096700
FLUID-APPLIED FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring and cove base.

1.02 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).
- C. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.05 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).
- B. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fluid-Applied Flooring:
 - 1. Everlast Epoxy Systems, Inc: www.everlastepoxy.com
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring: Epoxy base coats, with troweled aggregate.
 - 1. Aggregate: Quartz granules.
 - 2. Top Coat: As recommended by manufacturer.
 - 3. System Thickness: 1/8 inch (3.2 mm), nominal, dry film thickness (DFT).
 - 4. Texture: Slip resistant.
 - 5. Products:
 - a. Substitutions: See Section 016000 - Product Requirements.

2.03 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; Style B, Cove.
 - 1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 2. Height: 4 inches (100 mm).

3. Thickness: 0.125 inch (3.2 mm).
4. Finish: Satin.
5. Length: Roll.
6. Color: To be selected by Architect from manufacturer's full range.
7. Accessories: Premolded external corners and internal corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
 1. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Prepare concrete surfaces according to ICRI 310.2R.

3.03 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.

3.04 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION 096700

SECTION 097200 WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall coverings.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets for wall covering and adhesive. Indicate compliance with specified flame spread and smoke developed ratings.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials for damage upon arrival.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

PART 2 PRODUCTS

2.01 WALL COVERINGS

- A. Performance Requirements:
 - 1. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 50, maximum, when tested in accordance with ASTM E84.
- B. Wall Covering - Fiberglass Reinforced Polymer (FRP) Panels
 - 1. Panel size: 4 feet by 8 feet
 - 2. Thickness: 3/32 inches
 - 3. Trim: Aluminum extruded trim
 - 4. Surface Texture: Smooth
 - 5. Color: As selected by Owner from manufacturer's full range.

2.02 ACCESSORIES

- A. Adhesive: Type recommended by wall covering manufacturer.
- B. Termination Trim: Aluminum, color as selected by Architect from manufacturer's standard range.
- C. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate surfaces are primed and meet manufacturer's requirements to receive work.
- B. Measure moisture content of substrates with electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) or at rate greater than 1/16 inch/ft (5 mm/m).
- D. Notify Architect of detrimental conditions affecting wall covering installation.

- E. Correct detrimental conditions before starting installation.

3.02 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall immediately before applying wall covering.
- C. Use wall covering in roll number sequence.
- D. Razor trim edges of wall covering. Do not razor trim on gypsum board surfaces.
- E. Smoothly apply wall covering without wrinkles, gaps, or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Horizontal seams are not permitted.
- G. Do not seam within 2 inches (51 mm) of internal corners or within 6 inches (152 mm) of external corners.
- H. Cover spaces above and below windows and above doors in pattern sequence from roll.
- I. Where wall covering tucks into reveals, metal wallboard, or plaster stops, use contact adhesive within 6 inches (152 mm) of wall covering termination. Ensure complete contact bond.
- J. Install termination trim.
- K. Remove excess adhesive from seams while wet and before proceeding to next wall covering sheet.
- L. Reinstall wall plates and accessories removed to accommodate work of this section.

3.03 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean wall coverings of dust, dirt, excess adhesive, and other contaminants.

3.04 PROTECTION

- A. Protect installed products from damage until substantial completion.

END OF SECTION 097200

SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Marble, granite, slate, and other natural stones.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Acoustical materials, unless specifically indicated.
 - 9. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- C. Maintenance Materials: Furnish the following for DNR's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gal (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.05 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. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Paints:
 - 1. Behr Paint Company: www.behr.com/#sle.
 - 2. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of the State in which the Project is located.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.

2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and aluminum.
 1. Two top coats and one coat primer.
 2. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
 3. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
 1. Medium duty applications include doors and door frames.
 2. Two top coats and one coat primer.
 3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
 4. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 5. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 1. Alkali Resistant Water Based Primer; MPI #3.
 - a. Products:
 - 1) Diamond Vogel.
 - 2) Sherman Williams
 - 3) Benjamin Moore
 - 4) Substitutions: See Section 016000 - Product Requirements
 2. Interior Drywall Primer Sealer.
 - a. Products:
 - 1) Behr Premium Plus Interior Drywall Primer and Sealer [No.73].
 - 2) Substitutions: See Section 016000 - Product Requirements

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or 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. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- G. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: 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.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- H. 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.
- I. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.

END OF SECTION 099123

SECTION 102113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Phenolic toilet compartments.
- B. Urinal screens.

1.02 REFERENCE STANDARDS

- A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Product Data: Provide color selection from manufacturer's full range, to be selected by Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Phenolic Toilet Compartments:
 - 1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
 - 2. ASI Accurate Partitions: www.asi-accuratepartitions.com/#sle.
 - 3. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
 - 4. Partition Systems International of South Carolina; Phenolic Toilet Partitions: www.psisc.com/#sle.
 - 5. Substitutions: Section 016000 - Product Requirements.

2.02 PHENOLIC TOILET COMPARTMENTS

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted unbraced.
- B. Doors:
 - 1. Thickness: 3/4 inch (19 mm).
 - 2. Width: 24 inch (610 mm).
 - 3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
 - 4. Height: 58 inch (1473 mm).
- C. Panels:
 - 1. Thickness: 1/2 inch (13 mm).
 - 2. Height: 58 inch (1473 mm).
- D. Pilasters:
 - 1. Thickness: 3/4 inch (19 mm).
 - 2. Width: As required to fit space; minimum 3 inch (76 mm).

2.03 ACCESSORIES

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing floor fastenings.
- B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch (25 mm by 38 mm) size, with anti-grip profile and cast socket wall brackets.
- C. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- D. Hardware: Polished stainless steel:

1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Door Latch: Slide type with exterior emergency access feature.
3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
4. Coat hook with rubber bumper; one per compartment, mounted on door.
5. 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.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) 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.

3.03 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

3.04 SCHEDULES

- A. Toilet Room 14: One toilet stalls of floor mounted, head rail braced type; two urinal screens with pilaster bracing; one color as selected by Owner.
- B. Toilet Room 15: Two toilet stalls of floor mounted, head rail braced type; one color as selected by Owner.

END OF SECTION 102113.17

SECTION 102213
WIRE MESH PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire mesh systems for walls.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2025.
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for mesh materials, finishes.

PART 2 PRODUCTS

2.01 WIRE MESH PARTITIONS

- A. Wire Mesh Partitions: Factory-fabricated modular assemblies of panels, doors, anchors, hardware, and accessories as required to provide a complete system.
 - 1. Design Criteria:
 - a. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
 - b. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.02 COMPONENTS

- A. Woven Wire Mesh: Standard duty.
 - 1. Material: ASTM A510/A510M uncoated crimped steel wire.
 - 2. Wire Size: 10 gauge, 0.135 inch (3.5 mm).
 - 3. Mesh Opening Size: 1-1/2 inch (38 mm) diamond shape.
 - 4. Mesh Weave: Plain weave, inter-crimped.
- B. Framing and Support Members:
 - 1. Material: ASTM A36/A36M steel shapes and ASTM A500/A500M cold-formed steel tubing.
 - 2. Framing, Corner Posts, and Intermediate Support Members: Manufacturer's standard sizes for system specified and as indicated on drawings.
 - 3. Vertical Stiffeners: As required for partitions greater than 144 inches (3658 mm) in height.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.03 FASTENERS

- A. Bolts, Nuts and Washers: Hot dip galvanized.
- B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

2.04 ACCESSORIES

- A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

- B. Post Caps: Manufacturer's standard.
- C. Floor Base: Manufacturer's standard.

2.05 FABRICATION

- A. Fit and assemble in largest practical sections for delivery to site, ready for installation.
- B. Make exposed joints flush or tight.
- C. Provide components required for anchorage to adjacent construction.

2.06 FINISHES

- A. Painted Finish: Manufacturer's standard powder coat finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and required openings are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install items plumb and level, accurately fitted, free from distortion or defects.
- C. After installation, touch-up field welds scratched or damaged surfaces with shop applied finish.

3.03 ADJUSTING

- A. Adjust doors to achieve free movement.

END OF SECTION 102213

SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Diaper changing stations.
- D. Utility room accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- B. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- C. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. Bradley Corporation: www.bradleycorp.com/#sle.
 - 2. Georgia-Pacific Professional: www.gppro.com/#sle.
 - 3. Substitutions: Section 016000 - Product Requirements.
- B. Diaper Changing Stations:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com/#sle.
 - 3. Koala Kare Products: www.koalabear.com/#sle.
 - 4. Substitutions: 016000 - Product Requirements.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- C. Adhesive: Two component epoxy type, waterproof.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
- B. Paper Towel Dispenser: Manual, roll paper type.
 - 1. Material: Thermoplastic polymer.

2. Paper Discharge: Manual dispense by lever operation.
 3. Capacity: 8-inch diameter roll.
 4. Mounting: Surface mounted.
 5. Refill Indicator: Transparent viewing slot.
- C. Waste Receptacle: Stainless steel, freestanding style with swing top.
- D. Automated Soap Dispenser: Liquid soap dispenser, wall-mounted, with stainless steel cover and window to gauge soap level, tumbler lock.
1. Minimum Capacity: 48 ounces (1.5 liters).
- E. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 2. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 3. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
- F. Grab Bars: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.
- G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
- H. Coat Hook: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Shower Curtain Rod: Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 mm) wall thickness, satin-finished, with 3 inch (75 mm) outside diameter, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for installation with exposed fasteners.
- B. Shower Curtain:
1. Material: Opaque vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
 2. Size: 36 by 72 inches (914 by 1830 mm), hemmed edges.
 3. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
 4. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
- C. Towel Pin: Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.06 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Material: Polyethylene.
 2. Mounting: Surface.
 3. Color: Gray.
 4. Minimum Rated Load: 250 pounds (113.4 kg).

2.07 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: Three spring-loaded rubber cam holders.
 - 2. Length: Manufacturer's standard length for number of holders.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.03 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 102800

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
- B. FM (AG) - FM Approval Guide; Current Edition.
- C. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.
- D. UL (DIR) - Online Certifications Directory; Current Edition.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

- A. General Requirements: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated on drawings.

2.02 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire-resistance rating of walls where cabinet installed.
- B. Fire-Rated Cabinet Construction: One-hour fire rated.
- C. Cabinet Configuration: Recessed type.
 - 1. Size to accommodate accessories.
- D. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.
- E. Fabrication: Weld, fill, and grind components smooth.
- F. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.
 - 1. See Section 099123 for field painting.
- G. Finish of Cabinet Interior: White colored enamel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and interfaces with other work.
- B. Verify substrate and site conditions for product installation are in accordance with manufacturer's written instructions.
- C. Verify rough openings for cabinet are sized and located in accordance with manufacturer's written instructions.
- D. Notify Architect in writing of conditions detrimental to completion of work. Do not proceed with installation until detrimental conditions are corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION 104400

SECTION 110000
EQUIPMENT – ADD ALTERNATE 2

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General Equipment Contractor Purchased, Contractor Installed.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing and application instructions.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover products to protect against moisture. Support stacked products to prevent deformation.
- B. Properly store products until ready for installation.

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide Basis of Design product or request substitution prior to bidding. Substitution shall be owner pre-approved, compatible equal.

2.02 WIRELESS ACCESS POINT

- A. Basis of Design: Catalyst 9120AX Series WAP Internal
 - 1. Manufacturer: Cisco
 - 2. Product number: C9120AXI-B
 - 3. Quantity: 4
- B. Basis of Design: Catalyst 9120AX Series WAP External
 - 1. Manufacturer: Cisco
 - 2. Product number: C9120AXE-B
 - 3. Quantity: 2
- C. Basis of Design: Catalyst 24 port 1G PoE with 4 uplinks
 - 1. Manufacturer: Cisco
 - 2. Product number: C9200L-24P-4G-A
 - 3. Quantity: 1
- D. Substitutions: See Section 016000 - Product Requirements.

2.03 MONITORS

- A. Basis of Design: 24 Inch Borderless Business Monitor S40G
 - 1. Manufacturer: Samsung
 - 2. Product number: LS24D408GANXGO
 - 3. Quantity: 2
- B. Substitutions: See Section 016000 - Product Requirements.

2.04 POINT OF SALE SYSTEM

- A. Basis of Design: EL 2202 L Touch Monitor 22" LCD Desktop
 - 1. Manufacturer: Vermont Systems
 - 2. Product number: VS-H-TSM-EL-11
 - 3. Quantity: 2

- B. Basis of Design: Star Micronics, value cash drawer
 - 1. Color: black
 - 2. Size: 5 bill – 8 coin, 2 media slots
 - 3. Manufacturer: Vermont Systems
 - 4. Product number: VS-H-DRW-ST-02-D-BK
 - 5. Quantity: 2
- C. Basis of Design: Custom Configuration for VSI Software
 - 1. Manufacturer: Vermont Systems
 - 2. Product number: VS-H-BCR-HY-11-X-C
 - 3. Quantity: 1
- D. Basis of Design: Star Receipt Printer TSP 143IIIU, 40 col Thermal, USB, Cutter
 - 1. Manufacturer: Vermont Systems
 - 2. Product number: VS-H-PRT-ST-05-U-B
 - 3. Quantity: 2
- E. Basis of Design: Honeywell genesis 7680G 1D/2D Barcode scanner
 - 1. USB with drivers license
 - 2. Manufacturer: Vermont Systems
 - 3. Product number: VS-H-BCR-HY-7680DL
 - 4. Quantity: 2
- F. Basis of Design: Card Pointe credit card pin pad and processor.
 - 1. Manufacturer: Card Connect
 - 2. Quantity: 2
- G. Basis of Design: Elite Desk 8 G1i Mini PC
 - 1. Manufacturer: HP
 - 2. Product number: AR6D2AV
 - 3. Quantity: 3
- H. Substitutions: See Section 016000 - Product Requirements.

2.05 PRINTERS

- A. Basis of Design: ECOSYS All-in-One Color Laser Printer
 - 1. Manufacturer: Kyocera
 - 2. Product number: MA2600cwfx
 - 3. Quantity: 1
- B. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General Contractor to provide all materials, fasteners and required data connections to install, mount and connect devices and equipment.
- B. Provide owner with all manuals, support material and warranty information.
- C. Coordinate with owner as required to access networks to connect devices unless coordinated otherwise.

END OF SECTION 110000

SECTION 124813
ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Extruded aluminum entrance floor grilles.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.
- C. Maintenance Data: Include cleaning instructions, and stain removal procedures.

PART 2 PRODUCTS

2.01 ENTRANCE FLOOR GRILLES AND GRATINGS

- A. Entrance Floor Grilles: Recessed extruded aluminum grille assembly with nominal 1 inch (25 mm) wide tread strips running perpendicular to traffic flow, slots between treads, and perimeter frame forming sides of recess; grille hinged for access to recess.
 - 1. Recess Depth: 3/4 inches (19 mm).
 - 2. Tread Surfaces: Serrated anodized aluminum.
 - 3. Colors: As selected by Architect from manufacturer's standard selection.
 - 4. Length in Direction of Traffic Flow: 72 inches (1830 mm).
 - 5. Width Perpendicular to Traffic Flow: Full width of entrance door opening.
 - 6. Frame: Anodized aluminum for embedding in concrete; minimal exposed trim; stud or hook concrete anchors.
- B. Mounting: Top of non-resilient members level with adjacent floor.
- C. Structural Capacity: Capable of supporting rolling load of 300 lb (136.1 kg) without permanent deformation or noticeable deflection.
- D. Vibration Resistant Fabrication: Welded, riveted, or bolted members; no snap or friction connections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor opening for mats are ready to receive work.

3.02 PREPARATION

- A. Mats: Verify size of floor recess before fabricating mats.
- B. Vacuum clean floor recess.

3.03 INSTALLATION

- A. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

END OF SECTION 124813

SECTION 220500
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Furnish and install a new domestic water service to the building.
 - c. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
 - d. Furnish and install complete propane piping system including all meter requirements.
 - e. Furnish and install water heaters.
 - f.
 - g. Furnish and install complete sanitary sewer and vent system.
 - h. Furnish and install site sanitary sewer piping, cleanouts.
 - i. Complete all applicable tests, certifications, forms, and matrices.
 - 2. Heating Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 3. Air Conditioning and Ventilating Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 4. Temperature Control Work: Refer to Section 230500 "Basic HVAC Requirements".
 - 5. Testing, Adjusting, and Balancing Work: Refer to Section 230500 "Basic HVAC Requirements".

1.03 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

- A. Definitions:
 - 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.

4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
 5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.
- C. Mechanical Contractor's Responsibility:
1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Furnaces
 2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
 3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
 4. Temperature Control Subcontractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- D. Electrical Contractor's Responsibility:
1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
 2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
 3. Provides motor control and temperature control wiring, where so noted on the drawings.
 4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
 5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.

6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.04 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for service connections, such as sewer, water, and gas.
 4. Make application for and pay for all meters and metering systems required by the utility company.
- F. Examination of Drawings:
1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
 3. Scaling of the drawings is not sufficient or accurate for determining these locations.
 4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
 5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
 6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
 7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
 8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.
- G. Field Measurements:
1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.
- H. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.

4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.05 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.06 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.
 1. Submittals List:

Referenced Specification Section	Submittal Item
22 05 29	Hangers and Supports
22 07 19	Plumbing Pipe Insulation
22 09 00	Instrumentation
22 10 00	Plumbing Piping Systems and Valves
22 10 23	Propane Piping Systems
22 10 30	Plumbing Specialties
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:
1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
 2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
 3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.

- c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 22 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 22 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.07 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
 3. Itemize the cost for each of the following:
 - a. Overhead and profit.
 - b. Bonds.
 - c. Insurance.
 - d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
 - a. Excavation and backfill for underground piping systems inside the building.
 - b. Underground piping systems inside the building (sanitary, etc.) listed separately. Break down the material and labor for each piping system based on geography (building, floor, wing and/or phase).
 - c. Each aboveground piping system (sanitary, domestic water, etc.). Break down the material and labor for each piping system based on geography (building, floor, wing and/or phase).
 - d. Pipe insulation with separate material and labor line items for each piping system listed above.
 - e. Each piece of equipment requiring shop drawings (e.g., water heater, water softener, etc.) using the project nomenclature (WH-1,, etc.).
 - f. Each plumbing fixture (e.g., WC, lavatory, sink, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.
 - g. Site utilities (5' beyond building)
 - h. Water balancing
 - i. Commissioning
 - j. Record drawings
 - k. Punchlist and closeout
- D. Update Schedule of Values when:
 1. Indicated by Architect/Engineer.
 2. Change of subcontractor or supplier occurs.
 3. Change of product or equipment occurs.

1.08 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.09 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 1. Motor windings and ventilation openings.
 2. Bearings.
 3. Equipment Pipe and Accessories connection openings. (e.g. boiler connections, coil connections, etc.)

4. Starter and control cabinets.
 5. Heat transfer coils.
 6. Pump Seals.
 7. Combustion burner and blower equipment (e.g. combustion air intake, combustion vent/flue, etc.)
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.11 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.13 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and

ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (<https://call811.com/>) or by calling 811.
 - 2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.
- B. Excavation:
 - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
 - 2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
 - 3. Trim bottom and sides of excavations to grades required for foundations.
 - 4. Protect excavations against frost and freezing.
 - 5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
 - 6. Perform all trenching in a manner to prevent cave-ins and risk to workers.

7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
 8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.
- C. Dewatering:
1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.
- D. Underground Obstructions:
1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
 2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.
- E. Fill and Backfilling:
1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
 2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone or flowable fill to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
 3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.
 4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
 5. Backfill Materials:
 - a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 - b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 - c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.
 6. Water shall not be permitted to rise in unbackfilled trenches.
 7. Dispose of excess excavated earth as directed.

8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.04 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up or reproducible drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; receipt by Architect/Engineer required prior to final payment approval.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. General:
 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
 1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div22.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD
 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
 6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
 7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.
16. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Maintenance of equipment.
 3. Start-up procedures for all major equipment.
 4. Explanation of seasonal system changes.
 5. Explanation of Owner's Responsibilities to operate, maintain, and flush domestic water system (i.e., ASHRAE Standard 188).

- E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 - 1. Domestic Hot Water System - 2 hours
 - 2. All Domestic Water Systems operation, maintenance and flushing of all fixtures and dead legs - 2 hours
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 SYSTEM STARTING AND ADJUSTING

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.08 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of plumbing drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

- C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.09 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.
- E. Paint all outdoor exposed propane piping the color selected by Owner or Architect/Engineer.

3.10 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - d. Protect stored on-site and installed absorptive materials from moisture damage.
 2. Request that the Owner designate an IAQ representative.
 3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
 5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
 6. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
 7. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
 8. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

3.13 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
1. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to requesting a final job observation.

1. All pumps operating and balanced.
2. All plumbing fixtures installed and caulked.
3. Pipe insulation complete, pipes labeled and valves tagged.
4. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 220500

SECTION 220529
PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Flashing and Sealing of Equipment and Pipe Stacks.
- D. Cutting of Openings.
- E. Escutcheon Plates and Trim.

1.02 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 220500. Include plastic pipe manufacturers' support spacing requirements.

1.04 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.01 HANGER RODS

- A. Hanger rods for single rod hangers shall conform to the following:
 - 1. Steel and Cast Iron:
 - a. Hanger Rod Diameter:
 - 1) 2" and smaller: 3/8"
 - 2) 2-1/2" through 3-5/8": 1/2"
 - 3) 4" through 6": 1/2"
 - 2. Copper and Plastic Pipe:
 - a. Hanger Rod Diameter:
 - 1) 2" and smaller: 3/8"
 - 2) 2-1/2" through 3-5/8": 1/2"
- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.02 PIPE AND STRUCTURAL SUPPORTS

- A. General:
 - 1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, -69, and -89.
 - 2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

3. Copper piping located in an exposed area, including indirect waste piping shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.
 - a. Products:
 - 1) nVent/M-Co Model #456
 - 2) Eaton Fig. 3198HCT
 - 3) Anvil Fig. CT138R
- B. Hangers and Clamps:
 1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
 2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp within their temperature limits of -65F to +275F.
 3. Vertical cold pipe drops and rough-ins to fixtures shall be supported by insulated pipe clamps to prevent thermal bridging and condensation.
 4. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
 5. Unless otherwise indicated, hangers shall be as follows:
 - a. Clevis Type: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches & Smaller
 - 1) Products: Bare Steel Plastic or Insulated Pipe:
 - a) Anvil Fig. 260
 - b) Eaton Fig. 3100
 - c) nVent Model 400
 - 2) Products: Bare Copper Pipe Felt or PVC Coated:
 - a) Eaton Fig. B3104F or B3100CTC
 - b) Anvil Fig. CT65
 - c) nVent Fig. 402
 - b. Continuous Channel with Clevis Type: Service: Plastic Tubing, Flexible Hose, Soft Copper Tubing:
 - 1) Products:
 - a) Eaton Fig. B3106, with Fig. B3106V
 - b) nVent Model 104, with Model 104V
 - c) Anvil Fig. 1V
 - c. Adjustable Swivel Ring Type: Bare Metal Pipe - 4 inches and Smaller
 - 1) Products: Bare Steel Pipe:
 - a) Anvil Fig. 69
 - b) Eaton Fig. B3170NF
 - c) nVent Model 115

- 2) Products: Bare Copper Pipe:
 - a) Eaton Fig. B3170CTC
 - b) nVent 102A0 Series
 - c) Anvil Fig. CT-69
6. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
 - a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
7. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
 - a. Clamp Type: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller
 - 1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.
 - 2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
 - 3) Products: Bare Steel, Plastic or Insulated Pipe:
 - a) Unistrut Fig. P1100 or P2500
 - b) Eaton Fig. B2000 or B2400
 - c) Anvil Fig. AS1200
 - d) nVent USC
 - 4) Products: Bare Copper Pipe:
 - a) Eaton Fig. BVT
 - b) nVent CADDY Cushion Clamp
- C. Upper (Structural) Attachments:
 1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:
 - a. Wood Anchors: Tension wood rod hanger for suspending 3/8" threaded rod. Zinc plated carbon steel.
 - 1) Minimum allowable tension loads for Douglass Fir/Southern Pine:
 - a) 3/8" diameter rod; 2-1/2" shank: 600 lb/590 lb.
 - b) Load values are based on full shank penetration into wood member. Minimum edge distance 3/4". Minimum end distance 3-1/4".
 - 2) Limitations:
 - a) Truss: Do not hang from wood trusses without truss manufacturer or Structural Engineer's approval.
 - b) Sheetrock/Gypsum Ceiling: When drilling through non-wood materials (e.g., sheet rock, gypsum, etc.), increase shank length by depth of non-wood materials.
 - c) Plywood Flooring/Roofing: Do not hang from plywood floor or roofing.
 - d) Spacing: Refer to wood structure spacing of hangers.

- 3) Products:
 - a) Simpson RWV
 - b) DeWALT
 - c) ITI Sammys GT25

2.03 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

- 1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
- 2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

- 1. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 6 inches on all sides of the equipment (6 inches larger than factory base), except where pad extension would interfere with working space at equipment control panels and electrical panels.
- 2. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
- 3. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.
- 4. Equipment requiring bases is as follows:
 - a. Hydropneumatic Tank
 - b. Water Heater

2.04 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.05 ROOF PENETRATIONS

- A. Break insulation only at the clamp for pipes between 60F and 150F. Seal outdoor insulation edges watertight.

2.06 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.07 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

2.08 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 PLUMBING SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.
- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Set all concrete inserts in place before pouring concrete.
 - 3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
 - 4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 - 5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
- C. Pipe Requirements:
 - 1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
 - 2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
 - 3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
 - 4. Piping shall not introduce strains or distortion to connected equipment.

5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
 6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
 7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
 8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. For attachments to joists that are concentrically loaded on the joist, a max of 100 lbs. may be attached to the joist within a chord panel.
 2. For attachments to joists that are eccentrically loaded, a max of 25 lbs. may be attached to the joist within a chord panel without an additional angle.
 3. Multiple attachments are allowed in each chord panel as long as the sum of the loads do not exceed the max load indicated.
 4. For loads between 100 lbs. - 200 lbs. additional L2x2x3/16" (L51xL51x4.8) ASTM A36 structural steel angles are required and joist must be concentrically loaded.
 5. For loading conditions noted above, total sum of loads shall not exceed 200 lbs. for an 8 ft. segment of joist. For loads greater than 200 lbs. and not noted on the drawings, contact engineer prior to installation.
 6. No loads shall be supported from joist bridging.
 7. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 8. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 7'-0"
 - 2) 1-1/2": 9'-0"
 - 3) 2": 10'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" through 6": 12'-0"

2. Hard Drawn Copper & Brass (Liquid Service):
 - a. Maximum Spacing:
 - 1) 3/4" and under: 5'-0"
 - 2) 1": 6'-0"
 - 3) 1-1/4": 7'-0"
 - 4) 1-1/2": 8'-0"
 - 5) 2": 8'-0"
 - 6) 2-1/2": 9'-0"
3. Plastic Pipe:
 - a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
4. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:
 - a. Continuous channel with hangers maximum 8'-0" OC.
- I. Installation of hangers shall conform to MSS SP-58, -69, -89 and the applicable Plumbing Code.

END OF SECTION 220529

SECTION 220593
PLUMBING TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjusting, and balancing of plumbing systems.

1.02 QUALITY ASSURANCE

- A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or TABB Certified Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.03 REFERENCES

- A. AABC - National Standards for Total System Balance, 2002.
- B. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.
- C. TABB - International Standards for Environmental Systems Balance.

1.04 SUBMITTALS

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.
- B. Electronic Copies:
 - 1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 2. All text shall be searchable.
 - 3. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.05 REPORT FORMS

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.
- C. Refer to PART 4 for required reports.

1.06 WARRANTY/GUARANTEE

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.

- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.07 SCHEDULING

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.
- B. Project will be constructed in phases. Provide balancing report after each phase is complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.
- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g., submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.02 EXAMINATION

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
 - 1. General Equipment Requirements:
 - a. Equipment is safe to operate and in normal condition.
 - b. Equipment with moving parts is properly lubricated.
 - c. Temperature control systems are complete and operable.
 - d. Proper thermal overload protection is in place for electrical equipment.
 - e. Direction of rotation of all pumps is correct.
 - f. Access doors are closed and end caps are in place.
 - 2. Pipe System Requirements:
 - a. Hydronic systems have been cleaned, filled, and vented.
 - b. Strainer screens are clean and in place.
 - c. Shutoff, throttling and balancing valves are open.
- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.

- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.04 INSTALLATION TOLERANCES

- A. $\pm 10\%$ of scheduled values:
 - 1. Adjust piping systems to $\pm 10\%$ of design values.

3.05 ADJUSTING

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.
- B. Once balancing of systems is complete, at least one valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.
- E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.06 SUBMISSION OF REPORTS

- A. Fill in test results on appropriate forms.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.01 GENERAL REQUIREMENTS

- A. Title Page:
 - 1. Project name.
 - 2. Project location.
 - 3. Project Architect.
 - 4. Project Engineer (IMEG Corp.).
 - 5. Project General Contractor.
 - 6. TAB Company name, address, phone number.
 - 7. TAB Supervisor's name and certification number.
 - 8. TAB Supervisor's signature and date.
 - 9. Report date.
- B. Report Index
- C. General Information:
 - 1. Test conditions.
 - 2. Nomenclature used throughout report.
 - 3. Notable system characteristics/discrepancies from design.
 - 4. Test standards followed.

5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

4.02 PLUMBING SYSTEMS

A. Pump Data:

1. Drawing symbol.
2. Service.
3. Manufacturer, size, and model.
4. Impeller size: specified, actual, and final (if trimmed).
5. Flow Rate (gpm): specified and actual.
6. Pump Head: specified, operating and shutoff.
7. Suction Pressure: operating and shutoff.
8. Discharge Pressure: operating and shutoff.

B. Balancing Valve:

1. Drawing symbol.
2. Service.
3. Location.
4. Size.
5. Manufacturer and model.
6. Flow rate (gpm): specified and actual.
7. Pressure drop: specified and actual.

C. Gas Fired Water Heater:

1. Drawing symbol.
2. Service.
3. Location.
4. Manufacturer and model.
5. Flow rate (gpm): specified and actual.
6. Pressure drop: specified and actual.
7. Capacity (Btuh): specified, nameplate, and actual.
8. Entering water temperature: specified and actual.
9. Leaving water temperature: specified and actual.
10. Control Setting: specified and actual.

END OF SECTION 220593

SECTION 220719
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Piping Insulation.
- B. Insulation Jackets.

1.02 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with five years minimum experience.
- B. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. 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. 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.

1.03 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- C. ANSI/ASTM C534 - Elastomeric Foam Insulation.
- D. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
- E. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- F. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.
- G. ASTM C1767 - Standard Specification for Stainless Steel Jacketing for Insulation.
- H. ASTM E84 - Surface Burning Characteristics of Building Materials.
- I. NFPA 255 - Surface Burning Characteristics of Building Materials.
- J. UL 723 - Surface Burning Characteristics of Building Materials.
- K. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

1.04 SUBMITTALS

- A. Submit shop drawings per Section 220500. Include product description, list of materials and thickness for each service, and locations.

PART 2 - PRODUCTS

2.01 INSULATION

- A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75F; non-combustible. All-purpose polymer or polypropylene service jacket, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

- B. Type B: Flexible elastomeric foam insulation; closed-cell, sponge or expanded rubber (polyethylene type is not permitted); ANSI/ASTM C534 Grade 1 Type I for tubular materials; flexible plastic; 0.25 maximum 'K' value at 75F, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Maximum 1" thick per layer where multiple layers are specified.

2.02 VAPOR BARRIER JACKETS

- A. All-purpose polymer or polypropylene service jacket vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.02 INSTALLATION

- A. General Installation Requirements:
 - 1. Install materials per manufacturer's instructions, building codes and industry standards.
 - 2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
- B. Insulated Piping Operating Below 60F:
 - 1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
 - 2. On piping operating below 60F in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.
 - 3. All balance valves with fluid operating below 60F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.
- C. Insulated Piping Operating Between 60F and 140F:
 - 1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.
- D. Exposed Piping:
 - 1. Locate and cover seams in least visible locations.
 - 2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
 - 3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping shall be insulated unless local code allows it to be uninsulated. In no instance should the uninsulated portion of the piping be more than 4ft in developed length.

3.03 SUPPORT PROTECTION

- A. Insulation with pipe size greater than 1-1/2" (38mm) shall be protected from sagging and crushing by one of the following means.
 - 1. High Compressive Strength Insert: On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:

- a. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180-degree cylindrical segment the same length as metal shields. Inserts shall be:
 - b. Provide metal shields between hangers or supports and the pipe insulation/insert. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.
 - 1) Shields shall be at least the following lengths and gauges:

Pipe Size	Shield Size
1/2" to 3-1/2"	12" long x 18 gauge
4"	12" long x 16 gauge
 - c. Where rolled steel plate is noted above, provide minimum 1/4" (6mm) rolled galvanized steel plates in addition to the shield as reinforcement on large pipes as noted above to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive strength.
2. Premanufactured Insulation Insert/Shield: As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.
 - a. Products:
 - 1) Buckaroo CoolDry
 - 2) Cooper/B-Line Fig. B3380 through B3384
 - 3) Pipe Shields A1000, A2000
 3. Premanufactured Insulation Couplings:
 - a. Molded thermoplastic slip coupling, -65F to 275F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
 - b. PET thermoplastic foam load bearing core with elastomeric foam ends and lap-seal jacket.
 - c. Horizontal Strut Mounted Insulated Pipe Manufacturers:
 - 1) Klo-Shure or equal
 - 2) Armafix Ecolight
 - d. Vertical:
 - 1) Manufacturers: Klo-Shure Titan or equal
 4. Premanufactured shield/saddle for use with Elastomeric Foam (Type B): Molded thermoplastic rigid pipe saddle sized for insulation outside diameter. Length as required by manufacturer.
- B. Rectangular blocks, plugs, or wood material are not acceptable.
 - C. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.
 - D. Neatly finish insulation at supports, protrusions, and interruptions.

3.04 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60F, seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Install per manufacturer's instructions or ASTM C1710.
2. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Exterior installations shall contain factory applied polymeric, moisture, and UV resistant covering with ends sealed with adhesive and similar cover; or Contractor shall paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
3. Insulation Installation on Straight Pipes and Tubes:
 - a. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - b. Insulation must be installed in compression to allow for expansion and contraction. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.05 SCHEDULE

- #### **A. Refer to drawings for insulation schedule.**

END OF SECTION 220719

SECTION 221000
PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Check Valves.

1.02 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.03 REFERENCES

- A. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- B. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- D. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- E. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- F. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- G. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- H. ANSI/ASTM B32 - Solder Metal.
- I. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.
- J. ANSI/AWS D1.1 - Structural Welding Code.
- K. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.
- L. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- M. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- N. ASME - Boiler and Pressure Vessel Code.
- O. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.
- P. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- Q. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.
- R. ASTM B88 - Seamless Copper Water Tube.
- S. ASTM B306 - Copper Drainage Tube (DWV).
- T. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- U. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

- V. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- W. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- X. ASTM D2661 - ABS DWV Pipe & Fittings.
- Y. ASTM D2665 - PVC DWV Pipe & Fittings.
- Z. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
- AA. ASTM D3034 - Type PSM (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
- BB. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
- CC. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- DD. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- EE. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.
- FF. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- GG. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- HH. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
- II. ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.
- JJ. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
- KK. ASTM F2618 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems.
- LL. AWS A5.8 - Brazed Filler Metal.
- MM. AWWA C651 - Disinfecting Water Mains.
- NN. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- OO. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- PP. FM 1680 - Couplings Used in Hubless Cast Iron Systems.
- QQ. NSF - National Sanitation Foundation

1.04 SUBMITTALS

- A. Submit shop drawings per Section 220500.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.01 CAST IRON PIPE

- A. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets:
 - 1. Pipe: Standard weight no-hub cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 and CISPI Trademark.
 - 2. Design Pressure: Gravity Maximum Design Temperature: 180F.

3. Joints: ASTM C1540, FM 1680, and ASTM C-564.
 - a. Super Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.015" thick 304 stainless steel shield, stainless steel 3/8" screw type clamps, minimum of four clamps for 1-1/2" to 4" and six clamps for 5" and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds or as manufacturer requires. Husky SD-4000 or equal.
4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 310. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
5. Adapters: Transition from cast iron soil pipe to other pipe materials with manufactured adapters specifically for the application. Adapter must meet the same requirements as the joints listed above. ASTM C1460. Sticker identifying transition fitting application must be visible to view. For example, the most commonly used transition fitting from cast iron no-hub to PVC would be the Husky SD-4200 series.

2.02 COPPER PIPE

- A. Copper Pipe; Type L; Solder Joints:
 1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
 2. Design Pressure: 175 psi; Maximum Design Temperature: 200F.
 3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
 4. Fittings: Wrought copper solder joint, ANSI B16.22.
- B. Copper Pipe; Type L; Mechanical Press Connection:
 1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
 2. Design Pressure: 175 psi; Maximum Design Temperature: 200F.
 3. Joints: Mechanical press connection.
 4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring / sealing element engineered for this application, NSF-61.
 5. Fitting Identification: Press ends shall provide the ability to identify an unpressed fitting from the floor prior to testing. The function of this feature is to provide the installer quick and easy identification of connections that have not been pressed prior to putting the system into operation.
 6. Special Requirements: Mechanical press fitting manufacturer shall provide Contractor training prior to installation.
 7. Manufacturers:
 - a. Viega ProPress
 - b. Apollo Press, a division of Aalberts - IPS
 - c. NIBCO Press System Fittings and Valves
 - d. Merit Brass
 - e. Mueller Streamline PRS

2.03 PLASTIC PIPE

- A. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints:
 1. Pipe: Schedule 40 rigid, PVC-DWV, or ABS-DWV, cell classification 12454 for PVC per ASTM D1784 or 42222 for ABS per ASTM D3965, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
 2. Design Pressure/Temperature: Gravity at 140F.
 3. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.

4. Fittings: PVC-DWV, or ABS-DWV, cell classification 12454 for PVC per ASTM D1784 or 42222 for ABS per ASTM D3965, with solvent-weld socket type ends for Schedule 40 pipe.
 5. Limits: Schedule 40 PVC-DWV, or ABS-DWV pipe must not be threaded. Do not use where exposed to damage. Do not use in return air plenums. Do not use where not allowed by local jurisdiction. Comply with all local jurisdiction special requirements or limitations.
 6. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 220516 for expansion joint requirements.
- B. PVC Pressure Pipe; Schedule 40/SDR26; Push-On Joints - Pressure Pipe:
1. Pipe: PVC pipe, Schedule 40 and SDR 26 or less with bell and spigot ends, ASTM D1785 or ASTM D3034. Cellular core piping is not acceptable.
 2. Joints: Elastomeric gaskets, ASTM F477.
 3. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
 4. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.

2.04 VALVES

- A. Shutoff Valves:
1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
 2. Ball Valves:
 - a. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, threaded or solder ends (acceptable only if rated for soldering in line with 470F melting point of lead-free solder), stainless steel ball and trim, Teflon seats and seals.
 - 1) Body: Lead free NSF-372, two-piece bronze of a copper alloy containing less than 15% zinc. Apollo Valves; a division of Aalberts-IPS #77CLF140/240 Series, Milwaukee #UPBA450S, Watts #LFB6080G2-SS, NIBCO #T-585-66-LF, Jomar T-200CSSG.
 - 2) Body: Dezincification resistant brass alloy, lead free NSF-372. Jomar T-100CSSG.
 - 3) Provide solid extended shaft for all insulated piping. (For example, Apollo adds option -04 Stem Extension, NIBCO Nib-Seal Handle-NS, and Jomar modifies valve part number with -IH for insulated handle.)
 - 4) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120F, heating water piping over 120F. Solid extended shaft is not required on valves with lockout trim. (For example, Jomar and NIBCO modify valve part number with -LH for locking handle.)

2.05 CHECK VALVES

- A. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

- B. CK-1: Threaded Ends, 2" and under, 125 psi steam at 406F, 200 psi CWP at 150F, threaded connection, lead free bronze body with brass or bronze disc, horizontal swing. Hammond #UP904, Milwaukee #UP509, NIBCO T-413-Y-LF, Jomar T-511G, Apollo Valves, a division of Aalberts-IPS #161T-LF.

2.06 CONNECTIONS BETWEEN DISSIMILAR METALS

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron and steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed and/or Grooved Joints (acceptable up to 4" size):
 - 1. Dielectric waterway rated for 300 psi CWP and 225F.
 - 2. Optional: Copper-silicon casting conforming to UNS C87850 with grooved and/or threaded ends.
 - 3. UL classified in accordance with ANSI / NSF-61 for potable water service.
 - 4. Manufacturers:
 - a. Elster Group ClearFlow fittings
 - b. Victaulic Series 647
 - c. Grinnell Series 407
 - d. Matco-Norca

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- E. Connect to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.
- F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.

G. Roof Penetration (Vent) Flashing:

1. Membrane, Metal or Shingled Roofs: Flash vents with premolded pipe flashing cones for single-ply membrane roofs, metal roofs, or shingled roofs.

3.02 SYSTEM, PIPING AND VALVE SCHEDULE

A. The schedule below lists acceptable pipe and valve materials for each plumbing system type. Refer to the paragraph of the same name above in Part 2 for material specifications and limits for usage. This schedule is kept brief to simplify the information but shall not be interpreted to contradict limitations in Part 2. For example, if PVC/ABS is listed for sanitary waste and vent above ground in this schedule, that does not mean it is universally allowed for the entire project. Rather the material is still limited by Part 2 and is not allowed in return air plenum spaces.

B. Cold Water, Hot Water, - Potable (Above Ground):

1. Copper Pipe; Type L; Solder Joints: All Sizes
2. Copper Pipe; Type L; Mechanical Press Connection: 4" and Under
3. Shutoff Valves: BA-1
4. Check Valves: CK-1

C. Sanitary Waste and Vent, Gravity (Above Ground):

1. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15" PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes

D. Sanitary Waste and Vent, Gravity (Underground - Inside Building):

1. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
2. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes

E. Sanitary Waste and Vent, Gravity (Underground - Outside Building):

1. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
2. PVC Pressure Pipe; Schedule 40/SDR26; Push-On Joints - Pressure Pipe: All sizes

F. ||Condensate/Equipment Drainage:

1. Copper Pipe: Type M; Solder Joints: 1-1/4" to 4"

3.03 TESTING PIPING

A. Sanitary Drainage, Sanitary Vent:

1. Test all piping with water to prove tight.
2. Test piping before insulation is applied.
3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.

- B. Hot Water - Potable and Non-Potable, Cold Water - Potable:
 - 1. Test pipes underground or in chases and walls before piping is concealed.
 - 2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
 - 3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
 - 4. Hold test pressure for at least 2 hours.
 - 5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.
- C. All Other Piping:
 - 1. Test piping at 150% of normal operating pressure.
 - 2. Piping shall hold this pressure for one hour with no drop in pressure.
 - 3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
 - 4. Drain and clean all piping after testing is complete.

3.04 CLEANING PIPING

- A. Assembly:
 - 1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
 - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
 - 3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
 - 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.
- B. All Water Piping:
 - 1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
 - 2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
 - 3. If necessary, remove valves to clean out all foreign material.

3.05 INSTALLATION

- A. General Installation Requirements:
 - 1. Provide dielectric connections between dissimilar metals.
 - 2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
 - 3. Group piping whenever practical at common elevations.
 - 4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
 - 5. Slope water piping and arrange to drain at low points.
 - 6. Install bell and spigot piping with bells upstream.

7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
 8. Seal pipes passing through exterior walls with a wall seal per Section 220529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
 9. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.
- B. Installation Requirements in Electrical Rooms:
1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- C. Valves/Fittings and Accessories:
1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
 2. Provide clearance for installation of insulation and access to valves and fittings.
 3. Provide access doors for concealed valves and fittings.
 4. Install valve stems upright or horizontal, not inverted.
 5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.
 6. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
- D. Underground Piping:
1. Install buried water piping outside the building with at least 5 feet of cover.
 2. Install thrust blocking and restraints on all underground fire protection service piping per NFPA 24 and as shown on drawings.
 3. Install underground, sleeved, corrugated, stainless steel tubing system according to manufacturer's written instructions. Extend vent from sleeve to exterior of building and terminate with screened elbow.
 4. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
 - a. Manufacturers:
 - 1) Republic Steel Corp. "X-Tru-Coat"
 5. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
 6. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
 7. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.

8. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

E. Sanitary Piping:

1. Install all sanitary piping inside the building with a slope as shown on the drawings.
2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
3. Slope sanitary piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
4. All sanitary piping shall have at least 42" of cover when leaving the building.
5. Starter fittings with internal baffles are not permitted.

3.06 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Section 220500 for Excavation, Fill, Backfill and Compaction requirements.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45-degree or 90-degree angle from the horizontal plane for air lines, and from top, bottom or side for liquids.

3.07 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- G. All vent and drain piping shall be of same materials and construction for the service involved.

3.08 PLUMBING VENTS

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at the roof with 3# lead sheet. Extend flashing under roofing 15" in all directions from pipe to be flashed. Extend a lead collar up on the outside of pipe to be flashed and extend 1" beyond the top of the pipe. The 1" excess length of collar shall be turned down into the top of the pipe where it shall fit tight to the inside of the pipe.
- D. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- E. In no case shall the vent through the roof be less than 4" in diameter.
- F. Vent pipes through the roof shall be located a minimum of 10 feet from any air intake opening on the roof.

3.09 BRANCH CONNECTIONS

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:
 - 1. Domestic water piping above ground.
- E. Further limit use of mechanically formed fittings as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be Type K or L copper tubing.
 - 3. Permanent marking shall indicate insertion depth and orientation.
 - 4. Branch pipe shall conform to the inner curve of the piping main.

5. Main must be 1" or larger.
 6. Branch must be 3/4" or larger.
- F. Forged weld-on fittings are limited as follows:
1. Must have at least same pressure rating as the main.
 2. Main must be 2-1/2" or larger.
 3. Branch line is at least two pipe sizes under main size.

3.10 JOINING OF PIPE

- A. Solder Joints (Copper Pipe):
1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
 2. Flux shall be non-acid type.
 3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470F melting point solder. Remove discs and seals during soldering if they are not suitable for 470F.
- B. Mechanical Press Connection (Copper Pipe):
1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
 2. Fully insert tubing into the fitting and mark tubing.
 3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
 4. Joint shall be pressed with a tool approved by the manufacturer.
 5. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.
- C. Push-On Joints - Pressure Pipe (Ductile Iron, PVC Pressure):
1. Joints shall be single gasket type conforming to ANSI A21.11 "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings". The bell shall have cast or machined gasket socket recesses, a tapered annular opening and flared socket design to provide deflections up to 5 degrees. Plain spigot ends shall be suitably beveled for easy entry into bell, centering in gasket and compression of gasket.
 2. The joint shall be liquid tight under all pressures from vacuum to 350 psig.
 3. Furnish sufficient lubricant for a thin coat on each spigot end. Lubricant shall be non-toxic, impart no taste or odor to conveyed liquid, and have no deleterious effect on the rubber gasket. Lubricant shall be of such consistency that it can be easily applied to the pipe in hot and cold weather and shall adhere to either wet or dry pipe.
 4. Assemble per manufacturer's installation instructions.
- D. Couplings: Assemblies with combinations of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

- E. Adapters and Transition Fittings: Assemblies with combinations of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.
- F. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.
- B. Provide necessary connections at the start of individual sections of mains for adding chlorine.
- C. Before starting work, verify system is complete, flushed and clean.
- D. Follow the disinfection of potable water procedure outlined in this project's applicable plumbing code. For example: IPC 610.1, UPC 609.10, CPC 609.10, and Illinois 890.1180. Where local codes do not outline a disinfection procedure, follow the International Plumbing Code procedure 610.1.
- E. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.
- F. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

END OF SECTION 221000

SECTION 221023
PROPANE PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Propane Piping System.

1.02 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.

1.03 REFERENCES

- A. ANSI/AWS D1.1 - Structural Welding Code.
- B. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- C. ASME - Boiler and Pressure Vessel Code - Section 9.
- D. ASME B1.20.1 - Pipe Threads, General Purpose.
- E. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
- F. ASME B16.5 - Pipe Flanges and Flanged Fittings.
- G. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- H. ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- I. ASME B16.21 - Nonmetallic Flat Gaskets for Pipes Flanges.
- J. ASME B16.39 - Malleable Iron Threaded Pipe Unions.
- K. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
- L. ASME B18.2.2 - Square and Hex Nuts, Inch Series.
- M. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- N. ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.
- O. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.
- P. ASTM A197 - Standard Specification for Cupola Malleable Iron.
- Q. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- R. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- S. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- T. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
- U. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe.
- V. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

- W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- X. NFPA 54 - National Fuel Gas Code.

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 22 05 00. Include data on pipe materials, fittings, valves, and accessories.
- B. Test Reports: Provide results of piping system pressure test.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.01 PROPANE (0 to 125 PSI)

- A. Design Pressure: 125 psi. Maximum Design Temperature: 350F.
- B. Piping - 2" and Under:
 - 1. Pipe: Standard weight black steel, threaded and coupled, ASTM A53.
 - 2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)
 - 3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.
 - 4. Unions: 250# - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.
- C. For Underground Gas Piping - Refer to paragraph "Underground Piping Protection."
- D. Shutoff Valves/Throttling Valves:
 - 1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
 - 2. BA-13: 2" and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing.
 - a. Body: Bronze.
 - 1) Manufacturers:
 - a) Apollo #80-100
 - b) Nibco #T580-70-UL or #T585-70-UL
 - b. Body: Dezincification resistant brass alloy. Jomar T-100NE.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- D. Connect to all equipment with flanges or unions.
- E. After completion, fill, clean, and treat systems. Refer to Section 232500 for treatment.

3.02 TESTING PIPING

- A. Low Pressure - Up to 1 psi:
 - 1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.
- B. High Pressure - Above 1 psi:
 - 1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.
- C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

3.03 CLEANING PIPING

- A. Assembly:
 - 1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
 - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.
 - 3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
 - 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

3.04 INSTALLATION

- A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
- B. Install piping to conserve building space, and not interfere with other work.
- C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Install thrust blocking and restraints on all buried piping at elbows and other changes in pipe direction.
- G. Provide chain operators for all valves over 2" size that are over 10'-0" above finished floor. Extend to 7'-0" above finished floor.
- H. Provide valve position indicator on all valves 10'-0" or greater above finish floor and not located above ceiling.
- I. Provide clearance for access to valves and fittings.
- J. Provide access doors where valves are not exposed.
- K. Prepare pipe, fittings, supports, and accessories for finish painting.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.

- N. Provide shutoff valves to isolate part of systems and vertical risers.
- O. Provide shutoff valves to boilers and water heaters in readily accessible location, maximum 6 feet above finished floor, within 6 feet of boiler connection per ASME CSD-1.
- P. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
- Q. Reducers are generally not shown. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.
- R. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.
- S. Seal pipes passing through exterior walls with a wall seal per Section 230529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
- T. Refer to Section 230500 for Excavation, Fill, Backfill and Compaction requirements.
- U. Underground Piping Protection:
 - 1. Direct buried, uninsulated steel pipe shall have a factory applied external protective coating consisting of two coats with an intermediate layer of 18 mil fibrous glass mat. Coating thickness shall total not less than 3/32". The outer coating shall be further protected by a wrapping of heavy Kraft paper. This external protection shall extend and be exposed for a minimum of 1 foot beyond the buried or concealed portion of the pipe.
 - 2. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
 - 3. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
 - 4. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
 - 5. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
 - 6. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.
- V. All vertical pipe drops to equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.
- W. Install underground plastic pipe with an electrically continuous corrosion-resistant tracer wire (minimum AWG 14) or tape per section 22 05 53 and 23 05 53 to facilitate locating. One end of the tracer wire or tape shall be brought aboveground at a building wall or riser.
- X. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
- Y. Install underground, sleeved, corrugated, stainless steel tubing system according to manufacturer's written instructions. Extend vent from sleeve to exterior of building and terminate with screened elbow.

3.05 BONDING AND GROUNDING

- A. Each above ground portion of a corrugated stainless steel tubing gas piping systems shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream corrugated stainless steel tube fitting. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent. Gas piping systems that contain one or more segments of corrugated stainless steel tubing shall be bonded in accordance with this section.
- B. Each above ground portion of a gas piping system, other than corrugated stainless steel tubing systems, that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas piping, other than corrugated stainless steel tubing, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.
- C. Gas piping shall not be used as a grounding conductor or electrode.
- D. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.

3.06 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.
- B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.
- F. Use full and double lengths of pipe wherever possible.
- G. Cut all pipe to exact measurement and install without springing or forcing.
- H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.
- I. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Provide and operate sufficient pumping equipment to maintain excavations, trenches and pits free of water. Dispose of pumped water so operation areas and other facilities are not flooded. Pipe laying shall follow excavating as closely as possible.

3.07 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.
- B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.

- C. Provide drip legs at low points and at the base of all risers in gas pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

3.08 BRANCH CONNECTIONS

- A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.
- B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- C. Use of forged weld-on fittings is also limited as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Header or main must be 2-1/2" or over.
 - 3. Branch line is at least two pipe sizes under header or main size.
- D. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- E. All branch piping connections for natural gas shall take off on the top or on the side of the main.

3.09 JOINING OF PIPE

- A. Threaded Joints:
 - 1. Ream pipe ends and remove all burrs and chips.
 - 2. Protect plated pipe and valve bodies from wrench marks when making up joints.
 - 3. Apply gas-rated Teflon tape or thread compound to male threads.

3.10 PAINTING EXPOSED PIPE

- A. Paint all outdoor exposed propane piping the color selected by Owner or Architect/Engineer.

END OF SECTION 221023

SECTION 221030
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cleanouts.
- B. Traps.
- C. Trap Seals and Primers.
- D. Floor Drains and Sinks
- E. Backflow Preventers.
- F. Balancing Valves.
- G. Dielectric Fittings (Connections Between Dissimilar Metals).
- H. Air Vents.

1.02 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.
- B. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.03 REFERENCES

- A. ANSI A112.21.1 - Floor Drains.
- B. ASSE 1010 - Water Hammer Arresters.
- C. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.
- D. ANSI 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering.
- E. PDI WH-201 - Water Hammer Arresters.

PART 2 - PRODUCTS

2.01 CLEANOUTS

- A. Provide cleanouts as shown and specified on the drawings as well as required by code.
- B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.
- C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.
- D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

2.02 YARD CLEANOUTS

- A. Provide yard cleanouts as shown and specified on the drawings as well as required by code.
- B. Cleanout shall be same size as pipe up to 6" and 6" for larger pipes.

2.03 TRAPS

- A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be of the same material as specified for waste system.
- B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.

- C. Deep seal pattern traps shall be provided where required by code.
- D. Each trap shall be completely filled with water at the end of construction but before building turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water.

2.04 TRAP SEALS

- A. Provide trap seals as specified on the drawings.

2.05 FLOOR DRAINS

- A. Floor drains shall be in the form of a receptor with grate/strainer set flush with the surrounding floor.
- B. Provide floor drains as shown and specified on the drawings as well as required by code.

2.06 AUTO-THERMOSTATIC ADJUSTABLE BALANCING VALVE

- A. Adjustable thermostatic balancing valve for domestic hot water recirculation circuits. Dry well with temperature gauge and probe. Internal thermostatic balancing cartridge automatically modulates flow to ensure constant temperature. Adjustable from 111F to 140F. Set temperature to 5F below system temperature.
- B. Sizes: 1/2" and 3/4" with NPT female connections. Flow rating: 2.1 Cv maximum, 0.23 Cv minimum, 0.52 Cv design. Suitable fluid: Water.
- C. Maximum working pressure: 230 psi. Maximum differential pressure: 15 psi. Maximum inlet temperature: 195F.
- D. Low-lead brass valve, stainless steel and copper adjustable thermostatic cartridge, EPDM hydraulic seals, stainless steel springs, adjustment knob with temperature adjustment scale, and tamperproof adjustment locking screw with probe dry-well port with shutoff valve and check valve with temperature gauge. If manufactured unit does not contain integral gauge, Contractor shall install external gauge immediately upstream of unit.
- E. Acceptable Manufacturers:
 - 1. Caleffi Thermosetter 116
 - 2. Kemper Multi-Therm 154-02
 - 3. Acorn TZV-1
 - 4. B&G Temp Setter

2.07 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron, steel, and stainless steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.

- E. Screwed Joints (acceptable up to 2" size):
 - 1. Dielectric waterway rated for 300 psi CWP and 225F.
 - 2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 47, Grinnell Series 407, Matco-Norca.

2.08 AIR VENTS

- A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.
- B. At end of main and other points where large volume of air may be trapped - Use 1/4" globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4" discharge pipe turned down with cap.

PART 3 - EXECUTION

3.01 INSTALLATION AND APPLICATION

- A. Coordinate construction to receive drains at required invert elevations.
- B. Install all items per manufacturer's instructions.
- C. Cleanouts:
 - 1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet in pipe less than 6" size and 100 feet apart in 6" and larger pipes inside the building. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.
 - 2. Provide a cleanout at the upstream end of a horizontal waste pipe in a plumbing chase serving multiple plumbing fixtures; for example a bank of water closets or lavatories.
 - 3. Provide cleanouts on the branch line connected to individual plumbing fixtures as required by code; for example just below a sink, lavatory or urinal.
 - 4. Extend underfloor cleanouts up to the floor with long sweep elbows.
 - 5. Install a full size, two-way cleanout within 5 feet of the foundation inside or outside of building.
 - 6. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
 - 7. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.
- D. Yard Cleanouts:
 - 1. Install cleanouts on maximum 90 foot centers (including riser) for pipes 8" and smaller.
 - 2. Extend cleanout to grade. Encase cleanout in 5" thick concrete pad extending 6" beyond cleanout, set low enough not to interfere with lawn mowers.
- E. Floor Drains:
 - 1. Coordinate sloping requirements with the architectural plans and specifications.
 - 2. Top of floor drain and sink grate/strainer shall not extend above the finished floor elevation. Grate/strainer shall be installed flush with surrounding finished floor. Should the Plumbing Contractor believe this presents a conflict with code, the issue should be evaluated before installation of the floor drain begins. Proceeding with installing a floor drain raised above the finished floor without prior approval will result in the Contractor being required to remove the drain or sink in question and reinstall it at the approved elevation.

F. Balancing Valves:

1. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer's installation instructions.

END OF SECTION 221030

SECTION 223000
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Water Heaters.

1.02 QUALITY ASSURANCE

- A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:
 - 1. American Gas Association (AGA).
 - 2. National Sanitation Foundation (NSF).
 - 3. American Society of Mechanical Engineers (ASME).
 - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - 5. National Electrical Manufacturers' Association (NEMA).
 - 6. Underwriters' Laboratories (UL).
- B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.
- C. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

1.03 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASME Section 8D - Pressure Vessels.
- C. ANSI Section 21.10.1 or Section ANSI 21.10.3 - Gas Water Heaters Ratings 75,000 BTU per Hour and Less.
- D. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.
- E. ANSI/NFPA 54 - National Fuel Gas Code.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. ASSE 1005 - Water Heater Drain Valves, 3/4" Iron Pipe Size.

1.04 SUBMITTALS

- A. Submit shop drawings under provisions of Section 220500.
- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Include heat exchanger dimensions, size of tappings, and performance data.
- D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- E. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.
- F. Submit manufacturer's installation instructions including control and electrical power/controls wiring diagrams.
- G. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.

- H. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- I. Submit a current water analysis from the actual water source serving the project site for softening equipment verification before sending shop drawings to the Architect/Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 REGULATORY REQUIREMENTS

- A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.
- B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.
- C. Conform to ANSI/ASME Section 10 for manufacture of fiber-reinforced plastic pressure vessels.

PART 2 - PRODUCTS

2.01 WATER HEATERS

- A. All water heaters shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all items in accordance with manufacturer's instructions.

3.02 WATER HEATER INSTALLATION

- A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 220529.
- B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.
- D. Install gas water heaters according to NFPA 54.

END OF SECTION 223000

SECTION 224000
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. All plumbing fixtures.

1.02 REFERENCES

- A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
- D. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.
- E. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- F. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
- G. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- H. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- I. ASSE 1002 - Water Closet Flush Tank Ball Cocks.
- J. Americans with Disabilities Act (ADA), Title III.
- K. The Energy Policy Act (EPA) of 2005.

1.03 SUBMITTALS

- A. Submit product data under provisions of Section 220500. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
- B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All fixtures shall be as shown on the drawings and as scheduled in the plumbing material list. Additional requirements below:
- B. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.
- C. P-Traps and Tailpieces:
 - 1. Lavatories:
 - a. Accessible Type: 1-1/4" chrome plated 17-gauge cast brass offset tailpiece and p-trap with cleanout on bottom of trap.
 - b. Non-Accessible Type: Offset not required for tailpiece, otherwise same.
 - 2. Sinks:
 - a. Accessible Type: 1-1/2" chrome plated 17-gauge cast brass offset tailpiece and p-trap with cleanout on bottom of trap.
 - b. Non-Accessible Type: Offset not required for tailpiece, otherwise same.

3. Acceptable Manufacturers:
 - a. McGuire
 - b. Keeney
 - c. Dearborn Brass
 - d. Zurn
 - e. Chicago Faucet
- D. Insulation Covers and Enclosures for Accessible Lavatories and Sinks:
 1. Premanufactured cover for P-trap, stop valves, and supply lines.
 - a. 1/8" thick vinyl construction, paintable, tool free installation,
 - b. Acceptable Manufacturers:
 - 1) Truebro (Lav Guard 2)
 - 2) Plumberex (Pro-Extreme)
 - 3) McGuire (Prowrap)
 - 4) Buckaroos Inc.
 - 5) Zurn
 2. Premanufactured rigid enclosure for concealing lavatory P-trap, stop valves, and supply lines,
 - a. Rigid, high impact PVC, paintable, stainless steel fasteners for anchoring and removal.
 - b. Acceptable Manufacturers:
 - 1) Truebro (Lav Shield #2018)
 - 2) Zurn (Z6900-VG)
 - 3) Approved equal
 3. Premanufactured rigid enclosure for concealing sink P-trap, stop valves, supply lines, garbage disposal, etc.
 - a. Rigid, high impact PVC, white or beige (Color by architect), paintable, 36" or 42" widths, stainless steel fasteners for anchoring and removal.
 - b. Acceptable Manufacturers:
 - 1) Truebro (Basin Guard)
 - 2) Approved equal
- E. Angle Stops and Supplies:
 1. Lavatories, Sinks and Tank Type Water Closets:
 - a. Lead-free, 3/8" chrome plated brass, quarter turn ball valve type with loose key stops, solder or compression or threaded connection type.
 - b. Lead-free, 3/8" chrome plated soft copper risers or stainless steel braided reinforced PVC hose.
 - c. Acceptable Manufacturers:
 - 1) McGuire
 - 2) BrassCraft
 - 3) Keeney
 - 4) Zurn
 - 5) Chicago Faucet

F. Wall Hung Fixture Carriers:

1. Material: All Metal, ASME/ANSI A112.6.1M.
2. Lavatory carrier shall be rated to support 250 lbs. unless noted otherwise on the drawings.
3. Water closet carrier shall be rated to support 500 lbs. unless noted otherwise on the drawings
4. Manufacturers:
 - a. Zurn
 - b. JR Smith
 - c. Wade
 - d. Josam
 - e. Watts
 - f. Mifab
 - g. Sun Drainage Products
 - h. Sioux Chief

PART 3 - EXECUTION

3.01 INSTALLATION

A. General Installation Requirements:

1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
3. Provide fixtures with supply lines, stop valves, reducers, escutcheons, and any other items required for a complete and operational plumbing fixture assembly.
4. Install components level and plumb.
5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.
6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.
7. Refer to Plumbing Material List for fixture mounting heights.
8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

B. Wall-Mounted Fixture Requirements:

1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab as intended by the carrier manufacturer.

C. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

- D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:
 - 1. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.
 - 2. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
 - 3. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.
- E. ADA Accessible Exposed Sink and Lavatory Trim:
 - 1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.
- F. ADA Accessible Water Closet Requirements:
 - 1. Handicapped accessible water closet flush valve or flush tank handles shall be on the left hand or right hand side of the fixture, whichever is nearer to the center of the stall.
 - 2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.
- G. Bathtubs and Shower Requirements:
 - 1. All acrylic and fiberglass bathtubs and showers shall have a non-shrink grout or manufacturer-approved material installed between the finished floor and floor of the fixture to prevent damage caused by deflection.
 - 2. All rough-in pockets for showers and tubs located in basement floor installations shall be filled in with concrete and sealed tight.

3.02 ADJUSTING AND CLEANING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

3.03 FIXTURE ROUGH-IN SCHEDULE

- A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

END OF SECTION 224000

SECTION 230500
BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work: Refer to Section 220500 "Basic Plumbing Requirements".
 - 2. Heating Work shall include, but is not necessarily limited to:
 - a. Furnish and install complete heating water system including pumps, piping, insulation, air control equipment, terminal heating equipment, and specialties. Make final connections to all coils, including those furnished by others.
 - b. Furnish and install complete gas piping system including all meter requirements.
 - c. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
 - d. Complete all applicable tests, certifications, forms, and matrices.
 - 3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - c. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - d. Furnish and install combustion air louver, damper, and ductwork.
 - e. Furnish and install complete fume hood exhaust systems including fans, ductwork, and fittings.
 - f. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
 - g. Furnish and install mechanical room ventilation systems including louvers, ductwork, insulation, and fans.

4. Temperature Control Work shall include, but is not necessarily limited to:
 - a. Furnish and install a complete temperature control system as specified in Section 230900.
 - b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
 - c. Furnish automatic control valves and dampers for installation by others.
5. Fire Protection Work: Refer to Section 210500 "Basic Fire Suppression Requirements".
6. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
 - a. Furnish complete testing, adjusting, and balancing as specified in Section 230593, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.
 - b. Complete all applicable tests, certifications, forms, and matrices

1.03 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Fire Protection Contractor.
 - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Furnaces
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Subcontractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.04 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Long Grove, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.

5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
 6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for service connections, such as gas.
 4. Make application for and pay for all meters and metering systems required by the utility company.
- F. Examination of Drawings:
1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
 3. Scaling of the drawings is not sufficient or accurate for determining these locations.
 4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
 5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
 6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
 7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.

8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.05 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.06 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
23 05 29	Hangers and Supports
23 05 93	Testing, Adjusting, and Balancing
23 07 13	Duct Insulation
23 23 00	Refrigeration Piping and Specialties
23 31 00	Ductwork
23 34 23	Power Ventilators
23 37 00	Grilles, Registers, and Diffusers
23 37 00	Louvers
23 54 00	Furnaces

- B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

- Date
- Project title and number
- Contractor's name and address
- Division of work (e.g., plumbing, heating, ventilating, etc.)
- Description of items submitted and relevant specification number
- Notations of deviations from the contract documents
- Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- Date
- Project title and number
- Architect/Engineer
- Contractor and subcontractors' names and addresses
- Supplier and manufacturer's names and addresses
- Division of work (e.g., plumbing, heating, ventilating, etc.)
- Description of item submitted (using project nomenclature) and relevant specification number
- Notations of deviations from the contract documents
- Other pertinent data
- Provide space for Contractor's review stamps

3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 9. Reproduction of contract documents alone is not acceptable for submittals.
 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 11. Submittals not required by the contract documents may be returned without review.
 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions, or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
 15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
 16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.
- C. Electronic Submittal Procedures:
1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 23 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 23 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.07 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 01.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
 3. Itemize the cost for each of the following:
 - a. Overhead and profit.
 - b. Bonds.
 - c. Insurance.
 - d. General Requirements: Itemize all requirements.
 4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
 - a. Each piece of equipment requiring shop drawings (e.g., each air handling unit, pump, exhaust fan, etc.). Use the equipment nomenclature (AHU-1, P-1, EF-1, etc.) on the Schedule of Values.
 - b. Each type of small unitary equipment (e.g., FCUs, UHs, CABs, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.
 - c. Each piping system (chilled water, heating water, steam, condensate, etc.). In addition, for larger projects, break down the material and labor for each piping system based on geography (building, floor, and/or wing).
 - d. Each duct system (supply, return, relief, outside air, etc.) listed separately for each unit they serve (AHU-1 supply air ductwork, AHU-1 return air ductwork, etc.).
 - e. Pipe insulation with separate material and labor line items for each piping system listed above.
 - f. Duct insulation with separate material and labor line items for each duct system listed above.
 - g. Temperature controls broken down into material and labor for the following:
 - 1) Engineering
 - 2) Controllers, devices, sensors, etc.
 - 3) Control valves
 - 4) Control dampers

- 5) Conduit
 - 6) Wiring
 - 7) Programming
 - 8) Commissioning
 - h. Site utilities (5' beyond building)
 - i. Seismic design
 - j. Air balancing
 - k. Water balancing
 - l. Commissioning
 - m. Record drawings
 - n. Punchlist and closeout
- D. Update Schedule of Values when:
- 1. Indicated by Architect/Engineer.
 - 2. Change of subcontractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.08 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.09 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 - 1. Air Cooled Condensers
 - 2. Base Mounted Pumps
 - 3. Boilers, Burners and Boiler Trim
 - 4. Computer Room Units
 - 5. Condensing Units
 - 6. Cooling Towers
 - 7. Gas Fired Makeup Air Units
 - 8. Fire Seal Systems
 - 9. Fluid Coolers
 - 10. Seismic Restraints and Equipment Bracing
 - 11. Vibration Isolation
 - 12. Water Chillers
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 - 1. Motor windings and ventilation openings.
 - 2. Bearings.
 - 3. Equipment Pipe and Accessories connections openings. (e.g. boiler connections, coil connections, etc.)
 - 4. Equipment Duct and Accessories connections openings. (e.g. AHU/RTU duct connections; Terminal Air Boxes, etc.)
 - 5. Starter and control cabinets.
 - 6. Heat transfer coils.
 - 7. Pump Seals.
 - 8. Combustion burner and blower equipment (e.g. combustion air intake, combustion vent/flue, etc.)
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, they shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date

when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.13 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.15 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 23 08 00 and provide all services as described in the Commissioning Plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (<https://call811.com/>) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone or flowable fill to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.

4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:
 - a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 - b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 - c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.
6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.

- b. Pipe and duct wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 - d. Main, branch and flexible ducts are installed.
 - e. Diffusers, registers and grilles are installed and connected to ductwork.
 - f. Terminal air box reheat coil piping or wiring is complete.
 - g. Terminal air box control wiring is complete and all control boxes are closed.
2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.04 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 01.
- B. Final Jobsite Observation:
 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up or reproducible drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 4. Inspection by State Boiler Inspector.
 5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; receipt by Architect/Engineer required prior to final payment approval.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. General:
 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.

2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div23.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD
 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
 6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
 7. All text shall be searchable.
 8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.
- C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
 4. Refer to Section 230900 for additional requirements for Temperature Control submittals.
 5. Copy of final approved test and balance reports.
 6. Copies of all factory inspections and/or equipment startup reports.
 7. Copies of warranties.
 8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
 9. Dimensional drawings of equipment.
 10. Capacities and utility consumption of equipment.
 11. Detailed parts lists with lists of suppliers.

12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Explanation of all air handling systems.
 3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
 4. Maintenance of equipment.
 5. Smoke control systems.
 6. Stairwell pressurization systems.
 7. Start-up procedures for all major equipment.
 8. Explanation of seasonal system changes.
 9. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 1. Heat Pump System - 4 hours.
 2. Exhaust System(s) - 2 hours.
 3. Temperature Controls - As defined in Section 230900.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 SYSTEM STARTING AND ADJUSTING

- A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.
- D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.08 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 01 requirements.
- B. Maintain at the job site a separate and complete set of mechanical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- D. Refer to Section 230900 for additional requirements for Temperature Control documents.
- E. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- F. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- G. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- H. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.09 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.11 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 - 1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - d. Protect stored on-site and installed absorptive materials from moisture damage.
 - 2. Request that the Owner designate an IAQ representative.
 - 3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 - 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
 - 5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
 - 6. Request copies of and follow all of the Owner's IAQ and infection control policies.
 - 7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
 - 8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
 - 9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".
 - 10. If permanently installed air handlers are used to serve both construction and occupied areas, all return grilles throughout construction areas shall be sealed to prevent air from construction areas being supplied to occupied areas.

11. If permanently installed air handlers are used during construction to serve only construction areas and do not supply air to adjacent occupied areas, MERV 8 filtration media shall be used to protect each return air grille or opening. The intent of this will be to prevent construction dust and debris from entering any return or supply air ductwork in the facility. All filtration media shall be replaced immediately prior to occupancy.
12. Construction areas shall be maintained at a negative pressure at all times during construction. When areas are under construction, HEPA filtered exhaust fan(s) shall be installed in sufficient quantities as required to maintain construction areas at sufficient negative pressure as called for in the Owner's Infection Control Risk Assessment (ICRA). HEPA filtered exhaust fan discharge shall be ducted either outdoors or back into designated hospital areas as called for in the Owner's ICRA.
13. For each area under construction, the Contractor shall install a negative pressure indicator equivalent to Lamiflow Model L-102F as manufactured by Lamiflow Technologies. Contractor shall regularly monitor and record the negative pressure condition of the construction areas as called for in the Owner's ICRA.

3.12 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION

- A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, terminal air boxes, fan coil units, cabinet heaters, blower coils, and the like.
- B. When air terminal devices are installed, contractors shall seal all supply, return, and exhaust grilles with polyethylene film or other airtight protective to keep dust, dirt, and construction debris out of ducts.
- C. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.
- D. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.
- E. The following steps shall be taken during testing, adjusting, and balancing of each air system:
 1. All construction activities in all spaces served by the air system shall stop.
 2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.
 3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.
 4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.
- F. The Owner shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

3.13 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All pumps, boilers and chillers operating and balanced.
5. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
6. All temperature control systems operating, programmed and calibrated.
7. Pipe insulation complete, pipes labeled and valves tagged.
8. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 230500

SECTION 230529
HVAC SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Flashing and Sealing of Equipment and Pipe Stacks.

1.02 REFERENCES

- A. ANSI/ASME B31.1 - Power Piping.
- B. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- C. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
- D. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- E. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 230500. Include plastic pipe manufacturers' support spacing requirements.

1.04 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.01 FOUNDATIONS, BASES, AND SUPPORTS

- A. Basic Requirements:
 - 1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
 - 2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.
- B. Concrete Bases (Housekeeping Pads):
 - 1. Refer to Section 230550 for additional requirements for concrete bases in seismic applications.
 - 2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 6 inches on all sides of the equipment (6 inches larger than factory base), except where pad extension would interfere with working space at equipment control panels and electrical panels.
 - 3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
 - 4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days (be 20 MPa strength).

5. New Bases in Existing Buildings: For proper bonding of new equipment bases to existing concrete floors: Existing concrete shall be thoroughly cleaned, scarified, and a bonding agent applied, in accordance with manufacturer's instructions, prior to placing new concrete. Bonding agent shall be "Weld-Crete" as manufactured by the Larsen Products Corporation or "Nitobind Acrylic" as manufactured by Fosroc Inc. or approved equivalent.
6. Equipment requiring bases is as follows:
 - a. Furnace
 - b. Tank
- C. Supports:
 1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
 2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.
- D. Grout:
 1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
 2. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.02 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Coordinate all openings with other Contractors.
- B. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- C. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- D. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.03 ROOF PENETRATIONS

- A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe and duct penetrations. Refer to drawings for details.

2.04 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
- E. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

- F. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- G. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- H. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.05 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.06 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.07 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

2.08 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 HVAC SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.
- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Set all concrete inserts in place before pouring concrete.
 - 3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.

4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
- C. Pipe Requirements:
1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
 2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
 3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
 4. Piping shall not introduce strains or distortion to connected equipment.
 5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
 6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
 7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
 8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. For attachments to joists that are concentrically loaded on the joist, a max of 100 lbs may be attached to the joist within a chord panel.
 2. For attachments to joists that are eccentrically loaded, a max of 25 lbs may be attached to the joist within a chord panel without an additional angle.
 3. Multiple attachments are allowed in each chord panel as long as the sum of the loads do not exceed the max load indicated.
 4. For loads between 100 lbs - 200 lbs, additional L2x2x3/16" (L51xL51x4.8) ASTM A36 structural steel angles are required and joist must be concentrically loaded.
 5. For loading conditions noted above, total sum of loads shall not exceed 200 lbs for an 8 ft segment for joist. For loads greater than 200 lbs and not noted on the drawings, contact engineer prior to installation.
 6. No loads shall be supported from joist bridging.
 7. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 8. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
 - 1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 7'-0"
 - 2) 1-1/2": 9'-0"
 - 3) 2": 10'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" through 6": 12'-0" 8": 9TM 10'-0" 10": 6TM 12'-0" 12": 4TM 12'-0"
 - 2. Steel (Std. Weight or Heavier - Vapor Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" and under: 9'-0"
 - 2) 1-1/2": 12'-0"
 - 3) 2" & larger: 12'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" through 8": 12'-0"
 - 7) 10": 9TM 12'-0"
 - 8) 12": 6TM 12'-0"
 - 3. Hard Drawn Copper & Brass (Liquid Service):
 - a. Maximum Spacing:
 - 1) 3/4" and under: 5'-0"
 - 2) 1": 6'-0"
 - 3) 1-1/4": 7'-0"
 - 4) 1-1/2": 8'-0"
 - 5) 2": 8'-0"
 - 6) 2-1/2": 9'-0"
 - 7) 3": 10'-0"
 - 8) 4": 12'-0"
 - 9) 6": 12'-0"
 - 4. Hard Drawn Copper & Brass (Vapor Service):
 - a. Maximum Spacing:
 - 1) 3/4" & under: 7'-0"
 - 2) 1": 8'-0"
 - 3) 1-1/4": 9'-0"

- 4) 1-1/2": 10'-0"
- 5) 2": 11'-0"
- 6) 2-1/2" & larger: 12'-0"
5. Plastic Pipe:
 - a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:
 - a. Continuous channel with hangers maximum 8'-0" OC.
- I. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
 1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 7'-0"
 - 2) 1-1/2": 9'-0"
 - 3) 2": 10'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 2. 4" through 6": 12'-0" Steel (Std. Weight or Heavier - Vapor Service):
 - a. Maximum Spacing:
 - 1) 1/2" and under: 6'-0"
 - 2) 3/4" to 1": 8'-0"
 - 3) 1-1/4" and under: 9'-0"
 - 4) 1-1/2": 10'-0"
 - 5) 2" & larger: 10'-0"
 - 6) 3": 12'-0"
 - 7) 4" through 8": 12'-0"
 3. Hard Drawn Copper & Brass (Liquid Service):
 - a. Maximum Spacing:
 - 1) 3/4" & under: 5'-0"
 - 2) 1": 6'-0"
 - 3) 1-1/4": 6'-0"
 - 4) 1-1/2": 6'-0"
 - 5) 2": 8'-0"
 - 6) 2-1/2": 9'-0"
 - 7) 3": 10'-0"
 - 8) 4": 10'-0"
 4. Hard Drawn Copper & Brass (Vapor Service):
 - a. Maximum Spacing:
 - 1) 3/4" & under: 6'-0"
 - 2) 1": 6'-0"

- 3) 1-1/4": 6'-0"
- 4) 1-1/2": 6'-0"
- 5) 2": 10'-0"
- 6) 2-1/2" & larger: 10'-0"
- 5. Plastic Pipe:
 - a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
- 6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:
 - a. Continuous channel with hangers maximum 8'-0" OC.
- J. Installation of hangers shall conform to MSS SP-58, -69, and -89.

END OF SECTION 230529

SECTION 230593
TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjusting, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

1.02 QUALITY ASSURANCE

- A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or TABB Certified Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.03 REFERENCES

- A. AABC - National Standards for Total System Balance, Seventh Edition.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. AMCA - Publication 203-90; Field Performance Measurement of Fan Systems.
- D. ASHRAE - 2019 HVAC Applications Handbook; Chapter 39, Testing, Adjusting and Balancing.
- E. ASHRAE/ANSI - Standard 111-2008; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
- F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Ninth Edition, 2019.
- G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing (latest edition).
- H. TABB - International Standards for Environmental Systems Balance.

1.04 SUBMITTALS

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.
- B. Electronic Copies:
 - 1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
 - 3. All text shall be searchable.
 - 4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.05 REPORT FORMS

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.

- C. Refer to PART 4 for required reports.

1.06 WARRANTY/GUARANTEE

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.07 SCHEDULING

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.
- B. Project will be constructed in phases. Provide balancing report after each phase is complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.
- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. The Balancing Contractor shall measure terminal air box air flow, and the TCC shall adjust DDC readout to match. Refer to Section 230900 for additional information.
- H. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.02 EXAMINATION

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
 - 1. General Equipment Requirements:
 - a. Equipment is safe to operate and in normal condition.
 - b. Equipment with moving parts is properly lubricated.
 - c. Temperature control systems are complete and operable.
 - d. Proper thermal overload protection is in place for electrical equipment.

- e. Direction of rotation of all fans and pumps is correct.
- f. Access doors are closed and end caps are in place.
- 2. Duct System Requirements:
 - a. All filters are clean and in place. If required, install temporary media.
 - b. Duct systems are clean and free of debris.
 - c. Fire/smoke and manual volume dampers are in place, functional and open.
 - d. Air outlets are installed and connected.
 - e. Duct system leakage has been minimized.
- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.04 INSTALLATION TOLERANCES

- A. $\pm 10\%$ of scheduled values:
 - 1. Adjust air inlets and outlets to $\pm 10\%$ of scheduled values.
 - 2. Adjust piping systems to $\pm 10\%$ of design values.
- B. $\pm 5\%$ of scheduled values
 - 1. Adjust outdoor air intakes to within $+ 5\%$ of scheduled values.
 - 2. Adjust exhaust air through energy recovery equipment to within $+ 5\%$ of scheduled values.
- C. Adjust supply, return, and exhaust air-handling systems to $+10\%$ / -5% of scheduled values.

3.05 ADJUSTING

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.
- B. Once balancing of systems is complete, at least one damper or valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.
- E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.06 SUBMISSION OF REPORTS

- A. Fill in test results on appropriate forms.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.01 GENERAL REQUIREMENTS

- A. Title Page:
 - 1. Project name.
 - 2. Project location.
 - 3. Project Architect.
 - 4. Project Engineer (IMEG Corp.).
 - 5. Project General Contractor.
 - 6. TAB Company name, address, phone number.
 - 7. TAB Supervisor's name and certification number.
 - 8. TAB Supervisor's signature and date.
 - 9. Report date.
- B. Report Index
- C. General Information:
 - 1. Test conditions.
 - 2. Nomenclature used throughout report.
 - 3. Notable system characteristics/discrepancies from design.
 - 4. Test standards followed.
 - 5. Any deficiencies noted.
 - 6. Quality assurance statement.
- D. Instrument List:
 - 1. Instrument.
 - 2. Manufacturer, model, and serial number.
 - 3. Range.
 - 4. Calibration date.

4.02 AIR SYSTEMS

- A. Duct Leakage Test:
 - 1. Air system and fan.
 - 2. Leakage class.
 - 3. Test pressure.
 - 4. Construction pressure.
 - 5. Flow rate (cfm): specified and actual.
 - 6. Leakage (refer to Section 233100 in the specifications): specified and actual.
 - 7. Statement that fire dampers, reheat coils and other accessories were included in the test.
 - 8. Pass or Fail.
 - 9. Test performed by.
 - 10. Test witnessed by.

B. Air Moving Equipment:

1. General Requirements:
 - a. Drawing symbol.
 - b. Location.
 - c. Manufacturer, model, arrangement, class, discharge.
 - d. Fan RPM.
 - e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
 - f. Final frequency of motor at maximum flow rate (on fans driven by VFD).
2. Flow Rate:
 - a. Supply flow rate (cfm): specified and actual.
 - b. Return flow rate (cfm): specified and actual.
 - c. Outside flow rate (cfm): specified and actual.
 - d. Exhaust flow rate (cfm): specified and actual.
3. Pressure Drop and Pressure:
 - a. Filter pressure drop: specified and actual.
 - b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
 - c. Inlet pressure.
 - d. Discharge pressure.

C. Air Terminal (Inlet or Outlet):

1. Drawing symbol.
2. Room number/location.
3. Terminal type and size.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Percent of design flow rate.

END OF SECTION 230593

SECTION 230713
DUCTWORK INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Ductwork Insulation.
- B. Insulation Jackets.

1.02 QUALITY ASSURANCE

- A. Applicator: Company specializing in ductwork insulation application with five years minimum experience. When requested, installer shall submit manufacturer's certificate indicating qualifications.
- B. Materials:
- C. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

1.03 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750C.
- C. ASTM E814 - Fire Tests of Through Penetrations Firestops.
- D. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.
- E. NFPA 255 - Surface Burning Characteristics of Building Materials.
- F. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.
- G. UL 263 - Full Scale External Fire Tests with Hose Stream.
- H. UL 723 - Surface Burning Characteristics of Building Materials.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.

2.02 JACKETS

- A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.
- B. Install materials after ductwork has been tested.
- C. Clean surfaces for adhesives.
- D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.

- E. Exterior Duct Wrap - Flexible, Type A:
 - 1. Apply with edges tightly butted.
 - 2. Cut slightly longer than perimeter of duct to insure full thickness at corners. Do not wrap excessively tight.
 - 3. Seal joints with adhesive backed tape.
 - 4. Apply so insulation conforms uniformly and firmly to duct.
 - 5. Seal all penetrations of the vapor barrier by strap hangers or slip cable hangers with adhesive backed tape.
 - 6. Provide high-density insulation inserts on rectangular ducts at trapeze duct hangers to prevent crushing of insulation. Provide high-density insulation inserts with clamp-on round ducts requiring two (2) rods or straps to prevent crushing of insulation. Maintain continuous vapor barrier through the hanger.
 - 7. Tape all joints with Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK. No substitutions will be accepted without written permission from the Architect/Engineer.
 - 8. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.
 - 9. Staples may be used, but must be covered with tape.
 - 10. Vapor barrier must be continuous.
 - 11. Mechanically fasten on 12" centers at bottom of ducts over 24" wide and on all sides of vertical ducts.
- F. Continue insulation with vapor barrier through penetrations unless code prohibits.
- G. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

3.02 SCHEDULE

- A. Refer to Ductwork Application Schedule in Section 233100 for scheduling of insulation.

END OF SECTION 230713

SECTION 230800
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Description
- B. Responsibilities
- C. Related Work
- D. Test Equipment

1.02 DESCRIPTION

- A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in Section 019100.
- C. Commissioning requires the participation of the Division 23 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019100. Division 23 Contractor shall be familiar with all parts of Section 019100 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.03 RESPONSIBILITIES

- A. Refer to Section 019100.

1.04 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
 - 1. Section 017823 - Operations and Maintenance
 - 2. Section 017900 - Demonstration and Training
 - 3. Section 019100 - Commissioning
 - 4. Section 220800 - Commissioning of Plumbing
 - 5. Section 260800 - Commissioning of Electrical
 - 6. Section 270800 - Commissioning of Communications
 - 7. Section 280800 - Commissioning of Electronic Safety and Security

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. The Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division. This equipment includes, but is not limited to, the following:
 - 1. Handheld temperature and relative humidity meter.
 - 2. Infrared thermometer gun.
 - 3. Analog differential pressure gauge and associated tubing.
 - 4. Portable computer with access to the building automation system.

- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the related specifications. If not otherwise noted, the following minimum requirements apply:
1. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5F and a resolution of +/- 0.1F.
 2. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
 3. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
- C. Refer to Section 019100 for additional Division 23 requirements.

PART 3 - EXECUTION

- A. Refer to Section 019100.

END OF SECTION 230800

SECTION 230905
SMALL EQUIPMENT CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Complete System of Automatic Controls.
- B. Control Devices, Components, Wiring and Material.
- C. Instructions for Owners.

1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years' experience.
- B. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under this section.

1.03 REFERENCES

- A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/ASHRAE Standard 135-2016: BACnet® - A Data Communication Protocol for Building Automation and Control Networks, including all amendments.
- D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts Maximum).
- E. ANSI/NFPA 70 - National Electrical Code.
- F. ANSI/NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.
- G. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- H. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.
- I. IEEE 802.15.4 - Standard for Low Rate Wireless Networks
- J. Federal Information Processing Standards (FIPS) Publication 197 - AES-128 Advanced Encryption Standard.
- K. Federal Information Processing Standards (FIPS) Publication 198 - HMAC Keyed Hash Message Authentication Code.

1.04 SUBMITTALS

- A. Equipment Coordination:
 - 1. The Mechanical Contractor shall obtain approved equipment submittals from other contractors to determine equipment wiring connections, to choose appropriate controllers, and to provide programming.
 - 2. Coordinate the control interface of all equipment with the equipment manufacturers prior to submittal submission.
- B. Shop Drawings:
 - 1. Submit shop drawings per Section 230500. In addition, submit an electronic copy of the shop drawings in Adobe Acrobat (.pdf) format to the Owner for review.
 - 2. Cross-reference all control components and point names in a single table located at the beginning of the submittal with the identical nomenclature used in this section.
 - 3. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.

4. System Architecture: Provide riser diagrams of wiring between central control unit and all control panels. This shall include specific protocols associated with each level within the architecture. Identify all interface equipment between CPU and control panels. The architecture shall include interface requirements with other systems including, but not limited to, security systems, lighting control, fire alarm, elevator status, and power monitoring system.
5. Diagrams shall include:
 - a. Wiring diagrams and layouts for each control panel showing all termination numbers.
 - b. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
 - c. Identification of all control components connected to emergency power.
 - d. Schematic diagrams for all field sensors and controllers.
 - e. A schematic diagram of each controlled system. The schematics shall have all control points labeled. The schematics shall graphically show the location of all control elements in the system.
 - f. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, label it with the same name. Label all terminals.
 - g. A tabular instrumentation list for each controlled system. The table shall show element name, type of device, manufacturer, model number and product data sheet number.
 - h. All installation details and any other details required to demonstrate that the system will function properly.
 - i. All interface requirements with other systems.
6. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system enhancement with minimal infrastructure modifications.
7. Sequences: Submit a complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system. The wording of the control sequences in the submittal shall match verbatim that included in the construction documents to ensure there are no sequence deviations from that intended by the Architect/Engineer. Clearly highlight any deviations from the specified sequences on the submittals.
8. Points List Schedule: Submit a complete points list of all points to be connected to the TCS and FMCS. The points list for each system controller shall include both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, the location of the I/O device, and reference drawings. Where a control point is the same as that shown on the control system schematic, label it with the same name. Points list shall specifically identify alarms, trends, event history, archive, totalization, graphic points, and all mapped points from other systems (security systems, lighting control, fire alarm, etc.). Provide points lists, point naming convention, and factory support information for systems provided and integrated into the FMCS.

9. Damper Schedule: Schedule shall include a separate line for each damper and a column for each of the damper attributes:
 - a. Damper Identification Tag.
 - b. Location.
 - c. Damper Type.
 - d. Damper Size.
 - e. Duct Size.
 - f. Arrangement.
 - g. Blade Type.
 - h. Velocity.
 - i. Pressure Drop.
 - j. Fail Position.
 - k. Actuator Identification Tag.
 - l. Actuator Type.
 - m. Mounting.
 10. Product Data Sheets: Required for each component that includes: unique identification tag that is consistent throughout the submittal, manufacturer's description, technical data, performance curves, installation/maintenance instructions, and other relevant items. When manufacturer's literature applies to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements.
 11. Provide documentation of submitted products that have been tested and listed by the BACnet Testing Laboratory (BTL) or provide a letter on the manufacturer's company letterhead indicating the anticipated date by which testing is expected to be completed. If, for any reason, BTL testing and listing has not been completed, a written commitment to upgrade installed controls to a version that meets BTL testing and listing requirements if problems are found during BTL testing is required.
 12. Control System Demonstration and Acceptance: Provide a description of the proposed process, along with all reports and checklists to be used.
 13. Clearly identify work by others in the submittal.
 14. Quantities of items submitted may be reviewed but are the responsibility of the Contractor to verify.
- C. Operation and Maintenance Manual:
1. In addition to the requirements of Section 230500, submit an electronic copy of the O&M manuals in PDF format.
 2. Provide three complete sets of manuals.
 3. Each O&M manual shall include:
 - a. Table of contents with indexed tabs dividing information as outlined below.
 - b. Definitions: List of all abbreviations and technical terms with definitions.
 - c. Warranty Contacts: Names, addresses, and 24-hour telephone numbers of contractors installing equipment and controls and service representatives of each.
 - d. Licenses, Guarantees, and Warranties: Provide documentation for all equipment and systems.

- e. System Components: Alphabetical list of all system components, with the name, address, and telephone number of the vendor.
 - f. Operating Procedures: Include procedures for operating the control systems; logging on/off; enabling, assigning, and reporting alarms; generating reports; collection, displaying, and archiving of trended data; overriding computer control; event scheduling; backing up software and data files; and changing setpoints and other variables.
 - g. Programming: Description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.
 - h. Engineering, Installation, and Maintenance: Explain how to design and install new points, panels, and other hardware; recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions; how to debug hardware problems; and how to repair or replace hardware. A list of recommended spare parts.
 - i. Original Software: Complete original issue CDs for all software provided, including operating systems, programming language, operator workstation software, and graphics software. In lieu of CDs, provide login information and access to a web application where the current information can be downloaded at no additional cost.
- D. Training Manual:
- 1. Provide a course outline and training manuals for each training class. Provide login information and access to a web application where the current training manuals can be downloaded at no additional cost.
- E. Record Documents:
- 1. Submit record documentation per Section 230500.
 - 2. Provide a complete set of "as-built" drawings and application software on CDs. Provide drawings as AutoCAD~~®~~ or Visio~~®~~ compatible files. Provide two copies of the "as-built" drawings with revisions clearly indicated in addition to the documents on compact disk. Provide all product data sheets in PDF format.
 - 3. Submit two hard copies and one electronic copy of as-built versions of the shop drawings, including product data and record drawings with revisions clearly indicated. Provide floor plans showing actual locations of control components including panels, thermostats, sensors, and hardware.
 - 4. Provide all completed testing and commissioning reports and checklists.
 - 5. Submit printouts of all graphic screens with current values (temperatures, pressures, etc.) to the A/E verifying completion and proper operation of all points.
- 1.05 DELIVERY, STORAGE AND HANDLING**
- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.
 - B. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.
- 1.06 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**
- A. Automatic Dampers.

1.07 AGENCY AND CODE APPROVALS

- A. All products shall have the following agency approvals. Provide verification that the approvals exist for all submitted products with the submittal package.
 - 1. UL-916; Energy Management Systems.
 - 2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "Signal Equipment."
 - 3. EMC Directive 89/336/EEC (European CE Mark).
 - 4. FCC, Part 15, Subpart J, Class A Computing Devices.

1.08 ACRONYMS

- A. Acronyms used in this specification are as follows:
 - 1. B-AAC - BACnet Advanced Application Controller
 - 2. B-ASC - BACnet Application Specific Controller
 - 3. BTL - BACnet Testing Laboratories
 - 4. DDC - Direct Digital Controls
 - 5. FMCS - Facility Management and Control System
 - 6. GUI - Graphic User Interface
 - 7. IBC - Interoperable BACnet Controller
 - 8. IDC - Interoperable Digital Controller
 - 9. LAN - Local Area Network
 - 10. NAC - Network Area Controller
 - 11. ODBC - Open DataBase Connectivity
 - 12. WNAC - Wireless Network Area Controller
 - 13. OOT - Object Oriented Technology
 - 14. OPC - Open Connectivity via Open Standards
 - 15. PICS - Product Interoperability Compliance Statement
 - 16. TCC - Temperature Control Contractor
 - 17. TCS - Temperature Control System
 - 18. WAN - Wide Area Network
 - 19. WBI - Web Browser Interface

1.09 SUMMARY

- A. Provide new standalone FMCS for this project.
- B. TCC shall furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management and Control System (FMCS) using direct digital controls as shown on the drawings and as described herein.
- C. All labor, material, equipment and software not specifically referred to herein or on the plans that is required to meet the intent of this specification shall be provided without additional cost to the Owner.
- D. The Owner shall be the named license holder of all software associated with any and all incremental work on the project.

1.10 SYSTEM DESCRIPTION

- A. The entire TCS shall be comprised of a network of interoperable, standalone digital controllers communicating via the following protocol to an NAC. Temperature Control System products shall be as specified below.

- B. The FMCS shall include network area controller or controllers (NAC) within each facility. The NAC shall connect to the Owner's local or wide area network, depending on configuration. Provide access to the system, either locally in each building or remotely from a central site or sites, through standard web browsers, via the Internet, and/or via local area network.
- C. The FMCS will include all related programming, with a fully operational web-based management system using a cloud server program and including a network of commercial internet programmable thermostats that use IEEE 802.15.4 mesh wireless communication protocol to reach a wireless network area controller (WNAC). The WNAC shall connect to the Owner's local or wide area network, depending on configuration, over a TCP/IP connection. Access and control of the FMCS is via a web-based management tool that resides on a cloud server and must be accessible either locally or remotely via the Internet.
- D. Provide materials and labor necessary to connect factory-supplied control components.
- E. Provide central and remote hardware, software, and interconnecting wire and conduit where required.
- F. The FMCS shall include automated alarming software capable of calling email-compatible cellular telephones and pagers. The email alarm paging system shall be able to segregate users, time schedules, and equipment and be capable of being programmed by the Owner.
- G. For each touchscreen display, mobile application, and web user interface provided, furnish one legal copy of all software tools, configuration tools, management tools, and utilities used during system commissioning and installation. All tools shall be readily available in the market. Contractor shall convey to the Owner all software tools and their legal licenses at project closeout.

1.11 SOFTWARE LICENSE AGREEMENT

- A. The Owner shall be the named license holder of all software and applications associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job-specific configuration documentation, data files, configuration tools, and application-level software developed for the project. This shall include, but is not limited to, all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN/WAN/intranet and/or Internet connected routers and devices. Provide the Owner with all required IDs and passwords for access to any component or software program. The Owner shall determine which organizations shall be named in the SI organization ID ("**orgid**") of all software licenses. Owner shall be free to direct the modification of the "**orgid**" in any software license, regardless of supplier.

1.12 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is this Contractor's responsibility to check the Contract Documents for possible conflicts between the Work of this section and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

1.13 WARRANTY

- A. Refer to Section 230500 for warranty requirements.
- B. Within the warranty period, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this Contractor at no expense to the Owner.
- C. Warranty requirements include furnishing and installing all FMCS software upgrades issued by the manufacturer during the one-year warranty period.
- D. Update all software and back-ups during warranty period and all user documentation on the Owner's archived software disks.

1.14 WARRANTY ACCESS

- A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS (BACnet Protocol)

- A. Carrier: iVU
- B. Lennox: iHarmony
- C. Honeywell: LCBS
- D. Johnson Controls: Verasys
- E. Trane: Concierge

2.02 SYSTEM ARCHITECTURE

- A. General:
 - 1. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall consist of a network of interoperable, standalone digital controllers, touchscreen display, mobile application, web user interface, network devices, dampers, sensors, and other devices as specified herein.
 - 2. The installed system shall provide secure password or PIN access to all features, functions and data contained in the overall FMCS.
- B. Open, Interoperable, Integrated Architectures:
 - 1. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data are not acceptable.
 - 2. The supplied system must be able to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. Systems requiring proprietary user interface programs are not acceptable.

2.03 ZONE AND BYPASS CONTROL DAMPERS

- A. Rectangular Control Dampers - Standard Construction:
 - 1. Shall be licensed to bear the AMCA Certified Rating Seal.
 - 2. Test leakage and pressure drop per AMCA 500.
 - 3. Frame: Hat-shaped channel, minimum 12 gauge extruded aluminum, and minimum 4" deep. Caulk or weld seams to prevent leakage.
 - 4. Blades: Minimum 12 gauge extruded aluminum airfoil design, minimum 6" wide, and overlapping blades and blade seals (overlapping blade seals only is unacceptable).
 - 5. Shaft: Non-cylindrical, solid aluminum or zinc plated steel with opening in blade to match profile of shaft. Shaft shall be securely fastened to the blade and of sufficient length to mount direct-coupled actuator. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
 - 6. Bearings: Acetal (Delrin/Celcon) inner bearing fixed to an aluminum shaft, rotating within a polycarbonate outer bearing inserted in the frame. Provide thrust bearings for vertical damper applications.
 - 7. Blade Seals: Extruded silicone gaskets secured in an integral slot within the blade.
 - 8. Side Seals: Stainless steel compression type or extruded silicone gasket secured in an integral slot within the frame.

9. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft. Blades linked for opposed operation, unless noted otherwise on the drawings. Blades shall close evenly. Use one direct-coupled actuator per damper section. Jack-shafting is not acceptable.
10. Size Limits: 48" maximum horizontal blade length, 24 square foot maximum area per damper. Total cross-sectional area of dampers in ducts shall be at least as large as the duct without the use of blank-off sections.
11. Maximum Leakage: Class 1A at 1" w.c. pressure differential for a 24" x 24" damper.
12. Maximum Pressure Drop for Opposed Blade Damper: 0.15" for 8000 CFM through a 24"x24" damper (2000 fpm).
13. Maximum Pressure Drop for Parallel Blade Damper: 0.08" for 8000 CFM through a 24"x24" damper (2000 fpm).

2.04 DAMPER ACTUATORS

A. Damper Actuators - Electronic:

1. Actuator shall be UL 873 or 60730 listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation. Mount actuator by means of a V-bolt dual nut clamp with a V-shaped toothed cradle, directly couple and mount to the valve bonnet stem, or ISO-style direct-coupled mounting pad. Actuators shall be capable of being mechanically and electrically paralleled to increase torque, if required.
2. Actuators shall be warranted for a period of five (5) years from the date of production, with the first two (2) years unconditional.
3. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.
4. Fail-Safe Dampers: Where shown on the drawings or sequences, fail-safe mechanism shall operate the damper to the fail position following power interruption.
 - a. Mechanical/Spring: Mechanical spring return mechanism to drive controlled drive to an end position (open or close) on loss of power.
 - b. Electronic: Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 percent increments with a 2 second operational delay.
5. Feedback: Where shown on drawings or sequences, provide analog feedback signal for positive position indication.
6. Damper End Switches: Where shown on the drawings or sequences, provide end switches to prove damper reaches open/closed position.

2.05 ZONE SENSORS

A. Temperature Sensors:

1. Room Temperature Sensor:
 - a. Sensor Only: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45F to 90F operating range, ± 0.50 F accuracy, no setpoint adjustment or override button.
 - b. Sensor with Setpoint Adjustment: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45F to 90F operating range, ± 0.50 F accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a single warmer/cooler or red/blue visual scale), no override button.

- c. Sensor with Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45F to 90F operating range, $\pm 0.50F$ accuracy, occupied/unoccupied override button with LED, no setpoint adjustment.
 - d. Sensor with Setpoint Adjustment and Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45F to 90F operating range, $\pm 0.50F$ accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a warmer/cooler or red/blue visual scale), occupied/unoccupied override button with LED.
 - e. Sensors shall include the following functions:
 - 1) A signal strength on the space sensor display.
 - 2) Error codes shall be displayed on the digital display. Error codes shall include: not associated, address to 000, improper software configuration, input voltage too high, or general sensor failure. Codes shall be indicated on inside of sensor back cover.
 - 3) Provide an LCD display readable in low light conditions, and text display shall be a minimum font size of 12 points.
 - 4) Space/wall sensors shall be supplied with batteries having a minimum life of 15 years.
- B. Pressure Measuring Devices:
- 1. Pressure Transmitters/Transducer:
 - a. Air-to-Air:
 - 1) Provide transducer having the following minimum performance for measuring duct static pressure for VFD control or measuring differential pressure across filter banks:
 - a) Accuracy: $\pm .0\%$ FS
 - b) Non-Linearity, BFSL: $\pm 0.96\%$ FS
 - c) Hysteresis: 0.10% full scale
 - d) Non-Repeatability: 0.05% full scale
 - e) Thermal Effects (compensated range): 0F to +150F
 - f) Maximum Line Pressure: 10 PSI
 - g) Zero/Span Shift: 0.033%FS/F
 - h) Long Term Stability: 0.5%FS/1 year
 - 2) Provide transducer with the following minimum performance for measuring differential pressure across piezometer fan inlet airflow measuring stations:
 - a) Unit shall come factory equipped with static tube attached.
 - b) Unit shall include: (1) LCD shall display differential pressure on face of sensor enclosure over the entire operational range; (2) IPCC-rated polycarbonate enclosure with short circuit-proof outputs and reverse polarity protected inputs.
 - c) Accuracy at 72F: $\pm 0.25\%$ FS
 - d) Stability: $\pm 0.25\%$ full scale per year
 - e) Temperature Error: (1) Zero: $\pm 0.025\%$ full scale per C; (2) Span: Maximum $\pm 0.03\%$ full scale per C
 - f) Environmental Operating Range: 32F to 140F.

- g) Overpressure: (1) Proof: 2 psi; (2) Burst: 3 psi
- h) Humidity: 0% to 95% RH non-condensing.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Verify that systems are ready to receive work. Beginning of installation means installer accepts existing conditions.
- B. Install system and materials in accordance with manufacturer's instructions.
- C. Drawings of the TCS and FMCS network are diagrammatic only. Any apparatus not shown but required to meet the intent of the project documents shall be furnished and installed without additional cost.
- D. Install all operators, sensors, and control devices where accessible for service, adjustment, calibration, and repair. Do not install devices where blocked by piping or ductwork. Devices with manual reset or limit adjustments shall be installed below 6'-0" if practical to allow inspection without using a ladder.
- E. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Maximum height above finished floor shall not exceed 48".
- F. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room.
- G. After completion of installation, test and adjust control equipment.
- H. Check calibration of instruments. Recalibrate or replace.
- I. Furnish and install conduit, wire, and cable per the National Electric Code, unless noted otherwise in this section. All hardware, software, equipment, accessories, wiring (power and sensor), relays, sensors, power supplies, transformers, and instrumentation required for a complete and operational FMCS system, but not shown on the electrical drawings, are the responsibility of the TCC.
- J. Labels For Control Devices:
 - 1. Provide labels indicating service of all control devices in panels and other locations.
 - 2. Labels may be made with permanent marking pen in the control panels if clearly legible.

3.02 FMCS INSTALLATION

- A. Coordinate voltage and ampacity of all contacts, relays, and terminal connections of equipment being monitored or controlled. Voltage and ampacity shall be compatible with equipment voltage and be rated for full ampacity of wiring or overcurrent protection of circuit controlled.
- B. Naming Conventions: Coordinate all point naming conventions with Owner standards. In the absence of Owner standards, naming conventions shall use equipment designations shown on plans.

3.03 COMMISSIONING

- A. Upon completion of the installation, this Contractor shall load all system software and start up the system. This Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.

- B. This Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the FMCS system operation. Test shall include onsite testing to verify each wireless device is responding to signals from other wireless devices and the cloud-based server without interruption.
- C. This Contractor shall prove that the controls network is functioning correctly and within acceptable bandwidth criteria and shall test the system with an approved protocol analysis tool. Provide a log and statistics summary showing that each channel is within acceptable parameters. Each channel shall be shown to have at least 25% spare capacity for future expansion.
- D. Upon completion of the performance tests described above, repeat these tests, point by point, as described in the validation log above in the presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- E. System Acceptance: Satisfactory completion is when this Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.04 PREPARATION FOR BALANCING

- A. Verify that all dampers are in the position indicated by the controller (e.g., open, closed or modulating).
- B. Check the calibration and setpoints of all controllers.
- C. Check the locations of all thermostats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.
- D. Check that all sequences operate as specified. Verify that no simultaneous heating and cooling occurs, unless specified. Observe that heating cannot begin at TAB reheat terminals until the unit is at the minimum CFM.
- E. Verify the operation of all interlock systems.

3.05 TEST AND BALANCE COORDINATION

- A. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
- B. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

3.06 DEMONSTRATION AND ACCEPTANCE

- A. At completion of installation, provide four hours minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

3.07 TRAINING

- A. On-Site:
 - 1. After completion of commissioning, the manufacturer shall provide 4 consecutive hours of training for 2 Owner's representatives. The training course shall enable the Owner's representatives to perform Day-to-Day Operations as defined herein. A factory-trained instructor with experience in presenting the training material and the system programmer for this project shall perform the training.

- B. Day-to-Day Operations - Training Description:
 - 1. Proficiently operate the system.
 - 2. Understand control system architecture and configuration.
 - 3. Understand FMCS systems components.
 - 4. Operate the web user interface, touchscreen display, and mobile application.
 - 5. Log-on and off the system.
 - 6. Access reports and logs.
 - 7. Adjust and change system setpoints, time schedules, and holiday schedules.
 - 8. Recognize malfunctions of the system by observation of the graphic visual signals.
 - 9. Understand system drawings and Operation and Maintenance manual.
 - 10. Understand the job layout and location of control components.
 - 11. Access data from FMCS controllers and ASCs.
- C. System Management - Training Description:
 - 1. Interface with job-specific, third-party operator software.
 - 2. Add new users and understand password security procedures.

3.08 INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Averaging sensors and low limits shall be installed at the top of the assembly with the element on a slight downward incline away from the sensor making a serpentine pattern over the cross-sectional area with elements spaced not over 12" apart and within 6" of the top and bottom of the area.
- F. All pipe-mounted temperature sensors shall be installed in immersion wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
- G. Install outdoor air temperature sensors on exterior of north wall, complete with sun shield at designated location approved by Architect/Engineer. TCC shall prime and paint the device enclosure. Color selection by Architect.

END OF SECTION 230905

SECTION 232300
REFRIGERATION PIPING AND SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Piping and Pipe Fittings
- B. Moisture and Liquid Indicators
- C. Check Valves

1.02 QUALITY ASSURANCE

- A. Remanufactured specialties are not acceptable.

1.03 REFERENCES

- A. ANSI/ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.
- B. ANSI/ASME SEC 9 - Boilers and Pressure Vessels Code, Welding and Brazing Qualifications.
- C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. ANSI/ASME B31.5 - Refrigeration Piping.
- E. ANSI/ASTM B32 - Solder Metal.
- F. ANSI/ASTM B88 - Seamless Copper Water Tube.
- G. ANSI/AWS A5.8 - Brazing Filler Metal.
- H. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.04 SUBMITTALS

- A. Submit shop drawings under provisions of Section 230500.
- B. Submit layout of entire piping system including equipment, critical dimensions, and all pipe sizes, traps, valves, and accessories. Layout shall be a custom drawing for this job, not a standard detail. The refrigeration equipment supplier shall stamp the approval on layout drawings.
- C. Submit product data for specialties, including manufacturers catalog information.
- D. Submit manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labels in place.
- B. Protect piping and specialties from entry of foreign material by leaving caps and plugs in place until installation.

PART 2 - PRODUCTS

2.01 PIPING

- A. Design Pressure: 450 psig.
 - 1. Maximum Design Temperature: 250F.
- B. Piping - 4" and under; Brazed Joint:
 - 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
 - 2. Joints: Brazed with silver solder.
 - 3. Fittings: Wrought copper solder joint, ANSI B16.22.

4. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
- C. Piping - 1-3/8" and Under; Dual Concentric Crimp Mechanical Press Connection (Contractor's Option):
1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
 2. Joints: Dual concentric crimp band mechanical press connection.
 3. Fittings: Refrigerant Grade Copper in accordance with ASTM B75 or ASTM B743 with embedded HNBR O-ring.
 4. Manufacturers:
 - a. Rapid Locking System (RLS)
 - b. Conex Banninger
 - c. Parker Hannifin
 - d. MaxiPro ACR
 - e. Nibco ACR Press
- D. Piping - 1-3/8" and Under; Mechanically Attached, Axially Swaged Compression Connection (Contractor's Option):
1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
 2. Joints: Mechanically attached connector, axially swaged compression connection.
 3. Fittings: Refrigerant grade copper in accordance with ASTM B75 or ASTM B743. Brass body with two stabilization inserts in accordance with ASTM B15/B16M. Two steel rings in accordance with ASTM A108-13; anerobic adhesive sealant.
 4. Manufacturers:
 - a. VULKAN Lokring

2.02 MOISTURE AND LIQUID INDICATORS

- A. UL listed, with copper, brass, or copper-plated steel body, flared or solder ends, extended fittings in units up to at least 1-1/8" to allow brazing without removing the cartridge, sight glass, color coded paper moisture indicator that is replaceable without breaking piping connections for units up to 1-1/8" size, and plastic cap; maximum working pressure of 500 psi, and maximum temperature of 200F.
1. Manufacturers:
 - a. Sporlan
 - b. Henry Valve Company
 - c. Alco Valve

2.03 CHECK VALVES

- A. CK-10: 1/4" thru 3-5/8", 500 psi, globe or angle pattern, brazed, brass body, cleaned-dried-plugged and tagged at factory for refrigerant service.
1. Manufacturers:
 - a. Henry Valve Company
 - b. Mueller
 - c. Wolf-Linde

2.04 SUCTION FILTERS

- A. Replaceable Cartridge Angle Type: UL listed for 500 psi up to 2" to 18" size, and 400 psi for larger sizes, steel shell that passes 1000-hour salt spray test with copper fittings, replaceable pleated filter element(s); maximum pressure drops of 3 psi with R410a or 2 psi with R134a at system flow rate, capable of accepting molded desiccant core for cleanup after compressor burnout, access valve in the removable end plate. Install with side refrigerant inlet.

2.05 SOLENOID VALVES

- A. Valve: AHRI 760; pilot operated; copper or brass body and internal parts; synthetic seat; stainless steel stem and plunger assembly; extended solder ends to permit installation without disassembly; maximum working pressure of 500 psi; normally closed. Maximum pressure drop at system flow of 5 psi for R410a and 3 psi for R134a.
- B. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, surge protector and color-coded lead wires, integral junction box, Class F temperature rated, ANSI/UL 429.

2.06 EXPANSION VALVES

- A. Angle or Straight Thru Type: ANSI/AHRI 750; materials suitable for system refrigerant, external equalizer, adjustable super heat setting, balanced port design, suitable for horizontal or vertical installation, with replaceable capillary tube and remote sensing bulb.
- B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10F super heat. Select to avoid being undersized at full load or excessively oversized at part load.

2.07 EXPANSION COMPENSATION

- A. Assembly consisting of two flexible connectors, two copper flexible connectors, two 90-degree elbows, and a 180-degree return pipe. Unit shall be in the form of a pipe loop.
- B. Connectors shall have corrugated copper hose bodies with copper braided casings.
- C. Connectors shall be rated for 150 psi working pressure at 70F.
- D. Sizes 2" and smaller shall have copper sweat ends.
- E. Connectors shall be suitable for 1/2" permanent misalignment.
- F. Manufacturer:
 - 1. Metraflex Type MLS

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

3.02 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.

- E. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- F. Group piping whenever practical at common elevations and locations. Slope piping 1% in direction of oil return.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access doors for concealed valves and specialties.
- J. Where pipe support members are welded to structural building frame, brush clean, and apply zinc rich primer to welding.
- K. Insulate piping and equipment; per Section 230719 and Section 230716.
- L. Provide external equalizer piping on expansion valves, and locate expansion valve sensing bulb immediately downstream of evaporator on suction line. Connect distributor to expansion valve outlet.
- M. Install flexible connectors parallel to the shafts of compressors.
- N. Fully charge system with refrigerant after testing.

3.03 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied identification sufficient to determine their conformance with specified requirements.
- C. Exercise care at all times to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings.
- F. Cut all pipe to exact measurement and install without springing or forcing.

3.04 APPLICATION

- A. Provide refrigerant charging valve connections.

3.05 JOINING OF PIPE

- A. Brazed Joints:
 - 1. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.
 - 2. Flux shall conform to ANSI/AWS A5.31.
 - 3. Remove composition discs and all seals during brazing if not suitable for a minimum of 840F or greater than the melting temperature of the brazing filler metal, whichever is greater.

B. Mechanical Press Connection:

1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
2. Examination: Upon delivery to the jobsite, examine copper tubing and fittings for debris, defects, incise marks (manufacturer's engraving on tube), holes, or cracks.
3. Fully insert tubing into the fitting and mark tubing.
4. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
5. Joint shall be pressed with a tool approved by the manufacturer.
6. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.

C. Axially Swaged Connection:

1. Brass axially swaged connectors shall be installed in accordance with the manufacturer's installation instructions.
2. Installers shall be trained by a certified Vulkan LOKRING trainer. Provide proof of certification upon request.

3.06 FIELD QUALITY CONTROL

- A. Test piping system with nitrogen at 300 psig for at least 8 hours without loss of pressure.
- B. Comply with ASHRAE Standard 147 for refrigerant system integrity testing.
- C. After pressure testing, evacuate all refrigerant piping to at least 28" of mercury for 24 hours without loss of vacuum. Ensure moisture does not enter the piping prior to and during the tests.

END OF SECTION 232300

SECTION 233100
DUCTWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Galvanized Ductwork
- B. Aluminum Ductwork
- C. Ductwork Sealants
- D. Rectangular Ductwork
- E. Flexible Duct
- F. Ductwork Penetrations
- G. Duct Cleaning

1.02 REFERENCES: Conform to all applicable requirements of the following publications:

- A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ASHRAE - Handbook 2020 Systems and Equipment; Chapter 19 - Duct Construction.
- D. ASHRAE - Handbook 2021 Fundamentals; Chapter 21 - Duct Design.
- E. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- F. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.
- G. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- H. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- I. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- J. ASTM E413-87 - Classification for Rating Sound Insulation.
- K. AWS D9.1M/D9.1 - Sheet Metal Welding Code.
- L. IECC - International Energy Conservation Code (latest published edition)
- M. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- N. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.
- O. SMACNA - Air Duct Leakage Test Manual.
- P. SMACNA - HVAC Duct Construction Standards.
- Q. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.
- R. UL 181 - Factory-Made Air Ducts and Air Connectors.
- S. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors
- T. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.

1.03 SUBMITTALS

- A. Submit shop drawings per Section 230500.
- B. Submit duct fabrication standards in compliance with SMACNA and these specifications. Clearly indicate metal gauges, reinforcement, and joining methods intended for use for each pressure classification. Furnish details of all common duct fittings and joint connections to be used on this project.

- C. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.
- D. Duct Leakage Test Summary Report: Upon completion of the pressure test described in Part 3, the Contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

1.04 DEFINITIONS

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.
- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.
- C. Exterior Duct: Ductwork located outside the conditioned envelope including exposed ductwork above the roof, outside exterior walls, in attics above insulated ceilings, inside parking garages, and crawl spaces.
- D. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS AND SUPPORTS

- A. Rectangular Duct - Single Wall:
 - 1. General Requirements:
 - a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
 - b. Transitions shall not exceed the angles in Figure 4-7.
 - 2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:
 - a. All ducts shall be cross-broken or beaded.
 - b. Snap lock seams are not permitted.
 - c. Turning vanes shall be used in all 90-degree mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:
 - 1) Type 1:
 - a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
 - b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.
 - 2) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
 - 3) Runners must be installed at a 45-degree angle. Elbows with different size inlet and outlet must be radius type.
 - 4) Omitting every other vane is prohibited.
 - d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3

elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.

- e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45-degree entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
- f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
- g. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45-degree rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
- h. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30-degree maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30-degree angle shall be formed of radius elbows with centerline radius $R/W=1.0$ or greater. SMACNA Type 1 offsets are not permitted.
- i. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
- j. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2 " pressure class, and must be less than 6" in length.
- k. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
 - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
 - 2) Manufacturers:
 - a) Ductmate Industries - 25/35/45
 - b) Nexus
 - c) Mez
 - d) WDCI
 - e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

B. Round and Flat Oval Spiral Seam Ductwork - Single Wall:

- 1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
- 2. 90-degree elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.

3. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
 4. Ductwork shall be suitable for velocities up to 5,000 fpm.
 5. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
 6. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
 7. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
 8. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
 9. Transverse Joint Connections:
 - a. Crimped joints are not permitted.
 - b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
 - c. Ducts and fittings larger than 36" shall have flanged connections.
 - d. Secure all joints with at least 3 sheet metal screws before sealing.
 - e. Manufacturers, Slide-on Flanges:
 - 1) Ductmate Industries - SpiralMate
 - 2) Accuflange
 - 3) Sheet Metal Connectors are acceptable.
 - f. Manufacturers, Self-Sealing Duct Systems:
 - 1) Lindab
 - 2) Ward "Keating Coupling"
- C. Hangers and Supports General Requirements:
1. Hanger and support materials shall be as defined within Materials and Application Specific section below.
 2. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge attached to the bottom of ducts.
 3. Cable Hangers:
 - a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.
 4. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs.. Install per manufacturer's ratings and instructions.

2.02 MATERIAL AND APPLICATION SPECIFIC

A. Galvanized Steel:

1. General Requirements:

- a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
- b. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
- c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
- d. Ductwork reinforcement shall be of galvanized steel.

2. Duct Hangers and Support Material:

- a. Ductwork hangers and supports shall be of galvanized or painted steel.
- b. All fasteners shall be galvanized or cadmium plated.

B. Aluminum Ductwork:

1. General Requirements:

- a. Material: ASTM B209; aluminum sheet, Alloy 3003-H14. Aluminum connectors and bar stock: Alloy 6061-T6. Aluminum or stainless steel fasteners are acceptable.
- b. All duct gauges and reinforcement shall be as called for in Tables 2-50, 2-51, 2-52, and 3-14 of the SMACNA HVAC Duct Construction Standards.
- c. Ductwork reinforcement shall be of aluminum.

2. Duct Hangers and Supports Material:

- a. Ductwork hangers and supports shall be of aluminum. Slip cable hangers are acceptable if constructed of aluminum.
- b. All fasteners shall be aluminum.

C. Duct Hangers and Support Material:

1. Ductwork hangers and supports shall be of galvanized or painted steel.
2. All fasteners shall be galvanized or cadmium plated.

D. Exposed Ductwork (Rectangular, Round, and Flat Oval):

1. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:

- a. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.
- b. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.
- c. Remove all identification stickers and thoroughly clean exterior of all ducts.
- d. Locate fitting seams on least visible side of duct.
- e. Provide exterior finish suitable for field painting without further oil removal.
- f. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2" from the end of the duct.

2. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:
 - a. Metal gauge of duct and fittings.
 - b. Fitting type and construction.
 - c. Type and size of reinforcement.

2.03 DUCTWORK SEALANTS

- A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20F to +175F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M.
- B. Two-part joint sealers shall consist of a minimum 3" wide mineral-gypsum compound impregnated fiber tape and a liquid sealant. Sealant system shall meet the following requirements: maximum 48-hour cure time, service temperature of 0F to 200F, resistant to mold, mildew, and water, flame spread rating below 25 and smoke developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes.
- C. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20F to +250F.
- D. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20F to +250F.
 1. Manufacturers, Pressure-Sensitive Tape:
 - a. Venture Tape 1581A
 - b. Compac #340
 - c. Scotch Foil Tape 3326
 - d. Polyken 339

2.04 FLEXIBLE DUCT

- A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.
- B. Flame Spread/Smoke Developed: Not over 25/50.
- C. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.
- D. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not

install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.

- D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Supply ductwork shall be free of construction debris, and shall comply with Level "B" of the SMACNA Duct Cleanliness for New Construction Guidelines.
- F. Repair all duct insulation and liner tears.
- G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.
- H. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- I. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.
- J. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.
- K. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 230550 for seismic requirements.
- L. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- M. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

3.02 DUCTWORK APPLICATION SCHEDULE

- A. Refer to Ductwork Application Schedule below for specific requirements for system, material, shape, pressure class, seal class and insulation application.
- B. Supply Duct from Fan to Outlets - Single Wall:
 - 1. Shape:
 - a. Rectangular Duct - Single Wall
 - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
 - 2. Material: Galvanized Steel
 - 3. Pressure Class: +3"
 - 4. Seal Class: A
 - 5. Insulation:
 - a. ASHRAE 90.1-2022: 1-1/2" thick Type A (R=4.5)
 - b. IECC-2021: 1-1/2" thick Type A (R=4.5)
 - 6. Additional Requirements: None
- C. Return Duct:
 - 1. Shape:
 - a. Rectangular Duct - Single Wall
 - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
 - 2. Material: Galvanized Steel

3. Pressure Class: -2"
4. Seal Class: A
5. Insulation:
 - a. ASHRAE 90.1-2022: None
 - b. IECC-2021: None
6. Additional Requirements: None

3.03 DUCTWORK SEALING

- A. General Requirements:
 1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
 2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
 3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
 4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.
- B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.
- C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

3.04 TESTING

- A. Interior Duct - Less than 3" WG (positive or negative):
 1. Leak testing of these pressure classes is not normally required for interior ductwork (inside the building envelope). However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
 2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
 3. Seal ducts to bring the air leakage into compliance.
 4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- B. Pressure Test Procedure:
 1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:
 - a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.
 - b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.

- c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
- d. All joints shall be felt by hand, and all discernible leaks shall be sealed.
- e. Totalling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
- f. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
- g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
- h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
- i. Positive pressure leakage testing is acceptable for negative pressure ductwork.

3.05 DUCTWORK PENETRATIONS

- A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.
- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

END OF SECTION 233100

SECTION 233300
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Manual Volume Dampers.

1.02 REFERENCES

- A. ASTM E477-20 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- B. SMACNA - HVAC Duct Construction Standards (latest edition).
- C. UL 555C - Ceiling Dampers.

1.03 SUBMITTALS

- A. Submit shop drawings under provisions of Section 230500.
- B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MANUAL VOLUME DAMPERS

- A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.
- C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.
- E. Provide locking quadrant regulators on single and multi-blade dampers.
- F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

2.02 DUCTWORK ACCESSORY SEALANTS

- A. Ductwork accessory sealants and adhesives shall conform to Section 233100.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General Installation Requirements:
 - 1. Install accessories in accordance with manufacturer's instructions.
 - 2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
 - 3. Coordinate and install access doors provided by others.
 - 4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
 - 5. Provide duct test holes where indicated and as required for testing and balancing purposes.

B. Manual Volume Damper:

1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing. Use splitter dampers only where indicated.
2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.

END OF SECTION 233300

SECTION 233423
POWER VENTILATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. In-Line Cabinet Fan.

1.02 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300.
- C. Fabrication: Conform to AMCA 99.
- D. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.1.

1.03 REFERENCES

- A. AMCA 99 - Standards Handbook.
- B. AMCA 208 - Calculation of the Fan Energy Index (FEI).
- C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- D. AMCA 230 - AMCA 230 - Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.
- E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- F. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- G. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- H. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- I. SMACNA - HVAC Duct Construction Standards (latest edition).

1.04 SUBMITTALS

- A. Submit shop drawings per Section 230500. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point (ceiling and HVLS fans are exempt from FEI submittal requirements).
- B. Submit manufacturer's installation instructions.
- C. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- D. Submit motor data indicating compliance with Section 230513.

1.05 EXTRA STOCK

- A. Provide one (1) extra belt set for each fan unit.

PART 2 - PRODUCTS

2.01 IN-LINE CABINET FAN

- A. Fiberglass lined, sheet metal housing, arranged for in-line installation.
- B. Rubber torsion motor mounts.
- C. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for fractional horsepower induction motors, with thermal overload relay, toggle operator.

- D. Built-in backdraft damper.
- E. Centrifugal fan.
- F. Provide variable speed controller if shown on the drawings.
- G. Manufacturers:
 - 1. ACME
 - 2. Broan
 - 3. Carnes
 - 4. Cook
 - 5. Jenco
 - 6. PennBarry
 - 7. Greenheck
 - 8. Soler-Palau
 - 9. York
 - 10. FloAire

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated lag screws to roof curb.
- C. If manufacturer has no recommendations, secure roof exhaust fans to curbs with 1/4" lag bolts on 8" maximum centers.
- D. MC shall install and wire factory provided damper to open when the fan runs if the manufacturer does not provide an option to pre-wire the damper.

END OF SECTION 233423

SECTION 233700
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Heat Only Exhaust Hood.
- B. Grilles And Registers.
- C. Architectural Square Panel Diffusers.
- D. Louvers.
- E. Goosenecks.

1.02 QUALITY ASSURANCE

- A. Test and rate performance of air inlets and outlets per ASHRAE 70.
- B. Test and rate performance of louvers per AMCA 500L-99.
- C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.03 REFERENCES

- A. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. SMACNA - Duct Construction Standards.

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 230500.
- B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.
- C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.
- D. Submit manufacturer's installation instructions.
- E. Where color selection by Architect is necessary, provide physical color chips for color selection directly to the Architect. Electronic color charts are not acceptable.

1.05 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A.
- B. Conform to ASHRAE 90.1.

1.06 EXTRA STOCK

- A. Provide clean filters in all filter return grilles at time of installation.
- B. Provide one additional set of replacement filters for all filter return grilles. Deliver to Owner at job site.

PART 2 - PRODUCTS

2.01 HEAT ONLY EXHAUST HOOD

- A. Hood shall be 18 gauge Type 304 stainless steel construction with #3 polished finish. All exterior seams shall be continuously welded, ground, and polished to match hood finish.
- B. Provide UL listed 100-watt incandescent vapor-proof lights, pre-wired to junction box mounted on top of hood. Fixture shall have plastic coated glass.

- C. Unit shall have NSF label and UL label in accordance with NFPA-96.
- D. Provide variable exhaust system controller as specified below.
- E. Manufacturers:
 - 1. Kees Incorporated
 - 2. Econovent
 - 3. Captive Aire
 - 4. Accurex (Greenheck)

2.02 AIR TERMINALS - GRILLES AND REGISTERS

- A. Reference to a grille means an air supply, exhaust or transfer device without a damper.
- B. Reference to a register means an air supply, exhaust or transfer device with a damper.
- C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.
- D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- E. The capacity and size of the unit shall be as shown on the drawings.
- F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10⁻¹² watts with a 10 dB room effect. Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70.
- G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.
- H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.
- I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.
- J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.
- K. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.
- L. Manufacturers:
 - 1. Tuttle & Bailey
 - 2. Titus
 - 3. Price
 - 4. Nailor
 - 5. Carnes
 - 6. Metalaire
 - 7. Krueger
 - 8. Anemostat
 - 9. Raymon Donco

2.03 AIR TERMINALS - ARCHITECTURAL SQUARE PANEL DIFFUSERS

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect.
- F. Diffusers shall be architectural solid square panel and flush with ceiling.
- G. The exposed surface shall be smooth, flat and free of visible fasteners. The face panel shall be 22 gauge steel with a rolled edge or shall be 18 gauge with a smooth ground, uniform edge.
- H. The back pan shall be one piece 22 gauge stamped and shall include an integral inlet. (Welded inlets and corner joints are not acceptable).
- I. Diffusers with a 24x24 back pan shall have a minimum 18x18 face panel size. Diffusers with a 12x12 back pan shall have a minimum 9x9 face panel size.
- J. The face panel shall be mechanically fastened to the back panel with steel components. (Plastic fasteners are not acceptable.)
- K. Manufacturers:
 - 1. Tuttle & Bailey
 - 2. Titus
 - 3. Price
 - 4. Nailor
 - 5. Carnes
 - 6. Metalaire
 - 7. Krueger
 - 8. Anemostat
 - 9. Raymon Donco

2.04 AIR TERMINALS - SQUARE MODULAR CORE DIFFUSERS

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to bid date. Submission of bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect. .

- F. Modular core diffusers shall consist of an outer frame assembly to facilitate mounting and shall include an integral square collar to allow connection to the square duct. Where shown on the drawings, the diffuser shall be supplied with a square to round adapter. Flat-oval inlets are not acceptable for connection to flexible ducts.
- G. The diffuser core shall consist of fixed louver directional modules that may be field adjusted from the diffuser face without any type of tools or mechanical device for four-way horizontal discharge airflow.
- H. Each louvered module shall be removable to allow access to any damper or other component in or near the diffuser neck.
- I. The core's blade spacing shall be 1 inch on center.
- J. Manufacturers:
 - 1. Tuttle & Bailey
 - 2. Titus
 - 3. Price
 - 4. Nailor
 - 5. Carnes
 - 6. Metalaire
 - 7. Krueger
 - 8. Anemostat
 - 9. Raymon Donco

2.05 LOUVERS - HORIZONTAL BLADE WIND DRIVEN RAIN FIXED - ALUMINUM

- A. Louvers shall be minimum 4" deep and constructed of extruded aluminum. Frame thickness shall be minimum 0.081". Blade thickness shall be 0.60".
- B. Blades shall be a horizontal, compound sinusoidal type arrangement spaced approximately 2" apart.
- C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.
- D. Size, cfm, finish, and pressure drop for louvers shall be as scheduled on the drawings.
- E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.35" pressure drop.
- F. AMCA Certified Wind Driven Rain performance shall be as follows:
 - 1. 50 MPH wind and 8" per hour rainfall at 500 FPM free area velocity: Minimum 98.4% and Class B effectiveness.
- G. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.
- H. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.
- I. Louvers shall be suitable for duct connection.
- J. Manufacturers:
 - 1. Ruskin - "420DD"
 - 2. Greenheck - "EHH-401"
 - 3. United Enertech D-HV-4

2.06 GOOSENECKS

- A. Fabricate in accordance with SMACNA Duct Construction Standards of minimum 18 gauge galvanized steel.
- B. Mount on minimum 12 inch high curb base.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General Installation Requirements:
 - 1. Install items in accordance with manufacturers' instructions.
 - 2. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
 - 3. Install diffusers to ductwork with air-tight connections.
 - 4. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.
 - 5. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.
- B. Volume Damper:
 - 1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.
- C. Maintaining Duct Cleanliness:
 - 1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 230500.

END OF SECTION 233700

SECTION 235400
FORCED AIR FURNACES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Forced Air Furnaces.
- B. Refrigerant Cooling Coil and Condensing Unit.
- C. Controls.

1.02 QUALITY ASSURANCE

- A. Conform to requirements of UL and applicable codes.
- B. Cooling system tested and rated per AHRI Standard 210.
- C. Conform to ASHRAE 90.1.

1.03 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. AHRI 210 - Standard for Unitary Air-Conditioning Equipment.

1.04 SUBMITTALS

- A. Submit shop drawings and product data per Section 230500 showing dimensions, connections, arrangement, accessories, and controls.
- B. Submit manufacturer's installation instructions.
- C. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Bryant
- B. Carrier
- C. Lennox
- D. Trane
- E. Daikin
- F. Rheem

2.02 TYPE

- A. Provide upflow type with .
- B. Provide self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls, air filter, refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.

2.03 FABRICATION

- A. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- B. Combustion Chamber: Pre-cast refractory.

- C. Supply Fan: Centrifugal type, rubber mounted with direct drive, rubber isolated 1750 rpm, 4-speed motor.
- D. Air Filters: 1" thick glass fiber, disposable type arranged for easy replacement.

2.04 BURNER

- A. Performance: Minimum 95% efficiency natural gas burner. Refer to mechanical schedules for capacity and type.
- B. Gas Burner: Condensing sealed combustion type, combustion gas valve and pressure regulator incorporating manual shutoff, standing pilot, pilot valve, automatic 100% shutoff, and thermocouple pilot safety device. 90% minimum efficiency.
- C. Gas Burner Safety Controls: Thermocouple sensor prevents opening solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

2.05 OPERATING CONTROLS

- A. Provide low voltage, adjustable room thermostats to control burner operation.
- B. Provide high limit control, with fixed stop at maximum permissible setting, to de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- C. Control supply fan based on bonnet temperature independent of burner controls. Include manual switch for continuous fan operation.

2.06 DRAFT CONTROL

- A. Provide each furnace with PVC combustion air inlet and CPVC outlet piping.
- B. For oil burner, provide barometric draft regulator in flue.
- C. Provide induced draft blower. Pressure switch prove blower operation before allowing gas valve to open. Draft blower shall only operate during heating cycle.

2.07 EVAPORATOR COIL

- A. Mount in furnace supply plenum, copper tube, aluminum fin, coil assembly, and refrigerant piping connections.
- B. Install a drain pan under each cooling coil per ASHRAE 62.1. Extend drain pans the entire width of each coil, including piping and header if in the air stream, and from the upstream face of each coil to a distance 1/2 of the vertical coil height downstream from the downstream face. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.
- C. Provide factory installed thermostatic expansion valve.

2.08 REFRIGERATION PACKAGE

- A. Compressor: Hermetically sealed, 3,600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, hard start kit, motor thermal overload protection, service valves, and drier.
- B. Air Cooled Condenser: Aluminum fin and copper tube coil, direct drive propeller fan resiliently mounted, galvanized fan guard.
- C. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

2.09 REFRIGERATION OPERATING CONTROLS

- A. Low voltage, room thermostat controls compressor, condenser fan, and supply fan. Refer to Section 230900 for thermostat description.
- B. Include thermostat system selector switch (heat-cool-off) and fan control switch (on-auto).
- C. Timer shall limit compressor starts to 12 per hour.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount counterflow furnaces on combustible floors, on additive base.
- B. Mount air cooled condenser package on concrete pad.

END OF SECTION 235400

SECTION 236213
AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Condensing Unit Package.
- B. Charge of Refrigerant and Oil.
- C. Controls and Control Connections.
- D. Refrigerant Circuit.
- E. Motor Starters.
- F. Electrical Power Connections.

1.02 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/UL - Safety for Heating and Cooling Equipment.
- C. AHRI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- D. ASHRAE 23 - Methods of Testing for Rating Positive Displacement Condensing Units.

1.03 SUBMITTALS

- A. Submit shop drawings per Section 230500 indicating components, assembly, dimensions, weights and loadings, required clearances, location and size of field connections, rated capacities, and electrical nameplate data. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system. Piping diagrams shall apply specifically to this job. Include description of capacity control logic and interface with building control system.
- B. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- C. Submit operation and maintenance data including start-up instructions, maintenance instructions, parts lists, controls, and accessories.
- D. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units on site from physical damage. Protect coils.

1.05 WARRANTY

- A. Provide a one-year parts and labor warranty. Compressors shall have an additional four year warranty covering all material and labor costs for compressor repair or replacement at the Owner's option.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Units: Self-contained, packaged, factory assembled and wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, hail guards and screens.
- B. Construction and Ratings: In accordance with AHRI 210/240 and ANSI/UL 207 and 303. Testing shall be in accordance with ASHRAE 14.
- C. Performance Ratings: EER and COP meeting ANSI/ASHRAE 90.1.

2.02 COMPRESSORS

- A. Construction: Semi-hermetic or hermetic scroll type with suction and discharge valves.
- B. Mounting: Dynamically balance rotating parts and mount on vibration isolators.
- C. Lubrication System: Oil pump with oil charging valve, oil level sight glass, oil filter, and magnetic plug or strainer.
- D. Capacity Reduction Equipment: Multiple compressors, and/or multi-speed or variable-speed compressors.
- E. Motor: Suction gas cooled with electronic sensor and winding over temperature protection.
- F. Suitable for operating on voltages plus or minus 15% of nameplate ratings.

2.03 REFRIGERANT CIRCUIT

- A. Refrigerant may be new or reclaimed, and shall meet ARI-700-2004 Standard for Refrigerant Purity.
- B. Provide each unit with the number of refrigerant circuits needed to provide the scheduled unloading and properly transport oil.
- C. Provide the following for each refrigerant circuit:
 - 1. Replaceable core type filter dryer.
 - 2. Liquid line sight glass and moisture indicator.
 - 3. Thermal expansion valve.
 - 4. Insulated suction line.
 - 5. Suction and liquid line service valves.
 - 6. Schraeder valve.
 - 7. Condenser pressure relief valve.
 - 8. Suction filter.
 - 9. Liquid line solenoid valve.
- D. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control using thermistors.
- E. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

2.04 CONTROLS

- A. On unit, mount NEMA 4 steel control panel containing power and control wiring, factory wired with single point power connection.
- B. For each compressor, provide across-the-line starter, factory wired non-fused disconnects, non-recycling compressor overload, starter relay, and control power transformer. For each condenser fan, provide across-the-line starter with starter relay.

- C. Provide the following safety controls arranged so operating any one will stop unit:
 - 1. Manual reset high discharge pressure switch for each compressor.
 - 2. Automatic reset low suction pressure switch for each compressor.
 - 3. Manual reset oil pressure switch.
- D. Provide the following operating controls:
 - 1. Timer(s) that prevents compressor short cycling.
 - 2. Low ambient temperature (as scheduled) thermostat to lock out compressor.
 - 3. If discharge or return air control is provided with the unit, provide adjustable time delay between stages of operation. All units shall be compatible with direct control of staging by DDC systems. Suction pressure control of staging is not acceptable.
 - 4. Pump down control that activates when the lead compressor of each circuit stops.
 - 5. Head pressure controlled damper or variable speed fan control on first stage condenser fan. Rated for starting at 0F.

2.05 MANUFACTURERS

- A. Trane
- B. York
- C. Daikin
- D. Carrier
- E. Units shall be of the same manufacturer as the evaporator coil.

2.06 REMOVABLE FILTER SCREEN

- A. Description: Removable, washable cottonwood airborne matter screen compatible with equipment intake.
- B. Submittal: Filter screen shall be included by equipment manufacturer to ensure equipment airflow/capacity is coordinated with screen.
- C. Filter Material: Flexible, UV resistant fine polyester screen.
- D. Fasteners: Commercial plastic/polyester twist lock fasteners fastened to equipment using self-tapping screws w/ bonded washer.
- E. Approved Manufacturers:
 - 1. By Equipment Manufacturer
 - 2. Air Solution Company

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comb all condenser coils to repair bent fins.
- C. Install on vibration isolators as scheduled on the drawings or in Section 230548.
- D. Connect to refrigeration piping and evaporators.

3.02 MANUFACTURER'S FIELD SERVICES

- A. Provide initial start-up by factory authorized service representatives. Adjust units to provide proper superheat.
- B. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil during the warranty period.

END OF SECTION 236213

SECTION 238200
TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Electric Cabinet Heaters.

1.02 QUALITY ASSURANCE

- A. All electrical equipment shall have a UL label.
- B. All gas fired units shall be AGA approved or UL listed.
- C. All gas trains shall comply with utility company and code requirements.

1.03 REFERENCES

- A. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/NFPA 70 - National Electrical Code.
- D. ASHRAE 200 - Methods of Testing Chilled Beams

1.04 SUBMITTALS

- A. Submit shop drawings per Section 230500.
- B. Submit catalog data including arrangements, cross sections of cabinets, grilles, bracing, typical elevations.
- C. Submit schedules of equipment and enclosures indicating length, number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, and comparison of specified to actual heat output.
- D. Indicate mechanical and electrical service locations and requirements. Show deviations from scheduled products.
- E. Submit manufacturers' installation instructions.
- F. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- G. Where color selection by Architect is necessary, provide physical color charts for color selection directly to the Architect. Electronic color charts are not acceptable.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.06 REGULATORY REQUIREMENTS

- A. Conform to ASHRAE 90.1.

1.07 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data. Include operating, installation, maintenance and repair data, and parts listings.

PART 2 - PRODUCTS

2.01 ELECTRIC CABINET HEATERS

- A. Forced air wall mounted heaters shall include cabinet, fan, motor, coil, inlet grille and discharge grille.
- B. Coil: Electric dual element with finned steel sheaths.

- C. Motor: Fan motor voltage shall be as scheduled on the drawings. Motors shall be permanently lubricated, direct drive.
 - 1. Electronically commutated motor (ECM).
 - 2. Permanent split capacitor type motor.
- D. Power connections, circuit breaker, or disconnect shall be provided by the E.C.
- E. Units shall have 1" disposable filters ahead of all coils.
- F. Cabinets shall have 16 gauge exposed surfaces, 18 gauge concealed surfaces, and no exposed plastic parts.
- G. Baked enamel finish. Color selected by Architect.
- H. Manufacturers:
 - 1. Trane
 - 2. Berko
 - 3. Redd-i
 - 4. QMark

2.02 ELECTRIC UNIT HEATERS

- A. Horizontal or vertical discharge as scheduled on the drawings.
- B. Horizontal units shall have adjustable outlet louvers.
- C. Metal sheathed fin tube electric heating elements.
- D. Casing: Heavy gauge steel with baked enamel finish.
- E. Automatic reset thermal overload wired for instantaneous pilot operation of contactor holding coil.
- F. Motors shall be totally enclosed continuous duty with built-in thermal overload protection.
- G. Provide unit mounted and wired disconnect.
- H. Provide resiliently mounted fan guard/motor support.
- I. Fans: Direct drive propeller type, factory balanced.
- J. Manufacturers:
 - 1. Trane
 - 2. Chromalox
 - 3. Modine
 - 4. Reznor
 - 5. Berko
 - 6. Redd-i
 - 7. QMark

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General Installation Requirements:
- B. Install all products per manufacturers' instructions.
 - 1. Coordinate recess sizes for recessed equipment.
 - 2. Comb all coils to repair bent fins.

3.02 CLEANING

- A. After construction is complete, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, with materials furnished by manufacturer.
- C. Install new filters.

END OF SECTION 238200

SECTION 260500
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 270528.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

1.03 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Description of Systems shall be as follows:
 - 1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
 - 2. Grounding system.
 - 3. Security system.
 - 4. Wiring system for temperature control system as shown on the drawings.
 - 5. Wiring of equipment furnished by others.
 - 6. Removal work and/or relocation and reuse of existing systems and equipment.
 - 7. Technology Systems as described in Division 27/28 and on the T-series documents as described in the Suggested Matrix of Scope Responsibility.
- E. Work Not Included:
 - 1. Telecommunications cabling will be by Division 27, in raceways and conduits furnished and installed as part of the Electrical work.
 - 2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.04 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.
- B. Itemize all work and list associated hours and pay scale for each item.

1.05 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, and CONTROL CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
 2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
 3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
 4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
 5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
 7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
 8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
 9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
 10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Luminaires.
 - b. Gravity flow piping, including steam and condensate.
 - c. Sheet metal.
 - d. Cable trays, including access space.
 - e. Other piping.
 - f. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.

2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
 3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
 4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- G. General (Electrical/Technology):
1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".
 2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.
 3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
 4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
 5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.
- H. Technology Contractor's Responsibility:
1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
 2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
 3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
 4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.06 QUALITY ASSURANCE

- A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:
 - 1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
 - 2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.
- B. Qualifications:
 - 1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
 - 2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.
- C. Compliance with Codes, Laws, Ordinances:
 - 1. Conform to all requirements of the State of Iowa Codes, Laws, Ordinances and other regulations having jurisdiction.
 - 2. Conform to all published standards of IDAS.
 - 3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
 - 4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
 - 5. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
 - 6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 - 7. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.
- D. Permits, Fees, Taxes, Inspections:
 - 1. Procure all applicable permits and licenses.
 - 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 - 3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
 8. Pay all telephone company charges related to the service or change in service.
- E. Examination of Drawings:
1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
 3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
 4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
 5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
 6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
 7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
 8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
 9. Any item listed as furnished shall also be installed unless otherwise noted.
 10. Any item listed as installed shall also be furnished unless otherwise noted.
- F. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
 4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.

5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.07 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced

Specification Section	Submittal Item
26 09 33	Lighting Control System
26 24 16	Panelboards
26 24 19	Motor Control
26 27 26	Wiring Devices
26 28 16	Disconnect Switches
26 51 19	LED Lighting

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number

- c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
- a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.

- 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
- a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal, excluding mailing.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.
- C. Electronic Submittal Procedures:
- 1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 26 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.08 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.09 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
 1. Distribution equipment - branch panels, distribution panels, switchboards, motor control centers, etc.
 2. Lighting luminaires and lighting control systems.
- C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.
- D. Keep all materials clean, dry and free from damaging environments.
- E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, they shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.
- B. The following network connected equipment shall be equipped with restricted access protocols:
 - 1. Electrical controls
 - 2. Lighting control system

1.11 WARRANTY

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.12 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.13 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.

- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.01 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
 - 2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.
- B. Excavation:
 - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
 - 2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
 - 3. Trim bottom and sides of excavations to grades required for foundations.
 - 4. Protect excavations against frost and freezing.
 - 5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
 - 6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
 - 7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
 - 8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.

9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

D. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.

3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. All junction boxes are closed and identified in accordance with Section 260553 Electrical Identification.
 - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
 - c. Luminaire whips are supported above the ceiling.
 - d. Conduit identification is installed in accordance with Section 260553 Electrical Identification.
 - e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
 - f. All wall penetrations have been sealed.
2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.04 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Pre-Occupancy Requirements:
 1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.
- C. Final Jobsite Observation:
 1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
 4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.
- D. The following must be submitted before Architect/Engineer recommends final payment:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up or reproducible drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.

4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed and submit receipt to Architect/Engineer.
 5. Inspection and testing report by the fire alarm system manufacturer.
 6. Start-up reports on all equipment requiring a factory installation or start-up.
- E. Circuit Directories:
1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. General:
1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div26.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
 6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
 7. All text shall be searchable.
 8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

- C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
 4. Copies of all factory inspections and/or equipment startup reports.
 5. Copies of warranties.
 6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
 7. Dimensional drawings of equipment.
 8. Detailed parts lists with lists of suppliers.
 9. Operating procedures for each system.
 10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
 11. Repair procedures for major components.
 12. Replacement parts and service material requirements for each system and the frequency of service required.
 13. Instruction books, cards, and manuals furnished with the equipment.
 14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
 15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- B. The instructions shall include:
1. Maintenance of equipment.
 2. Start-up procedures for all major equipment.
- C. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- D. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.
- E. Operating Instructions:
1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
 2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

3.08 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.
- C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect the color preference before ordering.

3.09 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.11 SYSTEM STARTING AND ADJUSTING

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.12 FIELD QUALITY CONTROL

- A. General:
 - 1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
 - 2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
 - 3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
 - 4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
 - 5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
 - 6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.
- B. Ground Resistance:
 - 1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
 - 2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain.

3. If the ground resistance value obtained is more than the value set forth in Section 260526, the following shall be done to obtain the value given:
 - a. Verify that all connections in the service ground system are secure.
 - b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
 - c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
 - d. Review results with the Architect/Engineer.
4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:
 - a. Date of test.
 - b. Number of hours since the last rain.
 - c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
 - d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
 - e. Make, model, and calibration date of test equipment.
 - f. Tabulation of measurements taken and calculations made.
- C. Ground-Fault Equipment Performance Testing:
 1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:
 - a. Outside branch circuits and feeders.
 - b. Code required.
 2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- D. Other Equipment:
 1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
- E. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.
- F. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.
- G. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

- H. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to requesting a final job observation.

1. Electrical panels have typed circuit identification.
2. Per Section 260500, cable insulation test results have been submitted.
3. Operation and Maintenance manuals have been submitted as per Section 260500.
4. Bound copies of approved shop drawings have been submitted as per Section 260500.
5. Report of instruction of Owner's representative has been submitted as per Section 260500.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 260500

SECTION 260513
WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Building Wire - Copper

1.02 RELATED WORK

- A. Section 260553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.03 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

PART 2 - PRODUCTS

2.01 BUILDING WIRE - COPPER

- A. The basis of design is copper conductor.
- B. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- C. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.
- D. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.
- E. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
- F. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.02 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS

- A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
 - 1. Low voltage switching and lighting control
 - 2. Electronic control
 - 3. Other specialized cabling, signal, and power limited cabling. Refer to the appropriate Division 23, 27, or 28 requirements; including, but not limited, to the following:
 - a. Information Technology Backbone and Horizontal Cabling, Division 27.
 - b. Television Distribution Systems CATV, Division 27.
 - c. Electronic Access Control, Intrusion Detection Systems, Video Surveillance, Division 28.
- B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60C, individual conductors twisted together, shielded, and covered with a PVC jacket.
- C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

PART 3 - EXECUTION

3.01 WIRE AND CABLE INSTALLATION SCHEDULE

- A. Above Accessible Ceilings:
 - 1. Building wire shall be installed in raceway.
- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".
- D. Underground or In Slab: All conductors shall be type "THWN".

3.02 CONTRACTOR CHANGES

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if other than the basis of design.
- B. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.
- C. Record drawing shall include the calculations and sketches.

3.03 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.
- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.
- D. Use no wire smaller than 8 AWG for outdoor lighting branch circuits.
- E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.
- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks, and label the spare conductors.
- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.04 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.

3.05 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.06 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
 - 1. Facing the front and operating side of the equipment, the phase identification shall be:
 - a. Left to Right - A-B-C
 - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

3.07 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. Inspect wire and cable for physical damage and proper connection.
- D. Torque test conductor connections and terminations to manufacturer's recommended values.
- E. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- F. Protection of wire and cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.
- G. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION 260513

SECTION 260526
GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Equipment grounding system
- B. Bonding system
- C. Grounding electrode system

1.02 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

1.03 SUMMARY

- A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 - PRODUCTS

2.01 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section 260513 "Wire and Cable".
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 260553 for insulation color.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.02 CONNECTOR PRODUCTS

- A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Hydraulic compression type, in kit form, and selected per manufacturer's written instructions.
- C. Bolted Connectors: Bolted-pressure-type connectors.

2.03 GROUNDING ELECTRODES

- A. Ground Rods Copper-clad steel.
- B. Ground Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4" in diameter by 120 inches per section.

PART 3 - EXECUTION

3.01 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Underground Connections: Hydraulic compression connection. Use for underground connections, except those at test wells.
- E. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.02 INSTALLATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.
- C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.
- D. In raceways, use insulated equipment grounding conductors.
- E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.03 EQUIPMENT GROUNDING SYSTEM

- A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.
- B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by Electrical Code:
 - 1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
 - 2. Single-phase and three-phase motor and appliance branch circuits.
- D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.04 BONDING SYSTEM

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.
- B. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.
- C. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.
- D. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- E. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.
- F. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.
- G. Equipment Ground Conductor Continuity: All spliced equipment grounding conductors in junction boxes, cabinets, and distribution equipment shall be connected together and bonded to the metal enclosure.
- H. Metal Poles Supporting Outdoor Lighting Fixtures Greater than 15 Feet: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.05 GROUNDING ELECTRODE SYSTEM

- A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
- B. Metal Water Service Pipe: Provide 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 by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- C. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filtering devices, and similar equipment. Connect to pipe with grounding clamp connectors.

- D. Natural Gas Service Piping: Bond to natural gas main service with grounding clamp connectors. Bonding conductor shall be connected to the main service ground bar. Provide grounding jumpers around all breaks in metallic continuity.
- E. Natural Gas Equipment Piping: Bond each aboveground portion of natural gas metallic piping system at each equipment location with grounding clamp connectors. Bonding shall be performed after any flexible attachment nearest the equipment. The equipment grounding conductors may serve as the bonding means.

3.06 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
 - 1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.

END OF SECTION 260526

SECTION 260527
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conduit and Equipment Supports
- B. Fastening Hardware

1.02 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.03 COORDINATION

- A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Allied Support Systems
- B. Cooper B-Line
- C. Erico, Inc.
- D. Hilti
- E. Power Fasteners
- F. Orbit Industries

2.02 MATERIAL

- A. Support Channel: Hot-dip galvanized for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:
 - 1. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts and Assemblies.
 - 2. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
- D. Truss and Joist Support System: Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
 - 1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
 - 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 - 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.

4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. Cable Ties for Cable Management Systems:
 1. Cables ties, UL Listed, Type 21 or Type 21S, and test to UL Standard 62275 for Cable Management Systems.
 2. Acceptable Applications: Low Voltage Wire and Cabling.
 - a. Bundle wires and cables within cable trays, auxiliary gutters, and similar applications.
 - b. Organize and support wiring and cables within equipment and distribution systems.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- E. Do not use powder-actuated anchors without specific permission.
- F. Do not drill structural steel members.
- G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.
- I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- L. Refer to Section 260533 for special conduit supporting requirements.

3.02 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION 260527

SECTION 260533
CONDUIT AND BOXES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Rigid metallic conduit and fittings (RMC)
- B. Electrical metallic tubing and fittings (EMT)
- C. Flexible metallic conduit and fittings (FMC)
- D. Liquidtight flexible metallic conduit and fittings (LFMC)
- E. Rigid polyvinyl chloride conduit and fittings (PVC)
- F. Wall and ceiling outlet boxes
- G. Electrical connection
- H. Pull and junction boxes
- I. Accessories

1.02 RELATED WORK

- A. Section 260553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.03 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
 - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
 - 3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
 - 4. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
- B. NECA "Standards of Installation"
- C. National Electrical Manufacturers Association (NEMA):
 - 1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
 - 2. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
- D. NFPA 70 - National Electrical Code (NEC)
- E. Underwriters Laboratories (UL): Applicable Listings
 - 1. UL 1 - Flexible Metal Conduit
 - 2. UL 6 - Rigid Metal Conduit
 - 3. UL 360 - Liquid Tight Flexible Steel Conduit
 - 4. UL514-B - Conduit Tubing and Cable Fittings
 - 5. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
 - 6. UL797 - Electrical Metal Tubing
- F. Definitions:
 - 1. Fittings: Conduit connection or coupling.
 - 2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.

3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.

PART 2 - PRODUCTS

2.01 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

- A. Manufacturers:
 1. Atkore Allied Tube & Conduit
 2. Nucor
 3. Electroline
 4. Western Tube
 5. Wheatland Tube Co
 6. or approved equal.
- B. Manufacturers of RMC Conduit Fittings:
 1. ABB/Thomas & Betts
 2. Eaton/Crouse-Hinds
 3. Electroline
 4. Emerson Appleton & OZ Gedney
 5. Hubbell Raco and Killark
 6. NSI Bridgeport
 7. Orbit Industries
 8. Wesco Regal
 9. or approved equal.
- C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.
- D. Fittings and Conduit Bodies:
 1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
 2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
 3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.

4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.02 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.
- B. Manufacturers of EMT Conduit:
 1. Allied Tube & Conduit
 2. Calbond Calpipe
 3. Nucor
 4. Electroline
 5. Western Tube
 6. Wheatland Tube Co
 7. or approved equal.
- C. Fittings and Conduit Bodies:
 1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
 2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
 3. Larger than 2": Compression type of steel designed for their specific application.
 4. Manufacturers of EMT Conduit Fittings:
 - a. ABB/Thomas & Betts
 - b. Eaton/Crouse-Hinds
 - c. Electroline
 - d. Emerson Appleton & OZ Gedney
 - e. Hubbell Raco and Killark
 - f. NSI Bridgeport
 - g. Orbit Industries
 - h. Wesco Regal
 - i. or approved equal.

2.03 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.
- B. Manufacturers:
 1. ABB/Thomas & Betts
 2. Anamet Electrical
 3. Atkore American Flex AFC and Flexicon
 4. Electri-Flex Co

5. Electroline
 6. Southwire Alflec
 7. or approved equal.
- C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.
- D. Fittings and Conduit Bodies:
1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.
 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
 3. Manufacturers:
 - a. ABB/Thomas & Betts
 - b. Eaton/Crouse-Hinds
 - c. Electroline
 - d. Emerson Appleton & OZ Gedney
 - e. Hubbell Raco and Killark
 - f. NSI Bridgeport
 - g. Orbit Industries
 - h. Wesco Regal
 - i. or approved equal.

2.04 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

- A. Manufacturers:
1. ABB/Thomas & Betts
 2. Anamet Electrical
 3. Atkore American Flex AFC and Flexicon
 4. Electri-Flex Co
 5. Electroline
 6. Southwire Alflec
 7. or approved equal.
- B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.
- C. Fittings and Conduit Bodies:
1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
 3. Manufacturers:
 - a. ABB/Thomas & Betts
 - b. Eaton/Crouse-Hinds

- c. Electroline
- d. Emerson Appleton & OZ Gedney
- e. Hubbell Raco and Killark
- f. NSI Bridgeport
- g. Orbit Industries
- h. Wesco Regal
- i. or approved equal.

2.05 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

- A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers:
 - 1. ABB/Carlson
 - 2. Chevron Phillips Chemical Company
 - 3. Cantex, J.M. Mfg.
 - 4. Atkore Heritage Plastics
 - 5. or approved equal.
- C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90C.
- D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.06 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.
- B. Cast Boxes: NEMA FB1, Type FD, Aluminum, cast ferrous alloy, or stainless steel deep type, gasketed cover, threaded hubs.
- C. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.
- D. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
- E. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- F. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.07 ECONN; ELECTRICAL CONNECTION

- A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.08 JB; PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.
- E. Flanged type boxes shall be used where installed flush in wall.

2.09 HANDHOLES

- A. HH-#; Handhole, composite polymer concrete body and cover. Stainless steel hardware. Bolted non-skid cover rated for 5,000 pounds. Design load occasional non-deliberate vehicular traffic. Stack units to achieve depth shown on plans. Units in landscaped areas shall be green in color. 11"W, 18"L, 18"D or dimensions as shown on plans.
 - 1. Manufacturers:
 - a. Hubbell/Quazite PG####BB18
 - b. Carson Industries H Series
 - c. Armorcast
 - d. Highline Products
 - e. Synertech

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.
- B. Installation Schedule: Refer to drawings.
- C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- D. Minimum Conduit Size (Unless Noted Otherwise):
 - 1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)

2. Below Grade 5' or less from Building Foundation: 3/4 inch.
 3. Below Grade More than 5' from Building Foundation: 3/4 inch.
 4. Telecommunication Conduit: 1 inch.
 5. Controls Conduit: 1/2 inch.
- E. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.02 CONDUIT ARRANGEMENT

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed.
- C. Conduit shall not share the same cell as structural reinforcement in masonry walls.
- D. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- E. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- F. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.03 CONDUIT SUPPORT

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.
1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.
- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.
- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.
- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- K. Finish:
 - 1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
 - 2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.04 CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
 - 2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
 - 3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
 - 4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.
- B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.
- C. Conduit Bends:
 - 1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.

2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360 degrees), including those bends located immediately at the outlet or body.
4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
 - a. A third bend is acceptable if:
 - 1) The total run is not longer than (33) feet.
 - 2) The conduit size is increased to the next trade size.
5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90-degree equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. .
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.

8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20F to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system.
9. Do not route conduits across each other in slabs on grade.
10. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40F.
11. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
12. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
13. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
14. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
15. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

3.05 CONDUIT TERMINATIONS

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.
- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.06 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION

- A. Conduit shall be installed away from high temperature piping and equipment.
- B. Conduit shall be installed to prevent exposure to ultraviolet radiation.
- C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.
- D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.
- E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the Electrical Code but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

3.07 UNDERGROUND CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
 - 1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
 - 2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.
- C. Conduit Elbows (vertical):
 - 1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.
- D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.
- E. Conduit Placement:
 - 1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
 - 2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
 - 3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum $f'c = 2500$ and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
 - 4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
 - 5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.

6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
- F. Raceway Seal (Exterior to Raceway):
 1. All power, telecommunication, electrical conduits and innerducts shall be sealed between the raceway and the building foundation. The raceway penetration shall be sealed liquid-tight, water-tight, non-corrosive.
 2. Below Grade Installation Options:
 - a. Cast-in-place concrete installation.
 - b. Hydraulic cement, hydraulic grout, hydraulic epoxy.
 - c. Foundation - Underground Sleeves and Seals; refer to Part 2-Products for product information.
 3. Above Grade Installation Options:
 - a. Masonry grout for masonry applications.
 - b. Caulk Sealant, interior/exterior rated, color per architect.
- G. Raceway Seal (Interior to Raceway, with Cables or Empty):
 1. All power, telecommunication, electrical conduits and innerducts, including those with cables, shall be sealed at the building and vault entry. The seal shall prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceways shall also be sealed.

3.08 BOX INSTALLATION SCHEDULE

- A. Galvanized steel boxes may be used in:
 1. Concealed interior locations above ceilings and in hollow studed partitions.
 2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
 3. Recessed in stud wall of kitchens and laundries.
- B. Cast boxes shall be used in:
 1. Exterior locations.
 2. Exposed interior locations within 8' of the highest platform level.
 3. Direct contact with earth.
 4. Wet locations.
 5. Kitchens and laundries when exposed on wall surface.

3.09 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.10 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls.
 - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls.
 - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.
- C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
- D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
- E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- I. Install boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
- K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
- L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.11 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.
- C. Do not install boxes back-to-back in walls.
 - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls.

END OF SECTION 260533

SECTION 260553
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Adhesive Markings and Field Labels
- B. Nameplates and Signs
- C. Product Colors

1.02 RELATED SECTIONS AND WORK

- A. Section 260500 - Basic Electrical Requirements

1.03 REFERENCES

- A. NFPA 70E - Standard for Electrical Safety in the Workplace
- B. NFPA 70 - National Electrical Code (NEC)
- C. ANSI A13.1 - Standard for Pipe Identification
- D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.04 QUALITY ASSURANCE

- A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

PART 2 - PRODUCTS

2.01 ADHESIVE MARKINGS AND FIELD LABELS

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Lighting, Power, HVAC, Communications, Control, Fire).
 - 1. Label Size as follows:
 - a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).
 - 2. Color: As specified for various systems.
- B. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- C. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.
- D. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- E. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Font: Normal 721 Swiss Bold
 - b. Adhesive Labels: 3/16 inch minimum text height
 - c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

2.02 NAMEPLATES AND SIGNS

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Text Height: 3/8 inch minimum
- C. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.03 PRODUCT COLORS

- A. Adhesive Markings and Field Labels:
 - 1. All Labels: Black letters on white face

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as required by code.
- B. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.
- C. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- E. Circuit Identification: Tag or label conductors as follows:
 - 1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
 - 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
 - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

- F. Apply Danger, Warning, Caution and instruction signs as follows:
1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
 3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
 4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
 5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- G. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- H. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- I. Install ARC FLASH WARNING signs on all branch panelboards.
1. Sample Label:

! WARNING
ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED
FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
REFER TO NFPA 70E
- J. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Limit line markers to direct-buried cables.

3.02 FEEDER AND BRANCH CIRCUIT DIRECTORIES

- A. Product:
1. Adhesive labels and field markings
 2. Nameplates and signs

- B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:
 - 1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
 - 2. Location: Room name, number, location.
- C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover.

3.03 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

- A. Product:
 - 1. Adhesive labels and field markings
 - 2. Nameplates and signs
- B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.
- C. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

3.04 CONDUIT AND EXPOSED CABLE LABELING

- A. Product:
 - 1. Adhesive labels and field markings
- B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 25 foot (7.5 meter) intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:
 - 1. Grounding: Indicate "GROUND" and equipment and designation.
 - 2. Security System: Indicate "Security".
 - 3. Telephone System: Indicate "Telephone".
- C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

3.05 BOX LABELING

- A. Products:
 - 1. Adhesive labels and field markings
- B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers. In rooms that are painted out, provide labeling on inside of cover.
- C. All junction, pull, and connection boxes shall be identified as follows:
 - 1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").

3.06 CONDUCTOR COLOR CODING

- A. Products:
 - 1. All wire and cables shall be color coded by the manufacturer.
 - 2.
- B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.
- C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.
- D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.
- E. Conductors shall be color coded as follows:
 - 1. 120/240 Volt, 3-Wire:
 - a. A-Phase - Black
 - b. B-Phase - Red
 - c. Neutral - White
 - d. Ground Bond - Green
 - 2. Grounding Conductors:
 - a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
 - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
 - 3. Cabling for Remote Control, Signal, and Power Limited Circuits:
 - a. Low Voltage Switching: Per manufacturer recommendations and code requirements.
 - b. Audio/Visual Systems: Refer to Division 27.
 - c. Structured Cabling: Refer to Division 27.

3.07 CONTROL EQUIPMENT IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs
- B. Provide identification on the front of all control equipment such as combination starters, starters, contactors, etc.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
- D. Labeling shall include:
 - 1. Equipment type and contract documents designation of equipment being served.
 - 2. Location of equipment being served if it is not located within sight.
 - 3. Voltage and phase of circuit(s).

4. Panel and circuit number(s) serving the equipment.
5. Sample Label:

EXHAUST FAN EF-1 ("LOCATED ON ROOF")
480V, 3-PHASE
FED FROM "1HA1-1"

3.08 EQUIPMENT CONNECTION IDENTIFICATION

- A. Products:
 1. Nameplates and signs
- B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner. The following list of equipment is specifically being listed to receive an equipment connection label; this list does not limit the equipment that shall receive a label:
 1. Mechanical heating, ventilation, and air conditioning equipment; chillers, boilers, pumps, air handling ventilation units, condensing units, unit heaters, and similar equipment
 2. Plumbing equipment
 3. Kitchen equipment (hardwired)
- D. Labeling shall include:
 1. Equipment type and contract documents designation of equipment being served
 2. Location of equipment being served if it is not located within sight.
 3. Voltage and rating of the equipment.
 4. Panel and circuit numbers(s) serving the equipment
 5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
 6. Date of fault current study; refer to one-line diagram
 7. Sample Label:

UNIT HEATER UH-1 ("LOCATED IN STORAGE ROOM 200")
480V: 3-PHASE
FED FROM "1HA1-1"

3.09 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

- A. Products:
 1. Nameplates and signs
- B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.
 1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
 2. Labeling shall include:
 - a. Equipment type and contract documents designation of equipment.
 - b. Voltage of the equipment.

- c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
- d. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").
- e. Sample Label:

PANEL DP-H1
480Y/277V

FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

3.10 ELECTRICAL WORKING CLEARANCE IDENTIFICATION

- A. Products:
 - 1. Safety Yellow paint and custom stencils
- B. Provide custom identification of electrical equipment working clearances in mechanical, electrical, storage, janitorial, and similar non-public areas.
- C. Identification shall include a painted rectangular box (on the finished floor) in front of the electrical equipment to define the code-required working clearance. Provide additional diagonal stripping inside the rectangle box. All painted stripping shall be safety yellow paint with 3 inch wide stripes.
 - 1. Width of area: Width of equipment or as required by code
 - 2. Depth of area: Depth as required by code

3.11 POLE IDENTIFICATION

- A. Product:
 - 1. Adhesive labels and field markings
 - 2. Nameplates and signs
- B. Lighting poles, bollards and overhead distribution poles shall be individually identified with a unique number, for maintenance purposes. Apply the vinyl label number above the hand hole cover or 24" (610mm) above grade. Bollards may be identified with a number applied inside the luminaire that is visible from the exterior.

END OF SECTION 260553

SECTION 260933
LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Lighting Control Overview
- B. Electrical Plan Symbols
- C. Device Color and Coverplates
- D. Standalone Line and Low Voltage Lighting Controls
 - 1. Wall switches and wall dimmers
 - 2. Sensors (occupancy, vacancy, daylighting, photocell, auxiliary power packs, etc.)
- E. Room-Based Lighting Controls (specification grade, commonly distributed controllers, occasionally networked, 'intelligent' controls)

1.02 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of directly comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
 - 1. Specification Section 265119 LED Lighting
 - 2. Electrical Drawings: Electrical Coversheet, plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.03 RELATED WORK

- A. Section 019100 - Commissioning

1.04 QUALITY ASSURANCE

- A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. All components and assemblies are to be factory pre-tested prior to delivery and installation.

1.05 REFERENCES

- A. FS W S 896 Switch, Toggle
- B. NEMA WD 1 - General Color Requirements for Wiring Devices
- C. NEMA WD 7 - Occupancy Motion Sensors
- D. NFPA 70 - National Electrical Code (NEC)

1.06 SUBMITTALS

- A. Submit product data under provisions of Section 260500.
- B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, component replacement instructions, warranty, system software requirements.

- C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form. Sensor coverage patterns shall have a 20% overlap.
- D. Submit a list of devices and equipment that will be installed for each sequence of operation.
- E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, automatic sensors, control stations, dimmer panels, relay panels, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.
- F. Programming Sequences: Provide a copy of the initial lighting control programming sequences in narrative and manufacturer/vendor format.
- G. Lighting Control Stations: The manufacturer/vendor shall provide control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. Label each applicable submittal with the applicable Sequence Of Operation SOO description. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.
- H. Nameplate Labels and Custom Engraving: Submit sample label/engraving text for review for each applicable Lighting Sequence Of Operation SOO. Include reference to applicable SOO description. Provide stencil templates for each device requiring stenciling.
- I. Coordinate integration with mechanical and/or other trades.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit project record documents under provisions of Section 260500.
- B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.08 OPERATION AND MAINTENANCE DATA

- A. Submit emergency, operation, and maintenance data under provisions of Section 260500. Data shall also include the following:
 - 1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
 - 2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
 - 3. Replacement part numbers for all system components.
- B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.
- C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

1.09 SYSTEM DESCRIPTION

- A. Performance Statement: The specification section and lighting design documents describe the minimum material quality, required features, and operational performance requirements of the lighting control system. The documents do not convey every component, relay, wire, and equipment connection required. The Contractor and lighting control manufacturer/vendor are solely responsible for determining all system components, wiring, and programming required for a complete and operational system based on the performance based requirements of the documents.
- B. Lighting Sequence Of Operation (SOO): The Sequence Of Operation (SOO) describes the required lighting control operation and performance in each space. The Sequence Of Operation descriptions are included on the drawings.
- C. Drawings: The drawings include the Sequence Of Operation (SOO), luminaire schedule, location of control devices, sensors, and identification of control zones, and branch power circuiting. Control wiring and manufacturer/vendor specific components are NOT shown, but shall be submitted with the shop drawing submittals.

1.10 COMMISSIONING

- A. The Contractor shall provide all services necessary for compliance with the IECC Section C408 Commissioning. The commissioning shall include, but not be limited to, a commissioning plan, preliminary commissioning report, construction documents, manuals, final commissioning report, and lighting system functional testing.
- B. This project will have selected building systems commissioned. The Contractor is responsible to execute commissioning. The commissioning process, equipment, and systems to be commissioned are defined in Division 1.
- C. The Contractor shall notify the Commissioning Agent, Architect/Engineer and Owner's Representative ten (10) working days prior to scheduled commissioning date.
- D. The commissioning process requires meeting attendance. Refer to Division 1 for meeting requirements.
- E. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation prior to system commissioning. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

1.11 WARRANTY

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.
- B. Automatic (occupancy, vacancy), daylight sensors, and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL OVERVIEW

- A. Lighting Control System: As defined in the System Description, the design documents describe the operational performance requirements of the lighting control system. The Lighting Control System has been categorized into the following groups. Refer to the Electrical Symbol Key, this specification section, and the drawings to determine the appropriate lighting control category when more than one is applicable to the project:
 - 1. Standalone Lighting Control Devices: Independent (standalone) devices traditionally operating at line or low voltage, field configurable with other standalone devices to provide an overall lighting control system.

2. Room-Based Lighting Controls: Integrated system comprised of switch stations, sensors, room controllers, control panels, and accessories, operating at line and/or low voltage, configured as an integrated overall 'intelligent' lighting control system. Lighting control zones and power circuits commonly align.
- B. All system components and materials of similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.
- C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space, unless otherwise noted.

2.02 ELECTRICAL PLAN SYMBOLS

- A. Refer to Electrical Coversheet for Electrical Symbols list and device specification tag.
 1. Standalone Lighting Control Devices: Control station commonly defined by an alpha character with subscripts.
 - a. Example symbol "S", tagged "SW-1P", description "switch- single pole switch".
 - b. Example Control Designation: a, b, c (when required to clarify design intent).
 2. Room-Based Lighting Controls: Control station commonly defined by a rectangle symbol.
 - a. Example Control Station: symbol "#B", tagged "SW-LV", description "Lighting Control Station".
 - b. Example Panel/Rack/Cabinet: tagged "LCPR#", description Room-Based lighting control panel/rack/cabinet.
 - c. Example Control Designations: a, b, c
 3. Sensors, Relays, Accessories: Common plan symbols are used for automatic (occupancy, vacancy), and daylighting sensors. The control designations (a, b, c or z1, z2, z3) and identification of a standalone or #B type control station in the space defines the basis-of-design intent category of the lighting control sensors and accessories.
 - a. Example, a standalone automatic sensor SW-OC-## or SW-VC-## device is the basis of design when shown in the same room as a standalone S (SW-1P) single pole light switch with or without a, b, c control designations.
 - b. Example, a Room-Based Lighting automatic sensor SW-OC-## or SW-VC-## device is the basis of design when shown in the same room as a #B (SW-#B) lighting control station with or without a, b, c control designations.

2.03 DEVICE COLOR AND COVERPLATES

- A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space. When the coverplate is proprietary to the device/manufacturer and do not match the wiring device coverplates, the architect shall select the coverplate color and materials from the standard coverplate options.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 260553.
- D. Plate-securing screws shall be metal with head color matching the wall plate finish.

2.04 STANDALONE LINE AND LOW VOLTAGE LIGHTING CONTROLS

- A. Standalone Lighting Control System Description: The standalone lighting control system includes individual devices, components, and accessories for lighting controls.

- B. The lighting control system manufacturer shall be responsible to assure coordination and compatibility between all system devices, components, and accessories.
- C. Global System Typography: The system shall be provided with the following global system characteristics. When multiple exclusive options are listed the manufacturer/vendor may submit a system based on either criterion unless otherwise noted. When the drawings identify a specific option (typically identified with a subscript) provide the specific option as scheduled on the drawings.
 - 1. Automatic Sensor Control Devices, Component, and Accessories: Field adjustable Occupancy or Vacancy.
- D. Overview:
 - 1. Wall Switches and Wall Dimmers:
 - a. UL listed with integral air-gap switch for on/off control, integral EMI/RFI suppression, non-viewable heat sink, dimmer to match device color.
 - b. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.
- E. **SW-1P**; Single Pole Switch:
 - 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
 - 2. Manufacturers:
 - a. Hubbell HBL1221
 - b. Leviton 1221-2
 - c. Pass & Seymour PS20AC1
 - d. Cooper AH1221
- F. **SW-O**; Dual Technology Automatic Sensor with Wall Switch (Standalone):
 - 1. Wall switch with manual on/auto/off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 20-minute adjustable OFF delay. Dual technology ultrasonic/acoustic and PIR coverage of minor motion in 12' x 15' pattern and occupancy detection in area based on half-step walking motion. Sensitivity adjustments separate for each sensing technology.
 - 2. Manufacturers:
 - a. Watt Stopper DW-100 Series
 - b. Hubbell LHMTS
 - c. Leviton ODSMT Series
 - d. Sensor Switch WSX-PDT SA Series (acoustic approved when listed in above description)
 - e. Cooper OWN Series
- G. **SW-LS-PC**; Exterior Photo Sensors (Standalone):
 - 1. Contractor / vendor to provide sensor based on sequence of operation requirements. Verify compatibility with lighting control system prior to purchase and installation.
 - 2. Subscripts: Subscripts are used to define the device type:
 - a. (Blank) = Standalone Device
 - b. #R = Room-Based Lighting Control Device

3. Exterior photocell sensor, 120/277 volt, 1800 VA minimum standard SPST formed contact zero-crossing closure, ambient sensor range 5 - 1,500 foot-candles, adjustable setpoint, adjustable deadband, adjustable time delay, weatherproof enclosure with threaded base for box installation and toolless twist-lock removable/replaceable photo eye assembly, -30°F to +130°F operation. Provide with lens cover that can be applied for system testing during daylight conditions.
 4. Installation: Mount sensor to face North-East.
 5. Manufacturers Standalone:
 - a. Paragon Twistlock Series
 - b. Tork Turnlock Series
 - c. Intermatic LC4546 Series
 6. Manufacturers Room-Based or Network-Based:
 - a. Manufacturer of Room-Based or Network-Based system.
- H. **SW-OC-#** and **SW-VC-#**; Automatic Sensors (Standalone):
1. Combination Devices: Subscripts identify combination type devices when applicable. The contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device. Manufacturer verified layouts shall include a 20% overlap of coverage patterns.
 2. Subscripts: Subscripts are used to define the device type.
 - a. Blank (or D) = Dual Technology
 - b. A = Ultrasonic two-sided corridor coverage
 - c. P = Passive infrared
 - d. U = Ultrasonic 360 degree coverage
 3. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.
 - a. Operation - Occupancy: Occupancy sensors turn lights 'on' when covered area is occupied and turn lights 'off' with a time delay when unoccupied, unless otherwise indicated.
 - b. Operation - Vacancy: Vacancy sensors require a manual switch operation to turn lights 'on' with a time delay when occupied to turn lights 'off'.
 - c. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - d. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by Electrical Code.
 - e. Mounting:
 - 1) Sensor: Suitable for mounting in any position on a standard outlet box.
 - 2) Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
 - 3) Time Delay and Sensitivity Adjustments: Recessed and concealed.
 4. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
 5. Bypass Switch: Override the on function in case of sensor failure.

6. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
7. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
8. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
 - a. (A); Ultrasonic Two-Sided Corridor Coverage Automatic Sensor: Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
 - 1) Manufacturers:
 - a) Watt Stopper WT-2250 Series
 - b) Hubbell OMNI-US or ATU Series
 - c) Cooper OAC-U Series
 - b. Blank (or D); Dual Technology 360 Degree Coverage Automatic Sensor: Combination of PIR and ultrasonic[or acoustic] detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay, integrated isolated relay contact. Sensor shall control all circuits in area, unless noted otherwise.
 - 1) Manufacturers:
 - a) Watt Stopper DT 300/200 Series
 - b) Hubbell OMNI-DT2000 / LODTRP / ATD2000C Series
 - c) Cooper OAC-DT Series
 - d) Leviton OSC-MOW / OSM12 Series
 - e) Sensor Switch CM PDT 10 / WvpDT 16 series (acoustic)
 - c. (P); Passive Infrared, 360 Degree Coverage Pattern Ceiling Mount Automatic Sensor: Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC Range), adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise.
 - 1) Manufacturers:
 - a) Watt Stopper CI Series
 - b) Sensor Switch CM-9
 - c) Hubbell Automation Omni-IR
 - d) Leviton OSC Series
 - e) Cooper OAC-P Series

- d. (U); Ultrasonic 360 Degree Coverage, Ceiling Mounted, Automatic Sensor: Detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage. 20' x 20' Hand Motion Coverage Pattern. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated 1-amp relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.

- 1) Manufacturers:
 - a) Watt Stopper WT-1100 Series
 - b) Hubbell OMNI-US or ATU Series
 - c) Leviton OSC Series
 - d) Cooper OAC-U Series

2.05 ROOM-BASED LIGHTING CONTROL SYSTEM ('INTELLIGENT CONTROLS)

- A. Manufacturers: Manufacturers as listed below meet the qualifications as outlined in this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.
 - 1. Acuity Controls nLight Series
 - 2. Cooper / Intelligent Lighting Controls ILC WaveLinx / EVO (room-based system) Series
 - 3. Current Automation NX Series
 - 4. Legrand Watt Stopper DLM Series
 - 5. Lutron
- B. Room-Based Lighting Control System Description: The room-based lighting control system is a distributed network of devices, components, and accessories for lighting controls and integrated control with other systems. The system includes system room controllers (network hubs), control stations, sensors (occupancy, vacancy, daylighting, etc.), switching/dimming modules, programming, 365/7 day scheduling, and associated wiring.
- C. The lighting control system manufacturer shall be responsible to assure coordination and network compatibility between all system devices, components, and accessories.
- D. Global System Typography: The system shall be provided with the following global system characteristics. When multiple exclusive options are listed the manufacturer/vendor may submit a system based on either criterion unless otherwise noted. When the drawings identify a specific option (typically identified with a subscript) provide the specific option as scheduled on the drawings. (Example, a control station (SW-#B) shown with a "W" subscript on the plans shall be provided in a wireless configuration regardless if the following specification descriptions allow both low voltage or wireless network.)
 - 1. System Controllers (Room Controllers): Room-based controllers located above accessible ceilings.
 - 2. Interior Lighting Control System Network Connectivity for System Devices, Components, and Accessories: Low voltage cabling.
 - 3. Exterior (Site) Lighting Control System Network Connectivity for System Devices, Components, and Accessories: Physical low voltage cabling.
 - 4. Power Source for System Devices, Components, and Accessories: AC power pack supply.
 - 5. Automatic Sensor Control Devices, Components, and Accessories: Field adjustable Occupancy or Vacancy.
- E. Lighting Control System Programming Protocol: Manufacturer's protocol.

- F. Lighting Control System (Room-Based Controller):
 - 1. Lighting Control System Room-Based Controller: Provide with data network to all lighting control system components, devices, and accessories. Provide network interface with other systems via BACnet IP communication or alternative protocol acceptable to the other system. System communication protocol shall be compatible with the building automation system.
- G. Time Clock and Scheduling: Provide 24 astronomical hour-based scheduling for interior lighting controls.
- H. Room-Based System Controllers (Room Controllers): Distributed room-based controller, integral switching relays and dimmers.
 - 1. Installation: Provide a dedicated controller for each space; not shared with adjacent rooms. Locate the controller near the associated wall controller, near the entry door when applicable, and above the finished accessible ceiling. As an alternative, the controller may be mounted above the finished accessible ceiling of the adjacent space when the associated ceiling space is not accessible. Example, located in adjacent corridor.
- I. Programming and Commissioning Dongle (Removable Style): Provide and permanently install a programming dongle for each room controller when a field removable dongle type device is required for programming and commissioning of the system. The programming dongle shall be permanently installed to allow for ease of programming the controller without above ceiling access.
- J. Control Devices: All automatic sensors (ultrasonic, PIR, dual technology, daylighting, photocell, timers), control stations, and other system components shall be provided with the system and designed to operate on system network. Sensors shall be powered from power supplies, modules, packs, or Power Over Ethernet POE. Refer to Standalone Line and Low Voltage Lighting Controls section of this specification for sensor performance descriptions (not duplicated in this section).
- K. Power Supplies (Modules, Packs, etc.): Provide power supplies for control devices. Power supply shall provide physical separation of 120/277 volt line voltage wiring and low voltage control wiring. Provide supplementary power supplies when required for multiple control devices. Provide switch or dimmed control as required by the Sequence Of Operation SOO.
 - 1. Installation: Install adjacent to wall room controller when applicable, near the entry door when applicable, and above the finished accessible ceiling. As an alternative, the controller may be mounted above the finished accessible ceiling of the adjacent space when the associated ceiling space is not accessible. Provide low voltage wiring to applicable control devices and control stations.
- L. **SW-#B**; Lighting Control Station, Default Dimming Control Raise/Lower/Fade: The lighting control station shall comply with the performance requirements of the lighting sequence of operation. The control station may consist of switches, pushbuttons, sliders, dimming functions, etc. Provide a common coverplate for lighting control stations.
 - 1. **#B**: The '#' indicates the minimum quantity of unique lighting control scenes when shown plus raise/lower and lights 'off' scene. Refer to the Lighting Sequence Of Operation (SOO) for the minimum quantity of scenes required (when a number is not designated) and a description of each control scene.
 - 2. Subscripts:
 - a. (BLANK) = Dimming Control (Default)
 - b. S = Switch Control

3. Manufacturer: Room-Based Lighting Controller Manufacturer:
 - a. Dimming (Blank) or Switch (S) Control Station: Modular, momentary pushbutton, with addressable capabilities to control the scene or luminaires assigned to the switch. The switch shall be able to actuate the functions based on the described sequence of operation and intended functions.
 - 1) Preset/fader stations shall operate using programmable buttons and/or faders as indicated on drawings.
 - 2) Raise, Lower, Integral Fader Control: Provide control station with manual raise and lower fader control for each control zone of lighting control. Manual raise/lower shall be separate buttons from scene control; hold and dim scene control buttons not acceptable. Faders may be physical sliders or up/down buttons. Fader range shall provide continuous even dimming matching full range of dimmer specification.
 - 3) Integral Pilot Light or LED: Indicate that controls are active or powered by being on continuously when powered or when pushbuttons are actuated.
 - 4) Labeling of buttons and faders shall be engraved/screened by manufacturer, using approved text returned with shop drawing submittals.
 - 5) Station control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via direct or network connection. Function options include: preset selection, manual mode, record mode, station lockout, raise/lower, macro, cue, and room join/separate.
 - 6) Multiple stations (shown in same space): When multiple control stations are shown in the same space the sequence of operation shall be the same at all locations unless noted otherwise.
 - 7) Multiple stations (movable partitions in same space): When multiple control stations are shown in the same space with movable partitions the sequence of operations shall be the same at all locations unless noted otherwise. A wall partition switch shall monitor the status of the movable partitions and automatically associated the control station(s) with the appropriate space based on the status of the wall partition.
- M. Additional Network-Based Characteristics for Room-Based Control Systems: The following network-based lighting control system characteristics and capabilities shall be provided with the room-based lighting control system. The following ADDITIONAL requirements supplement the system description included above.
 1. Additional Time Clock and Scheduling Requirements: Astronomical based scheduling for exterior site controls. Provide 365/7 day scheduling, with holiday events, with custom events, with on/off master override.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. All wiring shall be installed in conduit.
- C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.
- D. Lighting Control Station Wiring: Provide the grounded (neutral) conductor portion of the branch circuit with the line voltage phase conductors at each lighting control station.
- E. Lighting Control Panel Directories: Provide a typewritten directory for each lighting control panel indicating relay/dimmer and description of load controlled.

3.03 LOW VOLTAGE LIGHTING CONTROL CABLING

- A. Control Cable Raceway Routing: All wiring shall be installed in conduit.
- B. Network Cabling: As required by manufacturer.
- C. Splices and Taps: Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

3.04 SUPPORT SERVICES

- A. System Startup:
 - 1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.
- B. Pre-Program, Testing, Training Coordination:
 - 1. The construction documents and sequence of operations define the original design intent of the lighting controls as coordinated between the owner and the design team. The definition of the scope is intended to identify the hardware and programming flexibility required prior to programming, system testing, and owner training.
 - 2. The final system programming, control station labels, scene presets, dimmer presets, dimmer range limits, fade times, etc. are subject to on site coordination between the design team, owner, contractor, and manufacturer. Contractor/manufacturer programming of the system prior to an onsite coordination with the owner and design team shall not be considered final programming nor commissioning.
 - 3. The contractor and manufacturer shall provide on site representatives to provide final programming including preset, scene, switch labeling, and other programming adjustments based on owner and design team onsite observation and verbally requested adjustments as part of the based bid scope of work.
 - 4. The contractor shall document onsite requested changes and update operation and maintenance manuals to match final programming.
- C. Testing:
 - 1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
 - 2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming. However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
 - a. Confirm automatic sensor placement, sensitivity, and time delay settings to meet specified performance criteria.

- b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
 - c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
 - d. Confirm control station labeling, presets, switch labels, and scenes.
- 3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
- 4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.
 - a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
 - b. Mask occupancy/vacancy sensors where necessary to prevent nuisance switching from adjacent areas.
- D. Training:
 - 1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
 - 2. Training duration shall be no less than three (1) days, with one (1) day being scheduled at least two (2) weeks after initial training.
- E. Documentation:
 - 1. Manufacturer shall provide system documentation including:
 - a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or building automation system BAS interface unit.
 - b. Drawings for each panel showing hardware configuration and numbering.
 - c. Panel wiring schedules.
 - d. Typical diagrams for each component.

3.05 SYSTEM COMMISSIONING

- A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 010900, General Commissioning, for further details.
- B. Mask sensors where necessary to prevent nuisance switching from adjacent areas.
- C. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 010900, General Commissioning, for system verification tests and commissioning requirements.
- D. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 010900, General Commissioning, for Contractor training requirements.

END OF SECTION 260933

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance branch circuit panelboards: **Panel '###'**

1.02 RELATED SECTIONS AND WORK

- A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

1.03 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers
- B. NEMA PB 1 - Panelboards
- C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- D. UL 67 - Panelboards

1.04 SUBMITTALS

- A. Submit shop drawings for equipment and component devices under provisions of Section 260500.
- B. Submit manufacturer's instructions under provisions of Section 260500.

1.05 SPARE PARTS

- A. Keys: Furnish four (4) each to the Owner.

PART 2 - PRODUCTS

2.01 RATINGS

- A. Definitions:
 - 1. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.02 BRANCH CIRCUIT PANELBOARDS

- A. General
 - 1. Manufacturers:
 - a. Square D NQ, NF
 - b. ABB ReliaGear Series
 - c. Siemens P1
 - d. Eaton PRL1, PRL2
- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.
- J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.
- B. Height: 6 feet to handle of highest device.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide custom typed circuit directory for each branch circuit panelboard. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.02 FIELD QUALITY CONTROL

- A. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 262416

SECTION 262419
MOTOR CONT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Manual motor starters and switches

1.02 RELATED SECTIONS AND WORK

- A. Refer to the Disconnect and Starter Schedule, Electrical Riser Diagram, and Equipment Connection Schedule for rating and configuration.

1.03 REFERENCES

- A. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted
- B. NEMA KS 1 - Enclosed Switches
- C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less

1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 260500.
- B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and over-current protective devices.
- C. Submit manufacturer's instructions under provisions of Section 260500.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 260500.
- B. Store and protect products under provisions of Section 260500.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from fumes, dirt, water, construction debris, traffic, and physical damage.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 260500.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

PART 2 - PRODUCTS

2.01 MANUAL MOTOR STARTERS MS-# AND SWITCHES MX-#

- A. Acceptable Manufacturers:
 - 1. Square D 2500 Series
 - 2. Eaton MS Series
 - 3. ABB
 - 4. Siemens SMF / MMS Series
- B. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, and toggle operator.

- C. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, and toggle operator.
- D. Enclosure: NEMA ICS 6; Type 1.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's instructions on concrete bases.
- B. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION 262419

SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Device plates and box covers
- B. Receptacles (REC-#)
- C. Floor boxes and floor box with service fitting (FB-#)

1.02 RELATED SECTIONS

- A. Section 260933 - Lighting Control Systems.

1.03 QUALITY ASSURANCE

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with the Electrical Code.

1.04 REFERENCES

- A. DSCC W-C-896F - General Specification for Electrical Power Connector
- B. NEMA WD 1 - General Color Requirements for Wiring Devices
- C. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- D. NFPA 70 - National Electrical Code (NEC)
- E. UL 943 - Standard for Ground Fault Circuit Interrupters

1.05 SUBMITTALS

- A. Submit product data under provisions of Section 260500.
- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

1.06 COORDINATION

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.01 DEVICE COLOR

- A. All switch, receptacle, and outlet colors shall be verified with Architect, unless indicated otherwise.

2.02 COVERPLATES

- A. All switches, receptacles, and outlets shall be complete with the following:
 - 1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
 - 2. #302 stainless steel coverplates in unfinished spaces for flush boxes.
 - 3. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

- C. Install nameplate identification as indicated in Section 260553.
- D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.03 RECEPTACLES

- A. Refer to Electrical Symbols List for device type.
- B. REC-DUP: NEMA 5-20R Duplex Receptacle:
 - 1. Spec Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.
 - a. Manufacturers:
 - 1) Hubbell 5352
 - 2) Leviton 5362-S
 - 3) Pass & Seymour 5362
 - 4) Cooper 5362
- C. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:
 - 1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.
 - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 - b. Manufacturers:
 - 1) Hubbell GF20L
 - 2) Leviton GFNT2
 - 3) Pass & Seymour 2097
 - 4) Cooper SGF20
- D. REC-DUP-W: NEMA 5-20R Weatherproof While-In-Use Ground Fault Duplex Receptacle:
 - 1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use cast aluminum outlet box hood.
 - 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 - a. Manufacturers:
 - 1) Hubbell:
 - a) GFRTW20 with aluminum housing WP826
 - 2) Leviton GFWT2 with aluminum housing M5979
 - 3) Pass & Seymour 2097TRWR with aluminum housing WIUCAST1
 - 4) Cooper WRSGF20 with aluminum housing WIUMV-1
- E. REC-USB: NEMA 5-20R Receptacle with USB Charger:
 - 1. Standard Grade Type A USB: 125-volt, 20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Type A USB charging rated at 5VDC 3.0A minimum. Mounted in double gang backbox.
 - a. Manufacturers:
 - 1) Hubbell USB20X2
 - 2) Leviton #####

- 3) Pass & Seymour TR5362USB
 - 4) Cooper TR7766
- F. REC-SIM-630R: NEMA 6-30R Simplex Receptacle:
 - 1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.
 - a. Manufacturers:
 - 1) Hubbell HBL9330
 - 2) Leviton 5372
 - 3) Pass & Seymour 3801
 - 4) Cooper 5700N
- G. REC-SIM-1430R: NEMA 14-30R Simplex Receptacle:
 - 1. 125/250-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +24 AFF.
 - a. Manufacturers:
 - 1) Hubbell HBL9430A
 - 2) Leviton 278
 - 3) Pass & Seymour 3864
 - 4) Cooper 5744N
- H. REC-SIM-1450R: NEMA 14-50R Simplex Receptacle:
 - 1. 125/250-volt, 50 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +4" AFF.
 - a. Manufacturers:
 - 1) Hubbell HBL9450A
 - 2) Leviton 279
 - 3) Pass & Seymour 3894
 - 4) Cooper 5754N
- I. REC-SIM-L520R: NEMA L5-20R Simplex Receptacle, Locking Type:
 - 1. 125-volt, 20 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.
 - a. Manufacturers:
 - 1) Hubbell
 - 2) Leviton
 - 3) Pass & Seymour L520
 - 4) Cooper CWL520R
- J. REC-SIM-L530R: NEMA L5-30R Simplex Receptacle Locking Type:
 - 1. 125-volt, 30 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.
 - a. Manufacturers:
 - 1) Hubbell
 - 2) Leviton
 - 3) Pass & Seymour L530
 - 4) Cooper CWL530R

- K. REC-TAMP: NEMA 5-20R Tamper Resistant Duplex Receptacle:
1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.
 - a. Manufacturers:
 - 1) Hubbell BR20TR
 - 2) Leviton TBR20
 - 3) Pass & Seymour TR5362
 - 4) Cooper TRBR20
 2. Decorative Grade: Provide decorative style duplex tamper resistant receptacles in public spaces where walls are finished.
 - a. Manufacturers:
 - 1) Hubbell DR20TR
 - 2) Leviton TDR20
 - 3) Pass & Seymour TR2635
- L. REC-TAMP-GFI: NEMA 5-20R GFI Tamper Resistant Receptacle:
1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type tamper-resistant with test and reset buttons in impact resistant thermoplastic face, listed.
 - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 - b. Manufacturers:
 - 1) Hubbell GFTR20
 - 2) Cooper TRSGF20
 - 3) Pass & Seymour 2097TR
 - 4) Leviton GFTR2
- M. REC-TAMP-QUAD: NEMA 5-20R Double Duplex Tamper Resistant Receptacle:
1. Consists of two duplex tamper resistant receptacles, double gang box, plaster ring and faceplate.
 - a. Manufacturers:
 - 1) Refer to Tamper Resistant Receptacle above.
- N. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:
1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.
 - a. Manufacturers:
 - 1) Refer to Duplex Receptacle above.
- O. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.
- P. Side wired devices shall have four binding screws that are undercut for positive wire retention.
- Q. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

2.04 FLOOR BOXES

- A. Cover Color and Style: Verify with Architect from standard manufacturer options.
- B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.
- C. Floor Boxes Housing Material Based on Cast-in-Place Floor Type:
 - 1. Slab on Grade: Cast Iron or listed for slab on grade with special kit, coating, or equivalent; corrosion resistant.
- D. FB-1: Concealed Center Compartment:
 - 1. Floor Box, flush-mounted hinged cover, square/rectangular center service area with closed while-in-use cover and cable egress doors in cover, provide complete with appropriate outlet cover plates and hardware. For use with 4-inch minimum concrete pour floors, fully adjustable, UL 514 scrub water listed.
 - 2. Gang / Outlet Descriptions:
 - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 3/4-inch conduit.
 - b. Spare with 3/4-inch conduit.
 - 3. Manufacturers:
 - a. Hubbell CFB Series
 - b. Legrand Wiremold RFB Series
 - c. ABB Steel City 664/665/667 Series
 - 4. Installation: Group route raceway conduits under slab on grade or in ceiling space below to nearest wall or as shown on plans. Provide provisions to core drill elevated floors and route conduits to ceiling space of associated floor box. Provide hub reducers when applicable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.
- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
- C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles and electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:
 - 1. Bathrooms, locker rooms, shower rooms
 - 2. Kitchens' all 120-volt through 250-volt receptacles
 - 3. Rooftops
 - 4. Interior/Exterior locations subject to damp/wet conditions
 - 5. When located within 6 feet of sinks, bathtubs, and shower stalls
 - 6. Plug-and-cord receptacles when the utilization appliance is located within 6 feet of a sink edge.

7. Specific Appliances: Auto vacuum machines, water drink/bottle fill coolers, pressure staying machines, tire inflation machines, vending machines, sump pumps, dishwashers, electric ranges, ovens, clothes dryers, microwave ovens
- D. Tamper Resistant Protection: Provide tamper resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted code.
 1. Public Buildings: Corridors, waiting rooms, common areas
- E. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- F. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- H. Install devices and wall plates flush and level.
- I. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 260553 - Electrical Identification.
- J. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.
- K. Floor Box Installation:
 1. Set boxes level and flush with finish flooring material.
 2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
 3. Provide a minimum horizontal offset of 24 inches between boxes.

END OF SECTION 262726

SECTION 262816
DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Non-fusible switches
- B. Enclosures

1.02 RELATED SECTIONS AND WORK

- A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.03 REFERENCES

- A. NEMA KS 1 - Enclosed Switches

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 260500.
- B. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.
- C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.05 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 NON-FUSIBLE SWITCHES

- A. Acceptable Manufacturers:
 - 1. Square D 3110 Series
 - 2. Eaton DH Series
 - 3. ABB TH Series
 - 4. Siemens HNF / HF Series
- B. DS-#; Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.
- C. Enclosures: Type as indicated on the disconnect schedule.
- D. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.
 - 1. Lockable
 - 2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install disconnect switches where indicated on the drawings.
- B. Field coordinate installation with other contractors and equipment to maintain code required working space requirements.
- C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION 262816

SECTION 265119
LED LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires and accessories
- B. Exterior luminaires and accessories
- C. LED emergency lighting units
- D. Emergency exit signs
- E. Lighting poles

1.02 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
 - 1. 26 09 33 Lighting Control Systems
 - 2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.03 REFERENCES

- A. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
- B. NFPA 70E - National Electrical Safety Code
- C. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System
- D. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
- E. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 260500.
- B. Basic Requirements of Submittal:
 - 1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
 - 2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
 - 3. Include outline drawings, support points, weights, and accessory information for each luminaire.
 - 4. Submit manufacturer origin of LED chipset and driver.

C. LED Lighting - Control Compatibility Submittal:

1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.

1.05 EXTRA STOCK

- A. Exit Signs: Provide 2 additional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Store and protect under provisions of Section 260500.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.
- C. Handle site lighting poles carefully to prevent breakage and damage to finish.

1.07 WARRANTY

- A. The warranty period begins at the date of Substantial Completion.
- B. LED Light Engines and Drivers:
1. LED Drivers and Dimming Drivers: Five (5) years
 2. Light Emitting Diode (LED) Light Engines: Five (5) years
- C. Emergency Lighting Units and Exit Signs:
1. Emergency Lighting Units: Three (3) year, non-prorated
 2. Exit Signs: Three (3) year, non-prorated
 3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.
- D. Pole Finish: Three (3) year warranty of pole color and finish

1.08 REGULATORY REQUIREMENTS

- A. Conform to NFPA 101 for installation requirements.

PART 2 - PRODUCTS

2.01 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
- B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.
- C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.
- D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.

2.02 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.
- B. Provide low temperature LED drivers, with reliable starting to -20°F.
- C. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

2.03 LED EMERGENCY LIGHTING UNITS

- A. Self-Powered Emergency Lighting Units: One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- B. Battery: Maintenance free lead calcium type, with 90 minute capacity to supply the connected lamp load.
- C. Charger: Dual-rate solid state current charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to full charged within 168 hours. Low voltage disconnect to prevent deep discharge of battery.
- D. LED Lamp Wattage: As scheduled on luminaire schedule.
- E. Remote Lamps: Match LED lamps on unit.
- F. Indicators: Provide lamps to indicate AC ON and RECHARGING.
- G. Provide test switch to transfer unit from normal supply to battery supply.
- H. Electrical Connection: Knockout for conduit connection.
- I. Unit Voltage: Refer to luminaire schedule volts, AC.
- J. Self-Diagnostics and Testing:
 - 1. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five-minute discharge/diagnostic test at any time.

2.04 EMERGENCY EXIT SIGNS

- A. Self-Powered Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, test switch, AC ON pilot light, automatic charger, and electronic circuitry. Power failure relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.
- C. Self-Diagnostics and Testing:
 - 1. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

2.05 LIGHTING POLES

- A. Manufacturers:
 - 1. Manufacturer of luminaire (metallic pole)

2. Valmont Poles (metallic pole)
 3. U.S. Pole Company (metallic pole)
 4. KW Industries (metallic pole)
 5. Ameron Pole Products Division (concrete pole)
 6. Stresscrete (concrete pole)
 7. Traditional Concrete (concrete pole)
 8. TimberWood (wooden pole)
 9. Lithonia (wooden pole)
 10. Valmont NV (wooden pole)
- B. Metal Poles: Round steel lighting pole with anchor base.
1. Painted steel poles shall have electrostatic applied polyester powder coated paint finish thermally cured with UV protection. Interior of pole shall be coated with same coating for a minimum of 12" from base plate.
- C. Wind Load: 100 MPH velocity, with 1.14 percent three-second gust factor with luminaires and brackets mounted.
- D. Hand Hole: 2 x 4 inches with removable weatherproof cover installed at manufacturer's standard location. Provide matching gasketed cover plate.
- E. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole. Grout between anchor plate and concrete base with non-shrink grout after pole is plumbed.
- F. Vibration Damper: Canister or snake type second mode vibration damper internal to the metal pole as recommended by pole manufacturer. Provide additional pole top damper for first mode vibration on single-head metal poles where recommended by manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.
1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:
 - a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
 - b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
 - c. Luminaires larger than eight square feet (8 ft²): Support luminaire independent of the ceiling system.
- B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.

- C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
- D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.
- E. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.
- F. Industrial Pendant Luminaires: Use power hook hangers rated 500 pounds minimum or provide safety chain between driver and structure. Provide safety chain between reflector and driver.
- G. Luminaire Pole Bases: Sized and constructed as indicated on the drawings. Project anchor bolts 2 inches minimum above base. Install poles plumb with double nuts for adjustment. Grout around pole anchor base.
- H. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

3.02 CONSTRUCTION USE OF PROJECT LUMINAIRES

- A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.
- B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

3.03 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

- A. Install units plumb and level.
- B. Aim directional lamp heads as directed.
- C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.04 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

3.05 OWNER TRAINING

- A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.
- B. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.06 LUMINAIRE SCHEDULE

- A. As shown on the drawings.

END OF SECTION 265119

SECTION 270500
BASIC COMMUNICATION SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Communications Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Communications Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Description of Systems include, but are not limited to, the following:
 - 1. Complete Structured Cabling System including, but not limited to:
 - a. Backbone cabling and terminations.
 - b. Horizontal cabling and terminations.
 - c. Information outlets (IOes) including faceplates, jacks and labeling.
 - d. Equipment, cabinets, cable management, and equipment.
 - e. Telecommunication Room equipment including patch panels, optical distribution cabinets.
 - f. Cabling pathways.
 - g. Grounding and bonding
 - h. Testing
 - 2. Mounting and patching of wireless access points provided by others.
 - 3. Removal/demolition work and/or relocation and reuse of existing systems and equipment.
 - 4. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.
 - 5. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
 - 6. Firestopping of penetrations as described in Section 270503.

1.03 OWNER FURNISHED PRODUCTS

- A. TV monitors, Video projectors, wireless access points.

1.04 WORK SEQUENCE

- A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.05 ALTERNATES

- A. Purchase and installation of Audio video components.
- B. Installation of owner provided Wireless Access points.

1.06 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 - 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
 - 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
 - 3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
 - 4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
 - 5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall be routed to above the lay-in ceiling.
- C. General:
 - 1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.
 - 2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
 - 3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.

4. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Sprinkler Piping and other Piping
 - f. Conduit and Wireway
 - g. Open Cabling
- D. Electrical Contractor's Responsibility:
 1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
 2. Responsible for Communications Systems grounding and bonding.
 3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- E. Technology Contractor's Responsibility:
 1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
 2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
 3. Assumes all responsibility for providing and installing all cable management hardware (as defined herein).
 4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.07 COORDINATION DRAWINGS

- A. Definitions:
 1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

- b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, , pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
 2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
 3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
 3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.
- C. Drawing Requirements:
 1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).

- 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
- 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.

11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.08 QUALITY ASSURANCE

- A. Telecommunications Structured Cabling System Standards:
 1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:
 - a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
 - b. ANSI/TIA-568-0-D - Generic Telecommunications Cabling for Customer Premises
 - 1) 1-D - Commercial Building Telecommunications Standard
 - 2) 2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - 3) 3-D - Optical Fiber Cabling Components Standard
 - c. ANSI/TIA-569-E - Telecommunications Pathways and Spaces
 - d. ANSI/TIA-606-C - Administration Standard for Commercial Telecommunications Infrastructure
 - e. ANSI/TIA-607-D - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - f. ANSI/TIA-758-B - Customer-Owned Outside Plant Telecommunications Standard
 - g. ANSI/TIA-862-A - Building Automation Systems Cabling Standard
 - h. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - i. ANSI/TIA-1179 Healthcare Facility Telecommunications Standard
 - j. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding
 - k. NFPA 70 (NEC) - National Electrical Code (Current Edition)
 - l. UL 444 - Standard for Safety for Communications Cable
- B. Refer to individual sections for additional Quality Assurance requirements.
- C. Qualifications:
 1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
 2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
 3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
 4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.

5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
 6. The Contractor shall obtain the services of a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) for the project. The RCDD or CNIDP shall perform the following tasks on the project:
 - a. Review contractor's submittals and stamp the submittals stating the submittals compliance with the contract documents.
 - b. Provide written and dated confirmation of an observation of the contractor's installation activities no less than every month during the construction period.
 - c. Provide a final written and dated confirmation of a final construction review prior to testing.
 - d. Review final testing of system and indication that the documented results or transmittal of the results stating the test results compliance with the contract documents.
 7. The Contractor shall have certified BICSI installation technicians or CNet CNIT (Certified Network Infrastructure Technician) on staff to perform the following tasks on the project:
 - a. Act as the field superintendent or job foreman with the responsibility of monitoring the daily work of each technician.
 - b. Oversee all testing and termination of cabling.
 8. The Contractor shall have certified BICSI Installer 2 or CNet CNCI (Certified Network Cabling Installer) on staff to perform the following tasks:
 - a. Installation and termination of copper cable.
 - b. Installation and termination of optical fiber.
 9. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.
 - b. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
 - c. A list of test equipment proposed for use in verifying the installed integrity of copper and fiber optic systems on the project.
 - d. A technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.
 - e. Resume and certification of the RCDD or CNIDP for the project as required by the form at the end of this specification section.
 - f. Resume and certification of the BICSI installation technician or CNet CNIT for the project.
- D. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the State of Iowa Codes, Laws, Ordinances and other regulations having jurisdiction.
 2. Conform to all published standards of City of Long Grove, IA.
 3. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.

4. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
 5. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal a separate price required to make the system shown on the drawings comply with the codes and regulations.
 6. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
 7. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
- E. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
 3. Pay all applicable charges for such permits or licenses that may be required.
 4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
 7. Pay any charges by the service provider related to the service or change in service to the project.
 8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.
- F. Service Provider Requirements:
1. Secure from the telecommunications service provider all applicable requirements.
 2. Comply with all service provider requirements.
 3. The Owner shall make application for and pay for new telecommunications service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and service provider.
- G. Examination of Drawings:
1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

I. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.

1.09 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.10 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
27 05 03	Through Penetration Firestopping
27 05 26	Communications Bonding
27 05 28	Interior Communications Pathways
27 05 43	Exterior Communications Pathways
27 05 53	Identification for Communication Systems
27 11 00	Communication Equipment Rooms
27 13 00	Backbone Cabling Requirements
27 15 00	Horizontal Cabling Requirements
27 17 10	Testing
27 41 00	Professional Audio/Video System
27 51 13	Paging Systems

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

- 1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Description of items submitted and relevant specification number
 - e. Notations of deviations from the contract documents
 - f. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Description of item submitted (using project nomenclature) and relevant specification number
 - g. Notations of deviations from the contract documents
 - h. Other pertinent data
 - i. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor shall provide proof of RCDD or CNIDP review on the submittal.
 - d. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.

- 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - e. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - f. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
- a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 27 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 27 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.11 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.12 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
 1. Firestopping, including mechanical firestop systems.

1.13 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.14 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.15 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.

- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.16 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.17 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.01 CABLE JACKET RATING

- A. This project requires all cable jackets to carry a plenum rating.

2.02 Refer to individual sections.

PART 3 - EXECUTION

3.01 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 260533. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.03 FIELD QUALITY CONTROL

- A. General:
 - 1. Refer to specific Division 27 sections for further requirements.
 - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
 - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
 - 4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
 - 5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

- B. Protection of cable from foreign materials:
1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
 2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.04 PROJECT CLOSEOUT

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
 2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
 3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.
- C. Before final payment will be authorized, this Contractor must have completed the following:
1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
 2. Submitted bound copies of approved shop drawings.
 3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
 4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
 5. Submitted testing reports for all systems requiring final testing as described herein.
 6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
 7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.
 8. Provide System Assurance Warranty certificate for the telecommunications system.

3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div27.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.

7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- D. Refer to the individual specification sections for minimum hours of instruction time for each system.
- E. Operating Instructions:
 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
 2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 SYSTEM STARTING AND ADJUSTING

- A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.08 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.09 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 90% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 50% of testing has been completed.
6. Telecommunications labeling has been provided on at least 50% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
8. All Audio/Visual components, cabling are installed, programmed and operational.
9. All overhead or integrated paging systems, including speakers, back boxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.
10. All CCTV cameras, mounts, cabling and all headend equipment are installed, programmed and operational.
11. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

Prime Contractor: _____

By: _____

Requested Observation Date _____

Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

TELECOMMUNICATIONS - PROOF OF CERTIFICATION

There are specific Contractor qualification requirements for this project as defined in Section 270500, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer: _____. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: _____

Authorized Representative: (print) _____

Date: _____

Manufacturer Certification Number (if any): _____

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: _____

RCDD #: _____ Expiration: _____

Submit the following with the bid:

This form.

Proof of Manufacturer Certification indicated above.

Proof of RCDD or CNIDP status.

END OF SECTION 270500

SECTION 270503
THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.03 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. HCAI - Health Care Access and Information (California)
- J. The Building Officials and Code Administrators National Building Code
- K. 1997 Uniform Building Code
- L. Wisconsin Administrative Code
- M. 2021 International Building Code
- N. NFPA 5000 – Building Construction Safety Code

1.04 SUBMITTALS

- A. Submit under provisions of Section 270500.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.06 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 CFM/sq.ft. at both ambient temperature and 400F .
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.07 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.08 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
1. 3M; Fire Protection Products Division
 2. Hilti, Inc.
 3. Specified Technologies Inc. (S.T.I.)
 4. Wiremold/Legrand: FlameStopper

2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:
1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:
 - a. F Rating = Floor/Wall Rating
 - b. L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

- a. F Rating = Wall/Floor Rating
- b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.02 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.03 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.04 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.05 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the Contractor's expense.

END OF SECTION 270503

SECTION 270526
COMMUNICATIONS BONDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Bonding Conductors
- B. Bonding Connectors
- C. Grounding Busbar (PBB and SBB)

1.02 RELATED WORK

- A. Section 260533 - Conduit and Boxes
- B. Section 260513 - Wire and Cable
- C. Section 260526 - Grounding and Bonding
- D. Section 264100 - Lightning Protection Systems
- E. Section 270500 - Basic Communications Systems Requirements
- F. Section 270503 - Through Penetration Firestopping
- G. Section 271100 - Communication Equipment Rooms
- H. Section 270528 - Interior Communication Pathways
- I. Section 270553 - Identification and Administration

1.03 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.
- B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
- C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

1.04 REFERENCES

- A. ANSI/IEEE 1100 - Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA 568-C - Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA 569-A - Commercial Building Standard for Telecommunications Pathways and Spaces
- D. ANSI/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA 758 - Customer Owned Outside Plant
- F. ANSI/TIA-607-D - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- G. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 - National Electrical Code
- J. NFPA 780 - Standard for the Installation of Lightning Protection Systems
- K. UL 96 - Lightning Protection Components

- L. UL 96A - Installation Requirements for Lightning Protection Systems
- M. UL 467 - Grounding and Bonding Equipment

1.05 SUBMITTALS

- A. Submit product data and shop drawings under provisions of Section 270500 and Division 1.
- B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.
 - 2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Provide CAD-generated, project-specific system shop drawings as follows:
 - 1. Provide a system block diagram indicating system configuration, system components, interconnection between components, and conductor routing. The diagram shall clearly indicate all wiring and connections required in the system. When multiple devices or pieces of equipment are required in the exact same configuration (e.g., multiple identical equipment racks or sections of ladder tray), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where system equipment will be located.
 - 2. Installation details for all system components.
- D. Provide system checkout test procedure to be performed at acceptance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 270500.
- B. Store and protect products under the provisions of Section 270500.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

1.07 SYSTEM DESCRIPTION

- A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.
- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.
- D. Basic System Requirements:
 - 1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-D and NFPA 70 for complete information.

2. The bonding system shall include, but not be limited to, the following major components:
 - a. Telecommunications Bonding Conductor (TBC)
 - b. Primary Bonding Busbar (PBB)
 - c. Telecommunications Bonding Backbone (TBB)
 - d. Secondary Bonding Busbar(s) (SBB)
 - e. Rack mount Telecommunications Grounding Busbar(s)
 - f. Bonding Conductor(s) (BC)
 - g. Bonding Connectors
 - h. Bonding system labeling and administration as defined in Section 270553.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 270500.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
 1. Actual locations of system components, devices, and equipment.
 2. Actual conductor routing.
 3. Actual system component, device, equipment, and conductor labels.
- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

1.09 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 270500.
- B. Submitted data shall include:
 1. Approved shop drawings.
 2. Descriptions of recommended system maintenance procedures, including:
 - a. Inspection
 - b. Periodic preventive maintenance
 - c. Fault diagnosis
 - d. Repair or replacement of defective components

PART 2 - PRODUCTS

2.01 BONDING CONDUCTORS

- A. Bare Copper:
 1. Annealed uncoated stranded conductor.
 2. Minimum size 6 AWG.
- B. Insulated Copper:
 1. Annealed uncoated stranded conductor.
 2. Insulation:
 - a. PVC insulation with nylon outer jacket.
 - b. Rated at 600 volts.
 - c. Green.
 3. Minimum size 6 AWG.

- C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.
- D. Bonding Conductor Sizing:
1. All communications bonding system conductors shall be sized by length as follows:

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
67 - 84 (20 - 26)	3/0
85 - 105 (26 - 32)	4/0
106 - 125 (32 - 38)	250 kcmil
126 - 150 (38 - 46)	300 kcmil
151 - 175 (46 - 53)	350 kcmil
176 - 250 (53 - 76)	500 kcmil
251 - 300 (76 - 91)	600 kcmil
Greater than 301 (91)	750 kcmil

2. The TBC shall be the same size as the TBB or larger.

2.02 BONDING CONNECTORS

- A. Acceptable Types:
1. Two-hole compression lug
 2. Exothermic weld
 3. Irreversible compression
- B. Connectors shall be provided in kit form and selected per manufacturer's written instructions.
- C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

2.03 GROUNDING BUSBAR (PBB)

- A. Features:
1. Wall-mount configuration.
 2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
 3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-D standards.
 4. Predrilled holes.

5. Integral insulators.
6. Stainless steel offset mounting brackets.
- B. Specifications:
 1. Material: Electrolytic tough pitch copper bar with tin plating.
 2. Refer to drawings for grounding busbar size(s).
 - a. Minimum Dimensions: Refer to drawings.
 - b. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
 - c. Hole patterns on busbars accommodate two-hole lugs per the recommendation of ANSI/BICSI N3-20 and ANSI/TIA-607 standards.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General Bonding Requirements:
 1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
 2. A licensed electrician shall perform all bonding.
 3. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Main Cross Connect and Service Entrance Room Bonding Requirements:
 1. Locate the PBB in the service entrance room unless otherwise noted on the drawings.
 2. The location of the PBB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
 3. Bond the telecommunications primary protectors to the PBB. Maintain a minimum 1 foot separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.
 4. In service entrance rooms where the entrance pathway contains an isolation gap, the pathway on the facility side of the gap shall be bonded to the PBB.
- C. Where the service entrance cable contains a shield, the shield(s) shall be bonded to the PBB using manufacturer-approved hardware.
- D. Primary Bonding Busbar (PBB) Requirements:
 1. Install PBB such that it is insulated from its support with a minimum 2" standoff.
 2. Bond the PBB to the electrical service ground via the TBC.
 - a. A minimum of 1 foot separation shall be maintained between the TBC and any DC power cables, switchboard cable, or high frequency cables.
 3. Where backbone or horizontal cabling contains a shield, the shield(s) shall be bonded to the PBB.
 4. PBB shall be bonded to all electrical panels located in the same room or space as the PBB. PBB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the PBB.
 5. PBB shall be bonded to accessible metallic building structure located within the same room or space as the PBB.

6. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the PBB, shall be bonded to the PBB.
7. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the PBB, shall be bonded to the PBB.
- E. Metallic Interior Communication Pathway Bonding Requirements:
 1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.
- F. Bonding Conductor Requirements:
 1. Bonding conductors shall be green or marked with a distinctive green color.
 2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
 3. Bonding conductors shall not be installed in metallic conduit.
 4. All conductors, including, but not limited, to the TBC, TBB, BBC, and TEBC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.
 - a. Where documented permission to splice a conductor is granted:
 - 1) The number of splices shall be limited to as few as possible.
 - 2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.
 - 3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
 - 4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.
 5. All bonding conductors shall be labeled in accordance with the requirements of Section 270553. In addition to the requirements of Section 270553:
 - a. Labels shall be nonmetallic.
 - b. Labels shall be printer-generated.
 - c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
 - d. Additionally, conductors shall be labeled as follows:
 - 1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."
 6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
 7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.

G. Bonding Connection Requirements:

1. Make all connections in accessible locations to facilitate future inspection and maintenance.
2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
3. Thoroughly clean conductors before installing lugs and connectors.
4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.
5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.
7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed under provisions of Section 270500.
- B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

3.03 ADJUSTING

- A. Adjust work under provisions of Section 270500.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

3.04 TESTING

- A. Measure and document resistance to ground at PBB, each SBB, each RBB, and each electrical distribution panel bonded to the PBB or a SBB.
 1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the 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. Perform tests by the fall-of-potential method according to IEEE 81.
 2. The preferred measured resistance to ground for the grounding electrode system is 5 ohms or less. Refer to Division 26 for exact project requirements.

3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.
- B. Two-point Ground/Continuity Test:
1. Two-point ground continuity test shall be performed per TIA-607D standards.
 2. Contractor shall use an earth ground resistance tester to confirm a resistance of less than 100 milliohms between the building's electrical grounding electrode system and any other point in the telecommunications bonding system.
 3. At a minimum, perform tests in the following areas:
 - a. PBB to the electrical ground in distributors
 - b. Each SBB to the electrical ground in distributors
 - c. PBB/SBB to the structural metal (if present)
 - d. PBB to SBB(s)
 - e. Structural metal (if present) to the electrical ground
 4. Complete testing prior to installation of Owner-provided equipment.
- C. Measure and document voltage between screen of installed and terminated ScTP, FTP, and/or SSTP horizontal cables and electrical ground of electrical outlet(s) serving the information outlet location area.
1. The voltage between the screen and the ground wire shall not exceed 1.0 V rms, and 1.0 V dc for any installed and terminated ScTP, FTP, and/or SSTP horizontal cables.
- D. Include measurement documentation in test data submitted at completion of project under provisions of Section 271710.

3.05 SYSTEM TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
 2. The Architect/Engineer shall be presented with the option to attend the training.
 3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- B. At a minimum, the following training shall be conducted:
1. A course detailing the system functions and operations that a technical user will encounter. Provide training on all aspects of using the system, including making new bonding connections to the PBB, SBB, or RBB. Provide training on all recommended inspection, maintenance, and repair procedures for the system.

END OF SECTION 270526

SECTION 270528
INTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 260533 - Conduit and Boxes
- B. Section 270500 - Basic Communications Systems Requirements
- C. Section 270526 - Communications Bonding

1.02 QUALITY ASSURANCE

- A. Refer to Section 270500 for requirements.

1.03 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. NEMA VE 2-2000 - Cable Tray Installation Guidelines

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

1.05 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

PART 2 - PRODUCTS

2.01 CONDUIT

- A. Refer to Section 26 05 33 for conduit requirements for this project.

2.02 CABLE HANGERS AND SUPPORTS

- A. Provide a non-continuous cable support system suitable for use with open cable.
- B. Cable Hooks:
 - 1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
 - 2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
 - 3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty use zinc plated steel, ASTM B633 SC3 suitable for heavy duty use. Provide stainless steel AISI Type 304 hooks for corrosive locations.
- C. Cable Hangers:
 - 1. Adjustable, non-continuous cable support slings for use with low voltage cabling.
 - 2. Steel and woven laminate construction, rated for indoor non-corrosive use. Laminate material shall be suitable for use in plenum environments.
 - 3. Sling length shall be adjustable to a capacity of 425 4-pair UTP cables.

4. Cabling hanger load limit shall be 100 lbs per foot.
5. Manufacturer:
 - a. Erico Caddy
 - b. CableCat CAT425
 - c. Arlington Fittings TI Series
 - d. Or approved equal.

2.03 INNERDUCT - CORRUGATED

- A. Fabricated from self-extinguishing high-impact polyvinyl chloride (PVC), orange in color.
- B. Fittings and accessories fabricated from same material as conduit and usable with rigid nonmetallic conduit.
- C. Solvent-cement type joints as recommended by manufacturer.
- D. Inside diameter not less than that of rigid steel conduit.
- E. Dielectric strength a minimum of 400 volts per mil.
- F. Corrugated wall construction.
- G. Pull rope pre-installed by manufacturer.
- H. Innerduct installed within buildings (not including riser paths) or utility tunnels shall meet all the above General requirements plus:
 1. Be fabricated of flame-retardant materials (plenum rated) suitable for installation in such environments.
 2. Meet or exceed all requirements for flame resistant duct as required by Bellcore TR-NWT-000356 (Section 4.33).
- I. Innerduct installed within building riser shafts shall meet all the above general requirements plus:
 1. Be fabricated of flame-retardant materials suitable for installation in such environment.
- J. Meet or exceed all requirements for flame propagation as specified by test method UL-1666 and referenced by the National Electrical Code (NEC) Section 770-53 for listed optical fiber raceways being installed in vertical runs in a shaft between floors.

PART 3 - EXECUTION

3.01 INNER DUCT INSTALLATION REQUIREMENTS

- A. Inner duct shall be riser or plenum rated as required by the installation environment. At minimum, inner duct should extend to the ladder rack above the termination enclosure at system endpoints. Where not installed in a continuous length, inner duct segments should be spliced using couplings designed for that purpose.
- B. All exposed inner duct is to be labeled at 35-foot intervals with tags indicating ownership, the cable type (e.g., "Fiber Optic Cable") and the cables it contains (e.g., MA-CS or FS-CS).
- C. Where exposed, fiber optic cable shall be installed in protective inner duct.
- D. Contractor shall determine optimum size and quantity to satisfy the requirements of the installation and to ensure that the mechanical limitations, including minimum bend radius of the cable, are considered.
- E. The inner duct should extend into the termination enclosure at system endpoints.
- F. Where not installed in a continuous length, inner duct segments should be spliced using couplings designed for that purpose.

3.02 CABLE HOOK SUPPORT SYSTEM

- A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
- B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.
- C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".
- D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
- E. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.
- F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.
- G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.03 CONDUIT AND CABLE ROUTING

- A. Refer to Section 260533 for additional requirements.
- B. All conduits shall be reamed and shall be installed with a nylon bushing.
- C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
- D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.
- E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.
 - 1. A separate pull box is required for each 90' (or greater) length section.
 - 2. A separate pull box is required after any two (2) consecutive 90-degree bends.
 - 3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.
- F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.
- G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

3.04 ATTACHMENT TO METAL DECKING

- A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

END OF SECTION 270528

SECTION 270543
EXTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing exterior racks, ladders, conduits, sleeves, innerduct, etc. for an exterior cabling plant.

1.02 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.
- B. Precast Manufacturer (if applicable): Company specializing in precast concrete structures with three (3) years documented experience.

1.03 REFERENCES

- A. Section 270500 - Basic Communications Systems Requirements.
- B. AASHTO HS-20 - Standard Specification for Highway Bridges.
- C. ANSI/ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.
- E. ASTM A48 - Gray Iron Castings.
- F. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Submit shop drawings and product data under provisions of Section 270500.
- C. Submit manufacturer's installation instructions under provisions of Section 270500.
- D. Coordination Drawings:
 - 1. Include manholes, hand holes, and conduits 1.5" and larger in coordination files. Include all in-floor and underfloor conduit in coordination files. Refer to Section 270500 for coordination drawing requirements.

1.05 REGULATORY REQUIREMENTS

- A. Equipment and material shall be UL (Underwriters Laboratory) listed and labeled.

PART 2 - PRODUCTS

2.01 OUTSIDE PLANT CONDUIT

- A. Rigid Metallic Conduit (RMC) and Fittings:
 - 1. Rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.
 - 2. Fittings and Conduit Bodies:
 - a. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.

- b. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
 - c. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.
3. Manufacturers:
- a. Allied
 - b. LTV
 - c. Steelduct
 - d. Wheatland Tube Co
 - e. O-Z Gedney
 - f. Or pre-approved equal

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	Less than 0.941
D-1238	Melt Index, g/10 min Condition E	Greater than 0.55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	Less than 80,000
D-746	Brittleness Temperature	-75°C Max

2.02 TEXTILE INNERDUCT

- A. Contractor shall provide and install innerduct in each conduit identified to have copper and fiber optic cable installed.
- B. Innerduct shall have an 18 gauge solid copper core tracer wire installed into each cell to allow for detection by industry standard toning equipment.
- C. Each innerduct cell shall have a pull tape installed.
- D. Acceptable Manufacturers:
 - 1. Maxcell
 - 2. or pre-approved equal.

2.03 UNDERGROUND WARNING TAPE

- A. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
- B. Overall Thickness: 5 mils.
- C. Foil Core Thickness: 0.35 mil.
- D. Orange colored tape 3-wide with 1-inch high black letters permanently imprinted with "CAUTION - BURIED COMMUNICATIONS LINE BELOW". Printing on tape shall be permanent and shall not be damaged by burial operations.

- E. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- F. Comply with ANSI Z535.1 through ANSI Z535.5.

2.04 FOUNDATION - UNDERGROUND SLEEVES AND SEALS

- A. Refer to Division 26 for additional information on foundation sleeves and seals.

PART 3 - EXECUTION

3.01 INSTALLATION - DUCTBANK

- A. Make duct bank installations and penetrations through foundation walls watertight.
- B. Top of duct banks shall be a minimum of 24 inches below grade, unless otherwise indicated on drawings.
- C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 3-inch minimum separation between the outer surfaces of the ducts.
- D. Transition from non-metallic to galvanized rigid steel conduit where duct banks enter buildings, manholes, and hand-holes.
- E. Where ducts enter structures such as manholes, hand-holes, pullboxes and buildings, terminate the ducts in suitable end bells.
- F. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3-inches per 100 feet.
- G. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand, or gravel have been left in the duct.
- H. Plug and seal empty spare ducts entering buildings and structures. Seal watertight all ducts in use entering buildings and structures.

3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. The Contractor shall do all necessary excavating, securing, filling, backfilling, compacting, and restoration in connection with their work.
- B. Excavation:
 - 1. Excavations for trenches shall be excavated to proper dimensions to permit installation and inspection of work.
 - 2. Where excavations are carried in error below indicated levels, thoroughly compacted sand-gravel fill, shall be placed in such excess excavations.
 - 3. Excavations shall be protected against frost action and freezing.
 - 4. Care shall be exercised in excavating so as to not damage surrounding structures, equipment, and buried utilities. In no case shall any major structural footing or foundation be undermined.
 - 5. Excavation shall be performed in all ground characteristics, including rock, if encountered. Each bidder shall visit the premises and determine, by actual observations, borings, or other means, the nature of the soil conditions. The cost of all such inspections, borings, etc., shall be borne by the bidder.
 - 6. In the case where the trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.

7. Where satisfactory bearing soil is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately and no further work shall be done until further instructions are given.
 8. Mechanical excavation of the trench to line and grade of the conduit, unless otherwise indicated on the drawings.
- C. Dewatering:
1. The Contractor shall be responsible for the furnishing, installation, operation and removal of all dewatering pumps and lines necessary to keep the excavation free of water at all times.
- D. Underground Obstructions:
1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locators can be found by calling 811. The Contractor is responsible for obtaining all utility locates for all trades on the project to determine obstructions indicated. The Contractor shall use great care in installing in the vicinity of underground obstruction.
- E. Fill and Backfilling:
1. No rubbish or waste material shall be permitted in excavations for trench fill and backfill.
 2. The Contractor shall provide the necessary sand for backfilling.
 3. Dispose of the excess excavated earth as directed.
 4. Soils for backfill shall be suitable for required stability and compaction, clean and free from perishable materials, frozen earth, debris or earth with an exceptionally high void content, and free from stones greater than 4 inches in diameter. Under no circumstances shall water be permitted to rise in unbackfilled trenches after installation has been placed.
 5. All trenches shall be backfilled immediately after installation of conduit, unless other protection is directed.
 6. All conduit shall be laid on a compacted bed of sand at least 3" deep. Backfill around the conduit with sand, spread in 6" layers, then compact each layer.
 7. Use sand for backfill up to grade for all conduit located under building slabs or paved areas. Native soil materials may be used as backfill if approved by the Geotechnical Engineer. All other conduit shall have sand backfill to 6" above the top of the conduit.
 8. The backfilling above the sand shall be placed in uniform layers not exceeding 6" in depth. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of lateral or vertical displacement.
 9. Install a warning tape approximately 12 inches below finished grade over all underground duct banks. The identifying warning tape shall be as specified above.
 10. Where the fill and backfilling will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
 11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

3.03 RESTORATION REQUIREMENTS

- A. Where soil and sod has been removed, it shall be replaced as soon as possible after backfilling is completed. All areas disturbed by work shall be restored to their original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching,

END OF SECTION 270543

SECTION 270553
IDENTIFICATION FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section describes the identification and administration requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Identification and labeling.
- C. Administration of structured cabling system, utilizing identifiers, records, record linkages and presentation.
 - 1. Identifier: Information that links a specific element of the telecommunications infrastructure with its corresponding record.

1.02 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements

1.03 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.
- B. Perform all work in accordance with State of Iowa standard.

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Documentation of labeling scheme.
 - 2. Complete documentation of nomenclature for all Administration components.

PART 2 - PRODUCTS

2.01 ADMINISTRATION

- A. Administrative requirements include identifiers, records, record linkages and labeling for the purposes of administering building cabling, pathways and spaces and grounding/bonding within a facility.
- B. The administrative system shall be developed in Microsoft Word format or other electronics program approved by the Architect/Engineer. Should the Contractor elect to provide documentation of the administrative system in a proprietary format, the owner shall be provided with a retail licensed version of the software by the Contractor allowing the full editing and reading the documentation.
- C. Refer to the Administrative System Outline below for minimum requirements.
- D. Identifiers:
 - 1. Identifiers shall be marked at the equipment to be administered.
 - 2. Identifiers shall be unique for each type of equipment. For example, in no case shall the identifier for a cable be the same as the identifier for a pathway.
- E. Administrative System Outline:
 - 1. Pathways:
 - a. Pathway identifier, type, fill, loading.
 - b. Cable records, space records, pathway records, grounding records.

2. Spaces:
 - a. Space identifier, space type.
 - b. Pathway records, cable records, grounding records.
3. Cable:
 - a. Cable identifier, cable type, total pair count, damaged pair count, unterminated pair count.
 - b. Termination records, splice records, pathway records, grounding records.
4. Primary Bonding Busbar:
 - a. PBB identifier, busbar type, grounding conductor identifier.
 - b. Bonding conductor records, space records.
5. Bonding Conductors:
 - a. Bonding conductor identifier, conductor type, busbar identifier.
 - b. Grounding busbar records, pathway records.

2.02 LABELING

- A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.
- B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.
- C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface and attachment method.
- D. Labels incorporating bar codes shall be either Code 39 conforming to USS-39 or Code 128 conforming to USS-128.
 1. All Code 39 bar codes shall have a ratio between 2.5:1 and 3.0:1. Provide a minimum "quiet zone" of 0.25" on each side of the bar code.
 2. A descriptive label for reading by personnel shall be provided with any bar code. Bar codes by themselves are not acceptable.
- E. Color Code: Observe the following requirements for color coding:
 1. Labels on each end of a cable shall be the same color for each termination.
 2. Labels for cross-connects shall be two different colors at each termination fields, representative of the color of that field.
 3. Orange (Pantone 15C) shall be used for the demarcation point.
 4. Green (Pantone 353C) shall be used for the termination point of network connection on the facility side of the demarc.
 5. Purple (Pantone 264C) shall be used to identify the termination of cables from common equipment (PBX, computers, LANS, etc.)
 6. White shall be used to identify the first-level backbone termination in the main cross-connect.
 7. Gray (Pantone 422C) shall be used to identify the second-level backbone termination in the main cross-connect.
 8. Blue (Pantone 291C) shall be used to identify the termination of station cabling at the telecommunications closet and/or equipment room end of the cable.
 9. Brown (Pantone 465C) shall be used to identify the termination of the interbuilding backbone cable terminations.

10. Yellow (Pantone 101C) shall be used to identify the termination of auxiliary circuits, alarms, maintenance, security, etc.
 11. Red (Pantone 184C) shall be used to identify the termination of key telephone systems.
 12. In facilities that do not contain a main cross-connect, the color white may be used to identify second-level backbone terminations.
- F. Tag all CAT 6, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
1. (Room Number) - (Outlet Number) - (Jack Number) - (Use).
 2. "Outlet Number" shall start with 1 in each room, with additional outlets in each room numbered sequentially.
 3. "Jack Number" shall start with 1 for the upper left jack in each outlet, increasing sequentially from left to right and top to bottom across the outlet face.
 4. "Use" shall be designated by the following:
 - a. "V" for voice (RJ-45)
 - b. "D" for data (RJ-45)
 - c. "C" for video (coax)
 - d. "M" for multimedia retrieval (coax)
 - e. "S" for speaker (RCA)

Example #1: "121-2-B - Room 121 – Wall Plate Location 2 – Jack B in that wall plate"

2.03 DOCUMENTATION/AS-BUILTS/RECORDS

- A. General:
1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 270500 and Division 1. Documentation shall include the items detailed in the subsections below.
 2. All documentation, including hard copy and electronic forms shall become the property of the Owner.
- B. Record Drawings:
1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

3.01 IDENTIFICATION AND LABELING

- A. Cable Labeling:
1. Horizontal cables shall be labeled at each end.
 - a. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color may include blue with a white stripe to indicate the higher performance class station cabling.
 2. Backbone cables shall be labeled at each end.
 - a. Provide additional cable labeling at each manhole and pull box.
 - b. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.

- c. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue with a white stripe to indicate the higher performance class station cabling.
- B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.
- C. Grounding/Bonding Labeling:
 - 1. The PBB shall be labeled "PBB." There shall be only one PBB in the facility.
 - 2. Label all TBB conductors connecting to the PBB with a unique label, located at both ends of the TBB.

3.02 ADMINISTRATION

- A. Provide administrative documentation of cabling, termination hardware, termination positions, splices and grounding as described above.
- B. Identifiers:
 - 1. Cable Identifiers: Provide a unique identifier for each cable serving as a link to the cable record. The identifier shall be marked on the cable or on the cable label.
 - 2. Termination Hardware Identifiers:
 - a. Provide a unique identifier for each termination hardware unit, serving as a linkage the unit record.
 - 3. Termination Position Identifiers:
 - a. A unique identifier shall be provided to each termination position to serve as a link to the termination position record.
 - b. An identifier shall be marked on each position label. Each termination position shall be marked with the termination position identifier.
 - 4. Splice Enclosure Identifier:
 - a. Provide a unique identifier for each splice enclosure to serve as a link to its record.
 - 5. Grounding/Bonding Identifiers:
 - a. The PBB shall be marked "PBB". Only one PBB shall be located in a facility.
 - b. Provide a unique identifier for each TBB attached to the PBB.

END OF SECTION 270553

SECTION 271100
COMMUNICATION EQUIPMENT ROOMS (CER)

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

1.02 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements
- B. Section 270526 - Communications Bonding
- C. Section 270528 - Interior Communication Pathways
- D. Section 271500 - Horizontal Cabling Requirements

1.03 QUALITY ASSURANCE

- A. Refer to Section 270500 for applicable standards.

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 EQUIPMENT GROUNDING

- A. Refer to specification section 270526 for grounding requirements.
- B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

2.02 EQUIPMENT CABINETS

- A. Where identified on the drawings in Communication Equipment Rooms, equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber) and network electronics.
- B. The equipment rack shall conform to the following requirements:
 - 1. Standard TIA/EIA 19" Wall Cabinet:
 - a. The equipment cabinets shall be constructed of painted steel or aluminum and offer a usable mounting height of 15 RU. Racks shall be a minimum of 21 inches deep. Access to the rear of the cabinet-mounted equipment shall be by a hinged arrangement.
 - b. The equipment cabinet shall be equipped with a lockable steel front door and furnished with two (2) keys that shall be usable on all cabinets furnished under this Contract.
 - c. The equipment cabinet shall be configured to allow for adjustment of the channel uprights (front to rear) in 1-inch increments and be spaced to accommodate industry standard 19-inch mounting. The cabinet shall be tapped to accept 12-24 screws.
 - d. The equipment cabinet shall be vented to allow for airflow through the cabinet.

2.03 PATCH PANELS

- A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.
- B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 271500.
- C. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.
- D. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.
- E. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

2.04 OPTICAL FIBER PANELS

- A. All terminated optical fibers shall be mated to simplex LC-type couplings mounted on enclosed fiber distribution cabinets. Couplings shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, FC, and MT-RJ by changing panels on which connector couplings are mounted.
- B. The fiber distribution cabinet shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings, including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the Contractor.
- C. The fiber distribution cabinet shall be an enclosed assembly affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to conceal and protect the optical fiber couplings, connectors, and cable.
- D. Access to the inside of the fiber distribution cabinet's enclosure during installation shall be from the front and/or rear. Panels that require any disassembly of the fiber distribution cabinet to gain entry will not be accepted.
- E. The fiber distribution cabinet's enclosure shall provide for strain relief of incoming optical fiber cables and shall incorporate radius control mechanisms to limit bending of the optical fiber to the manufacturer's recommended minimums or 1/2", whichever is larger.
- F. All fiber distribution cabinets shall provide protection to both the "facilities" and "user" side of the coupling. The fiber distribution cabinet's enclosure shall be configured to require front access only when patching. The incoming optical fiber cables (e.g., backbone, riser, horizontal, etc.) shall not be accessible from the patching area of the panel. The fiber distribution cabinet's enclosure shall provide a physical barrier to access such optical fiber cables.

- G. Where "Loose Buffered" cables are installed, the 250 um coated optical fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtailed") or (2) the use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering, an Aramid (e.g., Kevlar) reinforced tube for example, with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.3 dB for multi-mode fibers. Direct termination of 250 um coated optical fibers shall not be permitted.
- H. Fiber distribution cabinets for horizontal cabling: Where optical fiber horizontal cabling is to be terminated, the enclosure shall be compliant to all the above requirements plus the enclosure shall incorporate a storage mechanism designed to allow simplified identification, access to and termination of individual optical fibers. This may be in the form of a storage cassette, tray or other appropriate mechanism.

2.05 OPTICAL FIBER COUPLERS/ADAPTERS

- A. Optical Fiber Couplings (LCtype) (Multimode/Singlemode):
1. LC-type optical fiber couplings shall be used to terminate optical fiber backbone cable on fiber distribution cabinet panels in communication equipment rooms. Horizontal optical fiber cables shall also be terminated using optical fiber couplings at their designated work area locations on information outlet faceplates for "fiber to the desk."
 2. LC-type optical fiber couplings shall be snap-type with locking washer and nut.
 3. LC-type optical fiber couplings shall incorporate domed zirconia ferrule and shall utilize a PC polish to ensure fiber-to-fiber physical contact for low loss and reflections.
 4. LC-type optical fiber couplings shall accept 125-micron outside diameter multimode fiber.
 5. The attenuation per mated pair shall not exceed 0.7 dB (individual) and 0.5 dB (average). Connectors shall sustain a minimum of 200 mating cycles per TIA/EIA-455-21 without violating specifications.
 6. LC-type optical fiber couplings shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

7. Performance Requirements:
 - a. Length: 2 inches
 - b. Operating Temperature: -40C to 85C
8. Basis of Design:
 - a. Panduit

2.06 D-RINGS

- A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.
- B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.
- C. Provide 1/4" screw holes for wall mounting.

2.07 POWER STRIPS

- A. Provide power strips on all equipment racks, unless noted otherwise. These power strips shall have the following characteristics:
 - 1. Standard Rack Mount:
 - a. TIA/EIA 19" equipment rack mountable.
 - b. Compliant with UL-1449 Third Edition and UL-497A.
 - c. Provide transient suppression to 12,000-A. Protection shall be in all three modes (line-neutral, line-ground and neutral-ground).
 - d. Shall meet or exceed ANSI C62 Category A3 requirements.
 - e. Provide high-frequency noise suppression as follows:
 - 1) Greater than 20-dB @ 50 kHz
 - 2) Greater than 40-dB @ 150 kHz
 - 3) Greater than 80-dB @ 1 MHz
 - 4) Greater than 30-dB @ 6 to 1000 MHz
 - f. Protection Modes and UL 1449 Clamping Voltage: 475 volt L-N, L-G, and N-G.
 - g. Components: Nonmodular units composed of 20mm metal oxide varistors (MOV). Series inductors, SAD, or selenium cells may be used in addition to MOVs.
 - h. Be equipped with a 10-foot power cord.
 - i. Provide with raised floor twistlock compatible.

2.08 COPPER PATCH CORDS

- A. Modular Patch Panel:
 - 1. Provide Category 6 copper patch cords for 50% of all assigned ports on the modular patch panel. Of these cords, 60% shall be 3' in length and 40% shall be 5' in length. These patch cords shall be the cross-connect between the network electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.
 - 2. Refer to Section 271500 for cable and connector performance requirements.
 - 3. Patch cords shall not be made-up in the field.
 - 4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
 - a. Panduit TX6 PLUS UTP (16) 0.5m and (16)2.0m

2.09 FIBER PATCH CORDS

- A. Optical Fiber Patch Cords (Singlemode):
 - 1. The optical fiber patch cord shall be 8.3/3 mm singlemode (SM) optical fiber, utilizing tight buffer construction. The optical fiber patch cords shall be a minimum of 5 feet in length.
 - 2. Provide 8.3/3 mm singlemode (SM) optical fiber utilizing tight buffer construction for 50% of all assigned ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped LC-type connector on each end and shall be a minimum of 5 feet in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.
 - 3. Channels shall be of equal length.

4. Refer to Section 271500 for cable and connector performance requirements.
5. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
 - a. Panduit

PART 3 - EXECUTION

3.01 D-RINGS

- A. Provide D-rings for cable routing and management in all areas where open cabling is routed along the wall in an Equipment Room.
- B. Locate D-rings on 24" centers vertically and horizontally.
- C. Securely attach D-rings to the wall as required by the manufacturer.

3.02 GROUNDING

- A. Provide a complete grounding system in accordance with the requirements of Section 270526.

3.03 CROSS CONNECT INSTALLATION

- A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.
- B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.
- C. The cable jacket shall be maintained as close as possible to the termination point.
- D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

3.04 OPTICAL FIBER TERMINATION

- A. All fiber slack shall be neatly coiled within fiber splice enclosures or splice trays. No slack loops shall be allowed external to the enclosure.
- B. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cable strength member shall be securely attached to the cable strain relief bracket in the enclosure.
- C. Each cable shall be clearly labeled at the entrance to all enclosures.
- D. A maximum of 12 strands shall be spliced in any tray.

END OF SECTION 271100

SECTION 271300
BACKBONE CABLING REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing backbone communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of both optical fiber and/or copper cabling.

1.02 RELATED WORK

- A. Section 270500 - Basic Technology Systems Requirements.
- B. Section 271500 - Horizontal Cabling Requirements.
- C. Section 271720 - Structured Cabling System Warranty.

1.03 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The basis of design is listed herein. Refer to Section 271720 for additional acceptable manufacturers.

2.02 OPTICAL FIBER BACKBONE - OUTSIDE PLANT

- A. Exterior Conduit (Singlemode):
 - 1. This optical fiber cable shall be suitable for installation in underground duct and in innerduct.
 - 2. Optical fiber cable materials shall be all dielectric (no conductive materials).
 - 3. Optical fiber cable shall be filled with a water-blocking material.
 - 4. Outer Sheath: Polyethylene (PE). The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g., "Optical Fiber Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the optical fiber cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.
 - 5. Temperature Range:
 - a. Storage: -40C to +70C (no irreversible change in attenuation).
 - b. Operating: -40C to +70C.
 - 6. Humidity Range: 0% to 100%.
 - 7. Maximum Tensile Strength:
 - a. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation).
 - b. Long Term: 890 N (200 lb. force).

8. Bending Radius:
 - a. During Installation: 20 times cable diameter.
 - b. No Load: 10 times cable diameter.
9. Basis of Design (Singlemode):
 - a. Panduit: QuickNet OS2 (12)SM Fiber Optic Trunk Cable 60meter (Part # F9TNP5E5EAAM55)
 - b. Additional acceptable manufacturers:
 - 1) Architect pre-approved compatible equal

2.03 OPTICAL FIBER CONNECTORS

A. Optical Fiber Pigtailes (Singlemode):

1. Single-fiber fiber optic pigtailes shall be constructed from singlemode (SM) optical fiber of the same grade as the singlemode fiber optic backbone cable utilizing tight buffer construction.
2. Fiber optic pigtailes shall be factory terminated with a ceramic tipped LC-type connector on one end and shall be a minimum of 5 feet (1.5m) in length or as indicated on the drawings. Channels shall be of equal length.
3. Connector body shall be of materials similar to that used in the proposed couplings. Refer to Section 271500 for connector performance requirements.
4. Provide in quantity to terminate all backbone fiber optic cable strands on each end.
5. Basis of Design:
 - a. Singlemode optical fiber pigtailes shall be from the same manufacturer as used for the fiber optic termination equipment.

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB
Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

B. Optical Fiber Connectors (LC-type) (Singlemode):

1. LC-type Optical Fiber Connectors: Shall be used to terminate optical fiber in communication equipment rooms.
2. LC-type optical fiber connector plugs shall be snap-type with an integrated pull-proof design.
3. LC-type optical fiber connector plugs shall incorporate a zirconium ceramic ferrule and shall utilize a factory pre-polish end face to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber connector plugs shall accept 1.6mm - 2.0mm and 3.0mm outside diameter fiber.
5. The average insertion loss is 0.3db for multimode and single mode connectors
6. LC-type optical fiber connector plugs shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB
Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

7. Additional Performance Requirements:
 - a. Length: 2.23 inches
 - b. Operating Temperature: -40C to 85C
8. Basis of Design:
 - a. Optical fiber connectors shall be from the same manufacturer as fiber cable manufacturer.

2.04 OPTICAL FIBER BACKBONE PERFORMANCE

- A. Singlemode (SM):
 1. Fiber Type: Singlemode; doped silica core surrounded by a concentric glass cladding.
 2. Core Diameter: 8 to 9 um. All optical fibers shall be of the same nominal core diameter and profile.
 3. Cladding Diameter: 125 ± 1.0 um.
 4. Cladding Non-circularity: Less than or equal to 1%.
 5. Core to Cladding Offset: Less than or equal to 0.8 um.
 6. Fiber Coating Diameter:
 - a. 245 ± 15 um (primary coating).
 - b. 900-nm (nominal) secondary coating (tight buffer).
 - c. All coatings shall be mechanically strippable without damaging the optical fiber.
 7. Cut-off Wavelength (cabled fiber): Less than or equal to 1260-nm.
 8. Mode Field Diameter: 8.3 to 9.8 um at 1300-nm; 10.5 ± 1.0 um at 1550-nm.
 9. Zero Dispersion Wavelength: 1301.5 nm less than the initial length of 1321.5 nm.
 10. Zero Dispersion Slope: Less than $0.092 \text{ ps/nm}^2 \cdot \text{km}$.
 11. Fiber Attenuation (maximum @ $23 \pm 5\text{C}$; Backbone):
 - a. @ 1300-nm: 2.0 dB/km
 - b. @ 1550-nm: 1.75 dB/km
 - 1) When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550-nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550-nm.
 12. Fiber Dispersion (maximum):
 - a. @ 1285 to 1330-nm: $3.2 \text{ ps/nm} \cdot \text{km}$
 - b. @ 1550-nm: $18 \text{ ps/nm} \cdot \text{km}$

13. No optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION REQUIREMENTS

- A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.
- B. A minimum of 5 meters (approximately 15 feet) of slack cable (each cable if applicable) shall be coiled and secured at both ends located in the entrance room, telecommunications room or main equipment room, for backbone and intra-building cable.
- C. Where exposed, all backbone fiber optic cable shall be installed in protective inner duct. This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit and cable tray or into equipment racks). The inner duct should extend into the termination and/or storage enclosure(s) at system endpoints.

3.02 CROSS-CONNECTS

- A. The Owner will be responsible for all cross-connects between the data backbone cabling and network electronics and between the data network electronics and horizontal cabling.
- B. . It shall be the responsibility of the Contractor, to work with the Owner and provide the necessary assistance to allow Owner I to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross-connect documentation, general wiring overview and cable pair identification.

END OF SECTION 271300

SECTION 271500

HORIZONTAL CABLING REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.02 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements
- B. Section 271720 - Structured Cabling System Warranty

1.03 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 HORIZONTAL CABLE

- A. CAT 6 Cable:
 - 1. The horizontal cable requirements must be met, as well as the following channel requirements.
 - 2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
 - 3. Performance tests shall be conducted using swept frequency testing through 250 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 250 MHz is not acceptable.
 - 4. Performance data shall be characterized as "Guaranteed Headroom" and shall be guaranteed by the manufacturer to perform at guaranteed margins over ANSI/TIA/EIA-568-C.2. Performance data that is not warranted by the manufacturer will not be considered.
 - 5. The structured cabling and connectivity must be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed below. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.

6. The 4-connector channel performance margins listed in the below criteria shall be guaranteed minimum margins above ANSI/TIA/EIA-568-C.2 with electrical parameters between 1-250 MHz.
 - a. Insertion Loss: 5%
 - b. NEXT: 3.0 dB
 - c. PS NEXT: 5.0 dB
 - d. ACR-F (ELFEXT): 4.0 dB
 - e. PS ACR-F (PS ELFEXT): 5.0 dB
 - f. Return Loss: 2 dB
7. The jacket color for CAT 6 cable shall be blue for data applications.
8. Basis of Design:
 - a. Panduit TX6000 PFP6C04**-UG
 - b. Additional acceptable manufacturers:
 - 1) Architect pre-approved compatible equal

2.02 CONNECTORS/COUPLERS/ADAPTERS

- A. Refer to Section 271100 for requirements and 27 13 00 for requirements.

2.03 FACEPLATES/JACKS

- A. CAT 6 Jacks:
 1. CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
 2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
 3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
 4. Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
 5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.
 6. All modular jacks will be fitted with a dust cover. Modular jacks shall incorporate a dust cover that fits over and/or into the modular jack opening. The dust cover shall be designed to remain with the modular jack assembly when the modular jack is in use. No damage to the modular jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the modular jack pinning, will not be accepted.
 7. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
 - a. Match the receptacle color used for other utilities in the building, or
 - b. When installed in surface raceway (if applicable), match the color of that raceway.

8. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:
 - a. Be a low-profile assembly.
 - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
 - c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
 - d. Incorporate a shroud that protects the optical fiber couplings from impact damage.
9. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
10. The CAT 6 modular jacks shall be non-keyed 8-pin modular jacks.
11. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
12. CAT 6 modular jacks shall be pinned per TIA-568B.
13. CAT 6 termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:
 - a. ANSI/TIA/EIA-568-A-5
 - b. ANSI/TIA/EIA-568A
 - c. ISO/IEC 11801
 - d. IEC 603-7
 - e. FCC PART 68 SUBPART F
14. The color for CAT 6 jacks shall be yellow for CCTV applications and blue for data applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6 modular jack.

2.04 COPPER WORK AREA CORDS

- A. RJ-45:
 1. Provide the same quantity of Category 6 copper work area cords as copper patch panel cords specified in Section 271100. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
 2. Work area cords shall be 10' in length.
 3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION REQUIREMENTS

- A. Horizontal Cabling:
 1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.

2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
 3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
 4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
 5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
 6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
 7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
 8. Cabling shall not be routed through wall(s) without a pathway. Provide conduit sleeve pathways through wall(s) for proper installation of horizontal cabling.
- B. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
1. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of less than 5-kVa.
 - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
 - d. Thirty-nine (39) inches from transformers and motors.
 2. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

3.02 CABLE TERMINATION REQUIREMENTS

- A. Cable Terminations - Data UTP:
1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
 2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use..
 3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

END OF SECTION 271500

SECTION 271710
TESTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.02 RELATED WORK

- A. Section 270500 - Basic Communications Systems Requirements

1.03 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to the start of work, the Contractor shall submit:
 - 1. Complete information on testing procedure as described herein.
 - 2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

PART 2 - PRODUCTS

2.01 TESTING COPPER

- A. General Requirements:
 - 1. Perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
 - 2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
 - 3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
 - 4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
 - 5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.
 - 6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.
 - 7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.

8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
 - a. CAT 6 Cable:
 - 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
 - 2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
 - 3) CAT 6 horizontal cable shall be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link", including cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
 - a) Wire Map
 - b) Length
 - c) NEXT Loss (Pair-to-Pair)
 - d) NEXT (Power Sum)
 - e) ELFEXT (Pair-to-Pair)
 - f) ELFEXT (Power Sum)
 - g) Return Loss
 - h) Attenuation
 - i) Propagation Delay
 - j) Delay Skew
 - 4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.
 - 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
 - 6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.

- 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.02 TESTING FIBER

A. General Requirements:

1. Perform acceptance tests as indicated below for each optical fiber sub-system (e.g., backbone, horizontal, etc.) as it is completed.
2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
3. Visually inspect all optical fiber cabling and termination points to ensure that they are complete and conform to the standards defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove that the optical fiber connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results.
7. All optical fiber cabling shall be 100% fault-free unless noted otherwise. If any optical fiber cable is found to be outside the specification defined herein, that optical fiber cable and the associated connector(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
9. The optical fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include manufacturer's on-reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.
 - a. On-the-reel bandwidth performance as tested at the factory. Factory data shall be provided upon request.
 - b. The testing noted for optical fiber cabling utilizes an Optical Time Domain Reflectometer (OTDR). However, the Contractor may submit to the Architect/Engineer for pre-approval of alternate fiber optic testing equipment.

- B. Tests Prior to Installation: The Contractor, at their discretion and at no cost to the Owner, may perform an attenuation test with an OTDR at 850-nm or 1300-nm on each optical fiber of each cable reel prior to installation. Supply this test data to the Architect/Engineer prior to installation.

- C. Tests After Installation: Upon completion of cable installation and termination, the optical fiber cabling shall be tested to include:
1. Optical Attenuation ("Insertion Loss" Method):
 - a. Optical Attenuation shall be measured on all terminated optical fibers in one direction of transmission using the "Insertion Loss" method measurement in accordance with the TIA/EIA 526-14, Method B, and be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made. Multimode optical fibers shall be tested at 850 ± 30 nm. Singlemode optical fibers (if applicable) shall be tested at 1300 ± 20 nm.
 - b. Attenuation of optical fibers shall not exceed the values calculated as follows:
 - 1) $\text{Attenuation (max.)} = 2 \cdot C + L \cdot F + S$ dB.
 - 2) Where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers), and F is the maximum allowable optical fiber loss (in dB/km). S is the total splice loss (# of splices * maximum attenuation per splice).
 2. Verification of Link Integrity (OTDR):
 - a. All optical fibers shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Multimode optical fibers shall be tested at 850-nm and 1300-nm (nominal). Singlemode optical fibers (if applicable) shall be tested at 1310-nm and 1550-nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. Access jumpers used for testing shall match the type and core diameter of the fiber optic strand under test.
 - b. Set OTDR's test variables to the manufacturer's published backscatter coefficient and velocity of propagation figure for the specific strand of fiber under test. OTDR's range should be set to approximately 1.5 times the length of the strand under test, pulse width should be optimized for the length of the fiber optic strand under test, and number of averages should be adjusted to approximately 120 seconds per wavelength.
 - c. OTDR traces revealing a point discontinuity greater than 0.2 dB in a multimode optical fiber or 0.1 dB in a singlemode optical fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that optical fiber by the Owner. The installation of that optical fiber cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that optical fiber cable and the associated terminations shall be replaced at the expense of the Contractor.

2.03 DOCUMENTATION/AS-BUILTS/RECORDS

- A. General:
1. Upon completion of the installation, submit as-builts per the requirements of Section 270500 and Division 1. Documentation shall include the items detailed in the subsections below.
 2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.

3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.
- B. Copper Media Test Data:
1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
 2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.
- C. Optical Fiber Media Test Data:
1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
 2. OTDR traces of individual optical fiber "signatures" obtained as specified above shall be provided to the Architect/Engineer in electronic form for review. Trace files shall be so named as to identify each individual optical fiber by location in the cable system and optical fiber number or color. Where traces are provided in electronic form, provide along with the above documentation, one (1) licensed copy of software that will allow for the display of OTDR traces provided. The software shall run on a Microsoft Windows-based personal computer.

PART 3 - EXECUTION (Not Used)

END OF SECTION 271710

SECTION 271720
STRUCTURED CABLING SYSTEM WARRANTY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.02 RELATED WORK

- A. Section 270500 - Basic Technology Systems Requirements.
- B. Section 271100 - Communication Equipment Room (CER).
- C. Section 271300 - Backbone Cabling Requirements.
- D. Section 271500 Horizontal Cabling Requirements.

1.03 QUALITY ASSURANCE

- A. Refer to Section 270500 for relevant standards.

1.04 SUBMITTALS

- A. Under the provisions of Section 270500 and Division 1, prior to close of the project the Contractor shall submit:
 - 1. A numbered certificate from the manufacturing company registering the installation.

PART 2 - PRODUCTS

2.01 WARRANTY

- A. A twenty (20) year Product Installation Warranty shall be provided for the structured cabling system as described in the contract documents.
- B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
- C. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.

PART 3 - EXECUTION

3.01 WARRANTY REQUIREMENTS

- A. This Contractor shall be responsible for providing, installing and testing a structured cabling system that will meet the manufacturer's warranty requirements.

END OF SECTION 271720

SECTION 275113
PAGING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Paging Amplifier
- B. Ceiling Speaker
- C. Paging System Cable

1.02 RELATED WORK

- A. Section 260533 - Conduit and Boxes
- B. Section 260535 - Surface Raceways
- C. Section 260513 - Wire and Cable
- D. Section 270500 - Basic Communications Systems Requirements
- E. Section 270503 - Through Penetration Firestopping
- F. Section 270526 - Communications Bonding
- G. Section 270528 - Interior Communication Pathways
- H. Section 271500 - Horizontal Cabling Requirements
- I. Section 270553 - Identification and Administration

1.03 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer shall have five (5) years documented experience in the design and manufacture of paging system devices and equipment.
- B. Installer: The Contractor shall have a minimum of three (3) years documented experience in paging system installation and must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.
 - 1. The Contractor shall own and maintain all tools and equipment necessary for successful installation and testing of the system and have personnel adequately trained in the use of such tools and equipment.
- C. The following qualifications have been endorsed by the AudioVisual and Integrated Experience Association (AVIXA), which is formerly known as InfoComm International.
 - 1. The Contractor shall obtain the services of a Certified Technology Specialist with a specialized installation endorsement (CTS-I).
 - 2. The CTS-I shall perform the following tasks on the project:
 - a. Review contractor's submittals and provide a letter stating the submittals are in compliance with the contract documents.
 - b. Provide written and dated confirmation of an observation of the contractor's installation activities no less than every 2 weeks during the construction period.
 - c. Provide a final written and dated confirmation of a final construction review prior to testing.
 - d. Review final testing and calibration of the systems and provide a letter with the documented results or transmittal of the results stating the test results and calibration compliance with the contract documents.
- D. Audio System Programmer: All digital signal processing equipment (DSP) used on the project shall be setup, programmed, and calibrated by a factory-trained and certified technician.

- E. The Contractor shall have acquired and maintained all certifications for a minimum of one (1) month prior to the posted bid date of this project.
- F. Service: The manufacturer of the system must have local service representatives within 100.
- G. The entire installation shall comply with all applicable electrical and safety codes. All applicable devices, equipment, and cabling shall be listed by Underwriters' Laboratories, Inc.

1.04 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. ADAAG - Americans with Disabilities Accessibility Guidelines
- C. NFPA 70 (NEC) – National Electrical Code
- D. UL 813 - Standards for Commercial Audio Systems
- E. UL 1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use

1.05 SUBMITTALS

- A. Submit product data under the provisions of Section 270500.
- B. Provide materials documenting experience requirements of the manufacturer and installing contractor.
- C. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item by item.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage.
 - 4. Heat generation for all power consuming devices.
 - 5. Wiring and connection requirements.
 - 6. Manufacturer's installation instructions, indicating application conditions and limitations of use as stipulated by product testing agency and instructions for storage, handling, protection, examination, preparation, installation, and initiating usage of product.
- D. Certification Documentation Submittal:
 - 1. Provide documentation of all required certifications. All certifications shall be current and valid. Any certificate with expired dates will not be accepted. Submittal shall include documentation of the following:
 - a. Audiovisual and Integrated Experience Association (AVIXA) – Formerly InfoComm:
 - 1) Certified Technology Specialist (CTS)
 - 2) Certified Technology Specialist with a specialized Installation endorsement (CTS-I)
 - 3) Qualifications from InfoComm that have not expired will be accepted.
 - b. System Equipment Manufacturer(s) dealer certification(s) and dealer number(s).
 - c. System Equipment Manufacturer(s) programmer certification(s).
 - d. All other applicable dealer, installation, and programming certifications.
 - 2. If an alternate manufacturer is submitted, the equivalent certifications to the basis of design manufacturer's shall be required and submitted.
- E. Provide voltage drop calculations for each speaker cable circuit or run, showing the drop for the specific circuit or run wattage and cable size used.

F. Quality Assurance:

1. Provide list of test equipment proposed for use in testing the installed paging system.
2. Provide system checkout test procedure to be performed at acceptance, including demonstration of specified performance and all required system features and functions listed herein and as further detailed on the drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 270500.
- B. Store and protect products under the provisions of Section 270500.

1.07 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey multi-zone paging system.
- B. Performance Statement: This specification section and the accompanying design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed or every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required for a complete and operational system.
- C. This Contractor shall furnish and install a paging system as hereinafter specified and further detailed on the drawings. System shall be completely wired and ready for use including, but not limited to, outlet boxes, conduit, wire, equipment, speakers.
- D. Basic System Requirements: The system shall be capable of providing the following minimum features in addition to those specified elsewhere in this specification and on the drawings:
 1. paging system.
 2. Multi-zone paging system, capable of expanding the quantity of zones by the addition of modular components. Expansion of the quantity of zones by the replacement of equipment is not acceptable without a documented trade-in policy by the manufacturer.
 3. Live and pre-recorded emergency voice messages shall have priority over all non-emergency messages and other program material.
 4. Live all-call voice messages via microphone.
 5. Live and pre-recorded all-call voice message via message initiation station.
 6. Live and pre-recorded voice announcements to a specific zone or group of zones via message initiation station. Zone or group shall be user-selectable via touch-tone dialing at the initiation of a message.
 7. System-wide background music from media player located at head end equipment. Background music shall be automatically muted during a voice message.
 8. Digital feedback elimination for live voice messages.
 9. Field-configurable priority override hierarchy for signal source inputs.
 10. Individual volume control for each signal source input.
 11. Supervision of speaker cabling for electrical faults, including shorts, open circuits, and ground faults. Faults shall be indicated at a continually-attended location.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 270500.
- B. Provide documentation of all test results and statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.

- C. Warranty: Submit written warranty and complete all Owner registration forms.
- D. Complete all operation and maintenance manuals as described herein.

1.09 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 270500.
- B. Operation and Maintenance data shall be submitted in hard copy and electronic .pdf format.
- C. Operation data shall include:
 - 1. Manufacturer's full operation instructions for each piece of equipment.
 - 2. Complete documentation of all settings and programming.
 - 3. Detailed, step-by-step instructions for system operation, including accessing, initiating, and performing all required system features and functions listed herein.
- D. Maintenance data shall include:
 - 1. Description of servicing procedures:
 - a. Documentation of all manufacturers' recommended preventive and remedial maintenance procedures to be performed by the Owner.
 - b. Troubleshooting flowcharts.

1.10 WARRANTY

- A. Unless otherwise noted, provide warranty for a minimum of one (1) year after Substantial Completion, as defined by the Contract. Certain system components may require additional manufacturer's warranty as described herein.
- B. The warranty shall:
 - 1. Cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
 - 2. Include emergency service and repair on-site, with response times of 24 hours from time of notification. The system shall be repaired and restored to operation within 24 hours of technician's arrival on site.
- C. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 - PRODUCTS

2.01 PAGING AMPLIFIER

- A. Features:
 - 1. Two independent channels
 - 2. Independent volume controls for each channel
 - 3. High-pass filters on inputs
 - 4. Thermal protection circuitry
 - 5. 70-volt output
- B. Specifications:
 - 1. Frequency Response: 20 Hz to 20 kHz, $\pm 0.25\text{dB}$
- C. Refer to the drawings for manufacturer and part number.

2.02 CEILING SPEAKER

- A. Features:
 - 1. Integral 70-volt transformer
 - 2. Circular paintable steel grille
- B. Refer to the drawings for manufacturer and part number.

2.03 PAGING SYSTEM CABLE

- A. Refer to Section 270500 for plenum or non-plenum cable rating requirements.
- B. Speaker Cable
 - 1. Minimum 16/2 shielded with drain wire
 - a. Conductor Type: Bare copper, stranded
 - 2. Cable shall be NEC compliant and UL listed.
 - 3. Basis of Design:
 - a. West Penn 225
 - 4. Provide with larger-gauge conductors where necessary to maintain acceptable voltage drop as defined herein.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with all manufacturer's instructions and recommendations for installation of all equipment, devices, and materials.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. Wiring:
 - 1. Refer to Division 26 for conduit requirements and additional wiring requirements. Wiring not installed in conduit shall be plenum rated.
 - 2. All cabling shall be run in conduit "free-air" in non-continuous cable supports or cable tray above accessible ceilings, and in conduit or in a secured metal raceway in exposed areas. Supports shall be spaced at a maximum 4-foot interval. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.
 - 3. All overhead paging system audio cabling, including but not limited to speaker, line-level audio, and microphone-level audio cabling, shall be installed in its own cable pathway and shall not share any raceway or cable pathway with telephone or computer network cabling or cabling of any other system.
 - a. Cable shall not be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires. Cables shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, ceiling supports, electrical or communications conduit, or structural elements.
 - 4. Manufacturer's minimum bend radius specifications for cables shall be observed in all instances.
 - 5. All cable shall be installed at right angles and be kept clear of work by other trades. To reduce or eliminate EMI, the following minimum separation distances from $\geq 480V$ power lines shall be adhered to:
 - a. 12 inches from power lines of 5-kVa
 - b. 18 inches from high voltage lighting (including fluorescent)
 - c. 39 inches from power lines of 5-kVa or greater
 - d. 39 inches from transformers and motors

6. It shall be noted that all cables shall be installed in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted otherwise.
7. All cable shall be free of tension at both ends.
8. Both ends of all cables shall be clearly labeled with an alphanumeric identifier. On speaker cables, the label shall indicate the speaker cable circuit zone or run and the telecommunications room in which the zone or run initiates; on line-level cables, the label shall indicate the signal and signal source. Record all speaker cable identifiers on record drawings.
9. No acid core or other corrosive flux solder shall be used in this system.
10. Speaker cable conductor sizes listed are minimum requirements. Actual wire size required shall be determined by the Contractor to maintain a maximum of 10% voltage drop or 0.5 dB insertion loss on any speaker zone. Actual speaker cabling installed shall meet or exceed minimum conductor sizes listed. Basis of design paging speaker cable listed herein is provided to list the minimum criteria and performance requirements for paging speaker cable.
11. The polarity of all cabling shall remain consistent throughout the project, on all equipment.
12. Do not run unbalanced audio signals over cables longer than 10 feet. Contractor shall provide a shielded transformer-based converter at signal source to convert the unbalanced signal to a balanced signal.
13. The Contractor shall provide an isolation transformer for any balanced or unbalanced audio line that exhibits hum, EMI / RFI, power line noise, or ground loops.
14. Provide all system wiring between all components as shown on project documents, as directed by the manufacturer, and/or required for proper system operation and to provide specified system functionality.

D. Equipment:

1. All necessary devices, sub-components, accessories, and incidental materials required to provide a complete, turn-key paging system that provides specified performance and all required system features and functions listed herein and as further detailed on the drawings shall be provided and installed as part of a complete system.
2. All speakers shall be connected in proper polarity.
3. Install all head end equipment and devices in a manner that allows ample air flow for cooling.
4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tools recommended by the manufacturer for that purpose. Use caution to avoid stripping or damaging connectors, terminals, or equipment by over-tightening termination fasteners.
5. The conductor color code used in terminating system cabling at system equipment and devices shall remain consistent from device to device for each unique device type throughout the project.

E. Grounding Requirements:

1. Furnish and install a minimum #6 AWG bonding conductor from each overhead paging system head end component to the nearest wall-mounted telecommunications grounding busbar. Actual bonding conductor size determined by its installed length. Refer to Section 270526 for grounding and bonding conductor sizing criteria.
2. Audio cable shields for line level signals shall be connected to the metal equipment chassis at both ends of the cable. Audio cables connected to transformers shall have the cable shield connected to the transformer shield and transformer case ground.

3. Speaker cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground speaker cable shields at signal origin telecommunications room end only.

3.02 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Furnished products shall be listed and classified by UL as suitable for purpose specified and indicated.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the project documents. These services do not relieve the Contractor of responsibility for compliance with the project documents.

3.03 SYSTEM SETUP, PROGRAMMING, AND ADJUSTMENT

- A. The Contractor shall provide all system programming, startup, balancing, tuning, and adjustment required as part of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments that may be required.
- B. Complete all necessary programming to provide the indicated functionality.
- C. Program priority override hierarchy as follows:
 1. Emergency voice message input
 2. Emergency tones
 3. Voice paging microphone
 4. Voice Page port input
 5. Voice message input
 6. Schedule tones
 7. Night ring
 8. Background music
- D. Paging system shall be adjusted to provide 70 dBA of sound measured at one (1) meter from each speaker when voice pages are made. Sound shall be clear, even, and undistorted and free of any hum, noise, or sonic anomalies. Where speakers are controlled via local volume controls, adjustments shall be made with the volume control set at 70
- E. Paging system shall be adjusted to achieve a minimum Speech Transmission Index (STI) of 0.50 or a Common Intelligibility Scale (CIS) rating of 0.7 at representative points within all areas of coverage.
- F. Paging system zone output equalization shall be adjusted to achieve +/- 3 dB over entire published effective frequency range of installed speakers, measured on axis at a distance of 1 meter from 10% of each speaker type installed +/- 4 dB over the 2,000 Hz octave band throughout all corridors, open treatment areas, and public spaces. All efforts shall be made to adjust the audible system output's average frequency response in all areas covered by each speaker zone to be as equal as possible when measured at ISO R 266-1997 / ANSI S1.6-1984 1/3 octave preferred frequencies from 20 Hz to 20 KHz.

3.04 TESTING

- A. The Contractor shall conduct all system testing as part of the requirements of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments or corrective action that may be required to provide a complete system that provides the specified performance and all required system features and functions listed herein and as further detailed on the drawings.

- B. At a minimum, the installer shall perform the following inspections and tests of the installed overhead paging system:
 - 1. Verify that all features and functionality are operating properly.
 - 2. Verify that the system receives signal from all sources and routes those signals as specified.
 - 3. Verify that priority override hierarchy functions properly and according to the hierarchy specified.
 - 4. Verify that system output meets specified sound level at each speaker.
 - 5. Verify that system output meets specified minimum STI and/or CIS rating at representative points within all areas of coverage.
 - 6. Verify that system output meets specified equalization requirements in all coverage areas.
 - 7. Verify that all controls are properly labeled and interconnecting wires and terminals are identified.
- C. Document all test results and submit as part of final system documentation package.

3.05 TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two week's advanced notice of training to the user.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. Users:
 - a. Provide training on the system functions and operations that a daily user will encounter, including navigation of the user interface to accomplish common operations.
 - 2. Maintenance Staff:
 - a. Provide training on the system functions and operations that a daily user will encounter, including navigation of the user interface to accomplish all common operations.
 - b. Provide training on all system components and the basic configuration of the system.
 - c. Identify and describe preventive and remedial maintenance procedures to be performed by the Owner.
 - d. Review troubleshooting flow charts and describe troubleshooting procedures for common issues.
- E. Minimum on-site training times shall be:
 - 1. Users: Two (2) hours.
 - 2. Maintenance Staff: Two (2) hours.

END OF SECTION 275113

SECTION 280500

BASIC ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic Safety and Security System Requirements (herein referred to Security) specifically applicable to Division 28 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 SCOPE OF WORK

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the security systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make the portion of the security systems a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Description of systems include but are not limited to the following:
 - 1. Electronic access control system
 - 2. Electronic intrusion detection system
 - 3. Video surveillance
 - 4. Fire detection and alarm.
 - 5. Low voltage security wiring (less than +120VAC) as specified and required for proper system control and communications.
 - 6. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
 - 7. Firestopping of penetrations of fire-rated construction as described in Section 280503.

1.03 WORK SEQUENCE

- A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.04 DIVISION OF WORK BETWEEN ELECTRICAL AND SECURITY CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 - 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.

2. "Electrical Contractor" shall also refer to the Contractor listed in Division 28 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
3. "Security Contractor" as referred to herein refers to the Contractors listed in Division 28 of this Specification.
4. Low Voltage Security Wiring: The wiring (less than 120VAC) associated with the Security Systems, used for analog and/or digital signals between equipment.

C. General:

1. The purpose of these Specifications is to outline typical Electrical and Security Contractor's work responsibilities as related to security systems including back boxes, conduit, power wiring and low voltage security wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the Security Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Security Drawings but required for the successful operation of the systems shall be the responsibility of the Security Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Security systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Security Contractor has convened to determine the exact location and requirements of the installation.
4. This Contractor shall establish Electrical and Security utility elevations prior to fabrication and installation. The Security Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Sprinkler Piping and other Piping
 - f. Conduit and Wireway
 - g. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Responsible for Security Systems grounding and bonding.
3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Security Contractor's Responsibility:

1. Assumes all responsibility for the low voltage security wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of security equipment which is required to be bonded to the telecommunications bonding system.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other contractors to determine a viable layout.

1.05 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, , pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
 - a. In cloud ceiling architecture, when open cabling/wire crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the installation, termination, testing, and placing into operation electronic security devices shall be individually trained by the manufacturer.
3. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
4. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of electronic security devices and have personnel adequately trained in the use of such tools and equipment.
5. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
6. Conform to all requirements of the City of Iowa Codes, Laws, Ordinances and other regulations having jurisdiction.
7. Conform to all published standards of City of Long Grove, Ia.

8. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
 9. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
 10. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting clarification. If there is insufficient time to follow this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
 11. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
 12. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
- B. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
 3. Pay all applicable charges for such permits or licenses that may be required.
 4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
 7. All equipment, and materials shall be as approved or listed by the following: (Unless approval or listing is not applicable to an item by all acceptable manufacturers.)
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.
- C. Examination of Drawings:
1. The drawings for the Security Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
 3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
 4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.

5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

D. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

E. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

1.07 WEB-BASED PROJECT SOFTWARE

- A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.
- B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.
- C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.
- D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.08 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
28 13 00	Electronic Access Control
28 23 00	Video Surveillance

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 28 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 28 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.09 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

1.10 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
 - 1. Firestopping, including mechanical firestop systems.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from harmful conditions.

1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.13 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 28 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.14 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers' equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.01 Refer to individual sections.

PART 3 - EXECUTION

3.01 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 260533. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.03 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 28 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.04 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of this section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.

3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.

3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div28.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div28.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

- C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
 4. Copy of final approved test and balance reports.
 5. Copies of all factory inspections and/or equipment startup reports.
 6. Copies of warranties.
 7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
 8. Dimensional drawings of equipment.
 9. Capacities and utility consumption of equipment.
 10. Detailed parts lists with lists of suppliers.
 11. Operating procedures for each system.
 12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
 13. Repair procedures for major components.
 14. List of lubricants in all equipment and recommended frequency of lubrication.
 15. Instruction books, cards, and manuals furnished with the equipment.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- D. Refer to the individual specification sections for minimum hours of instruction time for each system.
- E. Operating Instructions:
1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the security systems.
 2. If the Contractor does not have Engineers and/or Technicians on staff that can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 SYSTEM STARTING AND ADJUSTING

- A. The security systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.08 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of Security Drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.09 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All CCTV cameras, mounts, cabling and all headend equipment are installed, programmed and operational.
3. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

Prime Contractor: _____

By: _____

Requested Observation Date _____

Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

END OF SECTION 280500

SECTION 281300
ELECTRONIC ACCESS CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Server
- B. Field Control Hardware
- C. Application Software
- D. Access Control Graphical User Interface
- E. Portal Devices

1.02 RELATED WORK

- A. Section 087100 - Door Hardware
- B. Section 260513 - Wire and Cable
- C. Section 260533 - Conduits and Boxes
- D. Section 260535 - Surface Raceways
- E. Section 270526 - Communications Bonding
- F. Section 270528 - Interior Communication Pathways
- G. Section 270543 - Exterior Communication Pathways
- H. Section 270553 - Identification and Administration
- I. Section 271500 - Horizontal Cabling Requirements
- J. Section 280500 - Basic Electronic Safety and Security System Requirements.
- K. Section 280503 - Through Penetration Fire stopping.
- L. Section 281600 - Intrusion Detection System
- M. Section 282300 - Video Surveillance
- N. Section 283100 - Fire Detection and Alarm Systems.

1.03 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer shall have a minimum of ten (10) years documented experience in the development and manufacture of access control software and hardware. The software developer shall be, at a minimum, a Microsoft Silver Certified Integrator and Partner for those systems that reside in a Microsoft environment.
- B. Contractor:
 - 1. Shall be a factory-authorized installation, service and support company specializing in the selected manufacturer's product, with demonstrated prior experience of a minimum of three (3) years installing, programming and supporting the selected manufacturer's system.
 - 2. Shall have been in business for a minimum of three (3) years and shall have installed a minimum of three (3) similar or larger sized systems. Contractor shall have a minimum of two (2) service technicians who are certified in the proposed manufacturer's system.
 - 3. Shall retain the services of a minimum of one employee with the following certification(s) or education. Should more than one certification be required, one employee may maintain multiple certifications.
 - a. A certification of RCDD from BICSI or CNIDP from CNet.
 - b. A certification of MCSA: Server: Server Infrastructure from Microsoft.
 - c. A certification of CCNA or CCNP from CISCO.

- C. Material:
 - 1. All material which is Contractor furnished shall be new, unused and free from defects.
 - 2. Where more than one of any specified item of equipment or material is used, all such items shall be the same product from the same manufacturer.

1.04 REFERENCES

- A. International Building Code
- B. NFPA 70 - National Electrical Code.
- C. The BOCA National Building Code
- D. UL 294 - Standard for Access Control Systems.
- E. UL 365 - Standard for Police Station Connected Burglar Alarm Units and Systems.
- F. UL 464 - Standard for Audible Signal Appliances.
- G. UL 603 - Standard for Power Supplies for Use with Burglar Alarm Systems.
- H. UL 609 - Standard for Local Burglar Alarm Units and Systems
- I. UL 634 - Standard for Connectors and Switches for Use with Burglar Alarm Systems.
- J. UL 827 - Standard for Central Station Alarm Services.
- K. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.
- L. UL 1449 - Standard for Surge Protective Devices.
- M. UL 1635 - Standard for Digital Alarm Communicator Systems.
- N. UL 1638 - Standard for Visual Signaling Appliances – Private Mode Emergency and General Utility Signaling.
- O. UL 1778 - Uninterruptible Power Systems.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 280500.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage including UPS sizing.
 - 4. Heat generation for all power consuming devices.
 - 5. Wiring requirements.
 - 6. Server processor(s), workstation configurations, total and available disk space, and memory size.
 - 7. All network bandwidth, latency and reliability requirements.
 - 8. Backup/archive system size and configuration.
 - 9. Submit two of each type of credential to be used (access card, key fob, etc.).

- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 - 1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where each controller will be located. This block diagram shall be provided in Adobe PDF.
 - 2. Provide a schedule of all controllers and the doors/points each controller controls. This schedule shall be provided in Adobe PDF.
 - 3. Provide schedules describing each system input location by an architecturally familiar reference, e.g., Door 312A. The architectural door schedule shall be used as the basis. These schedules shall be provided in Adobe PDF
- D. Submit sample format of site specific programming guides to be used for system planning/programming conference with Owner. These guides shall be provided in Adobe PDF.
- E. So that required Owner personnel are present at the planning/programming conference required in Part 3 of this section, submit meeting agenda for the conference a minimum of two weeks prior to the conference.
- F. Submit detailed description of Owner training to be conducted at project end, including specific training times. Refer to Part 3 of this section for details.
- G. IP Addresses: Contractor shall provide to Owner, in a documented transmittal and in Microsoft Excel format, the names and locations of devices and the IP addresses which the Contractor shall define. An authorized representative of the Owner shall approve the information in a documented transmittal. Should Owner change the IP address structure after approval of the list, Owner may be responsible for additional fees involved with reprogramming.
- H. Quality Assurance:
 - 1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor. Provide documentation of the training and other applicable certifications of the Contractor.
 - 2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.

1.06 SYSTEM DESCRIPTION

- A. This section describes the furnishing, installation, programming and commissioning of a complete, turnkey access control system. The terms "access control system" and "security management system", or SMS, may be used interchangeably herein.
- B. The company, manufacturer, and product names used in this section are for identification purposes only. All trademarks and registered trademarks are the property of their respective owners.
- C. Performance Statement: This section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required. The Contractor shall be responsible for determining quantities of materials required for a complete and operational system. Floor plan drawings and schedules have been developed to aid the Contractor in determining device quantities and installation locations, but, where discrepancies between floor plans and schedules arise, the greater number shall govern.

D. Basic System Description:

1. The access control system shall provide the following functionality:
 - a. Electronic control access to designated areas.
 - b. Validation of cardholder credentials by use of personnel database, card formats, PINs. The system shall compare the time, location, and unique credentials of an attempted entry with information stored in the database.
 - c. Access to designated areas will be validated only when a user's credential has a valid number for its facility and the number is valid for the current time and for the reader where it is used.
 - d. The system software shall access the hardware that validates the person and monitors the security of a building by use of intelligent system controllers, reader interfaces, locks, readers, inputs and outputs. When access has been validated, a signal to the portal locking device shall be activated to enable alarm free access at that location.
 - e. The system shall be configured by use of application software.
 - f. The system shall monitor activities using operator monitoring software which includes graphical maps which display alarms, status and activity.
 - g. The system shall differentiate and restrict administrative and operational access through use of password authentication.
 - h. The system shall report on various aspects of the system by use of reports, both default and customizable. Reports shall be able to be printed.
 - i. The system shall have the capability to report alarms both audibly and visually.
 - j. The system shall control hardware from the monitoring station by use of manual actions and events.
 - k. The system shall provide record and data management by use of journals. There shall be a full audit trail.
 - l. The system shall allow for data to be imported from other products by use of database migration tools. These products may include Human Resources databases for name and/or time and attendance information, information from previous access control systems consisting of badge numbers from credentials that will be re-used, Microsoft Excel spreadsheets, or other systems as defined herein.
 - m. The system shall allow access using a web interface or a mobile application for use on the iOS and Android operating systems.
 - n. The system shall utilize Open Supervised Device Protocol (OSDP) version 2.0 or later to all peripheral devices.

E. Integrations, Software Development Kit (SDK) and Application Programming Interface (API):

1. The manufacturers of the systems that are integrated shall make an SDK available to other manufacturers.
2. Prior to the release of this section, the manufacturers of the systems that are to be integrated shall have made available to each other all APIs to perform the specific integrated functions required in this section.
3. The integrations shall be completed and tested, and shall have been implemented on at least one system of similar size prior to the release of this section. The integrations shall not be accomplished for the first time for this project unless written pre-approval has been granted by Owner to Contractor prior to bid deadline.

4. During the warranty period, should a new API or version of software be released by the SMS manufacturer or any of the manufacturers of systems or devices that are integrated, that API or version of software shall be installed in the appropriate system or device defined in this section at no charge to Owner. Should any loss of functionality in the integration be exposed through this installation, as compared to the accepted system, Contractor shall correct the functionality at no charge to Owner.
5. Any and all development costs for specified functionality or inter-system integrations shall be included in the Contractor's bid. No additional costs or fees for the integrations shall be charged to Owner from the time of notice to proceed through system acceptance.

1.07 OWNER FURNISHED MATERIAL

- A. Telephone service
- B. Data circuit / internet service
- C. Active telephone service equipment, such as key system, PBX or VOIP switch equipment
- D. Active computer network equipment:
 1. Routers
 2. Switches
 3. Hubs
 4. Wireless access points
 5. Uninterruptible power supplies for Owner furnished products
- E. Active computer equipment:
 1. SMS server - refer to Part 2 for details
 2. SMS workstation(s) - refer to Part 2 for details
 3. SMS badging station(s) - refer to Part 2 for details
 4. Uninterruptible power supplies for Owner furnished products
- F. Credentials:
 1. Badges
 2. Key fobs
 3. Adhesive tags
 4. Active transmitters

1.08 LICENSING REQUIREMENTS

- A. All user licenses required for system operation shall be included in the Contractor's bid. User licenses shall include server and workstation software, network controllers, card readers, printers, badging stations, and any other licensing that is required by the manufacturer for operation of any system component.
 1. Licenses shall be provided on a one-to-one basis. One license shall be provided for each device requiring a license. In the event the manufacturer requires the purchase of a block of licenses, license blocks provided shall be no greater than what is required for the number of devices in this project. Contractor shall document the number of remaining licenses in the project record documents and Operations and Maintenance data.
 2. The system described herein is an extension of an existing Keyscan Aurora CA8500, located at a central location within a city management location. All licensing shall be new for each installed device. The Contractor shall not use any of the Owner's existing (spare) licenses for any new components.

3. All Contractor-furnished software shall contain a perpetual, permanent license in which no other fees beyond the single payment for the work of this section are required in order to use the proposed software indefinitely. Owner understands that, after the initial warranty period has expired, maintenance and technical support fees may be required annually, quarterly, or monthly in order to receive software updates and technical support. However, it remains the option of Owner to purchase or decline this service. If Owner chooses to discontinue or never purchase this service, the software shall continue to be legally licensed for use. All software shall be the latest version released, and all Contractor-furnished servers and workstations shall be current on all patches and updates for all software on the machines at the time of acceptance of the associated systems.
4. The SMS shall require only a single license key present on the server for the SMS to operate. The key shall be a physical device or a software key. License keys shall not be required at the client workstations.

1.09 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 280500.
- B. Provide final system block diagram showing any deviations from shop drawing submittal.
- C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
 1. Controller installation locations including specific door numbers being controlled.
 2. All terminal block wiring, including cable numbers.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance data manuals as described below.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 280500.
- B. Manuals: Final copies of the manuals shall be delivered within 7 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system, and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. Manuals shall be submitted in electronic format only, Adobe PDF. The manuals shall consist of the following:
 1. Hardware Manual: The manual shall describe all equipment furnished including:
 - a. General description and specifications.
 - b. Installation and check out procedures.
 - c. System and equipment layout and electrical schematics to the control board and field device level. For multiple devices wired identically, only one wiring diagram is required per door configuration, to be labeled "TYPICAL".
 - d. Alignment and calibration procedures.
 - e. Manufacturers repair parts list indicating sources of supply.
 2. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a. Definition of terms and functions.
 - b. System use and application software.

- c. Initializations, startup, and shutdown procedures.
 - d. Reports generation.
 - e. Details on forms customization and field parameters.
- 3. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - a. Computers and peripherals.
 - b. Log in/Log out procedures.
 - c. Use of system, command, and applications software.
 - d. Recovery and restart procedures.
 - e. Graphic alarm presentation.
 - f. Use of report generator and generation of reports.
 - g. Data entry.
 - h. Operator commands.
 - i. Alarm messages.
 - j. System permissions functions and requirements.
- 4. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, cleaning, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.11 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after date of Substantial Completion for all materials and labor.
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
 - 1. Inspections: The Contractor shall perform two minor inspections at six-month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
 - 2. Minor Inspections: These inspections shall include:
 - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
 - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
 - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
 - a. Clean all equipment, including exterior surfaces and accessible and serviceable interior surfaces.
 - b. Perform diagnostics on all equipment.
 - c. Check, test, and calibrate (if required) all sensors.
 - d. Run all system software diagnostics and correct all diagnosed problems.
- C. Operation: Upon the completion of any scheduled adjustments or repairs, Contractor shall verify operation of the SMS.

- D. Service: The Owner will initiate service calls when the SMS is not functioning properly. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Qualified service personnel shall be at the site within 24 hours after receiving a request for service.
- E. Records, Logs and Work Requests: Contractor shall keep records and logs of each task completed under and outside of warranty. These logs shall be maintained in Microsoft Word or Excel. The log shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, description of work performed, the amount and nature of the material used, and the time and date of commencement and completion of the work. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the SMS. The Contractor shall deliver a record of the work performed within three (3) business days after work is completed. Defective items that have been replaced shall be given to the Owner. Should the replacement item be a temporary replacement until the removed item is repaired, Contractor shall retain possession of the defective item for repair and subsequent re-installation.
- F. System Modifications: Modifications by the Contractor are allowed after system acceptance. Contractor shall make recommendations for system modification in writing to the Owner. No system modifications shall be made without prior, written approval of the Owner. Any modifications made to the system shall be incorporated into the Operations and Maintenance Manuals, and other documentation affected. The Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- G. Software: At no charge, the Contractor shall provide to Owner all updates released by the manufacturer during the period of the warranty and verify operation of the system upon installation. These updates include system software updates, patches, bug fixes and revisions, as well as firmware updates. These updates shall be accomplished in a timely manner, fully coordinated with SMS administrators and operators, shall include training for the new changes/features, and shall be incorporated into the Operations and Maintenance Manuals and software documentation.
- H. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 - PRODUCTS

2.01 ELECTRONIC ACCESS CONTROL SYSTEM MANUFACTURERS

- A. KeyScan Aurora
- B. Should the access control manufacturer offer, as an option, the use of hardware by Mercury Security, the Contractor proposed solution shall utilize this hardware. Contractor shall state whether or not the software is compatible with the SCP, AP and EP families of Mercury Security hardware. For future additions or defective hardware replacements, the system shall not be "locked" to require Mercury Security hardware be purchased only from the access control software manufacturer or from the original Installing Contractor.
- C. Approval of Alternate Manufacturers:
 - 1. Contractors seeking approval for alternate manufacturers for any devices or software in this section shall submit requests for approved equals as defined by Division 1 in addition to submitting:
 - a. Bill of materials for each piece of hardware and software proposed.
 - b. Manufacturer's data sheet for each piece of equipment proposed.

- c. Line-by-line typewritten statement of compliance or non-compliance comparing Part 2 of this section with the published specifications of the proposed alternate products. This compliance statement shall be signed by an officer of the local contractor branch office that proposes to install the alternate product and either an officer of the manufacturer or an officer of the manufacturer's representative.
2. Refer to the project drawings for manufacturer and model numbers for the Basis of Design products.

2.02 SERVER

- A. The system shall not be required to have a traditional or virtual server and, instead, may be provided with embedded server functionality integral to the controller if the following three (3) conditions are met. The server specified below shall apply if the system does not meet these three (3) conditions:
 1. The network controller is a distributed architecture, native IP network appliance.
 2. The network appliance contains an onboard, embedded operating system (e.g., Linux-based), web server, ODBC-compliant database engine, data storage device and application logic controller.
 3. The network appliance contains onboard SSL communications.
- B. If the system architecture utilizes traditional servers, the system shall be a true multi-tasking, multi-threading application system architecture designed specifically for the Windows environment. All modules, including access control, alarm monitoring, credential management, etc., shall be built from a single unified 32-bit source code set.
- C. The system shall communicate on a TCP/IP based Ethernet LAN capable of utilizing 10/100/1000 BaseT.
- D. The system shall be functional in a virtual server environment.
- E. The SMS software shall utilize the native Windows security features and be registered with the Windows operating system as a service. The security features shall be configured with the following layers:
 1. Workstation: Prohibits non-operators from accessing the system.
 2. Desktop: Controls which applications a given operator can run.
 3. Applications Commands: Controls which commands within an application a given operator can perform.
 4. Files: Controls an operator's read/write access rights to individual files.
 5. Breakthrough Alarms: The operating system shall allow high priority alarm condition notification regardless of the application software currently opened.
- F. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator/operator to learn a different and/or new interface from the previous version.
- G. Associated Software:
 1. Support for web client.
 2. Support for mobile client.

2.03 CLIENT WORKSTATIONS

- A. Provisioning:
 1. The workstation(s) shall be furnished by the Owner and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall furnish specifications to the Owner in writing as part of the submittals.

2.04 FIELD CONTROL HARDWARE

A. Interior Control Panels:

1. Control boards, power distribution and terminals shall be enclosed in a NEMA 1 rated enclosure that is key lockable. Contractor shall not furnish padlock. All enclosures that are part of this project shall be keyed alike. Contractor shall furnish and install a mechanically fastened tamper switch on the interior of the enclosure.
2. Control boards are allowed to be in an enclosure separate from the power supplies/power distribution. Should they be in separate enclosures, the interface wiring shall be in rigid metallic conduit, RMC, with Myers hubs at both ends of the conduit.
3. Control panels shall be rack mountable in an enclosure specifically for rack mounting. Control boards and power supplies shall be located in the enclosure. The enclosure shall have screw or compression terminals on the rear panel for connection of field devices.
4. Intra-enclosure wiring shall be dressed using tie wraps and/or covered plastic wire way. Hook-up wires for identical purposes shall have the same color insulation. For example, if one input pair utilizes green and white insulated conductors, all similar inputs shall use green and white insulated conductors. The same color scheme shall be followed for all access control panels that are part of this project.
5. Cabling from field devices such as readers, door position switches, request-to-exit devices and locking devices shall not be directly terminated to the control boards and power supplies. The field devices shall be terminated to terminals located on the left side, right side or both sides of the enclosure back panel. Intra-enclosure wiring shall be routed from the terminals to the control boards and power distribution. Quantity and functional sequence of the terminals shall be identical portal to portal.
6. All devices inside the enclosure, less cabling and batteries, shall be mechanically fastened to a removable solid or perforated metal back panel with either:
 - a. Metal or plastic standoffs
 - b. DIN rail
7. Hook and loop fasteners, double sided tape or adhesives are not allowed to attach devices to the back panel. Mounting devices to the interior of the door shall only be allowed when the following two (2) conditions are met:
 - a. The access control hardware manufacturer offers prefabricated enclosures with devices mounted to the interior of the door.
 - b. Only the same devices that the access control manufacturer mounts to the interior of the door are allowed to be mounted in a different enclosure, and those devices shall be mounted in an identical manner.
8. 120V 20A input power shall be hard wired to a circuit breaker disconnect and to one duplex receptacle on the interior of the enclosure. Should devices in the enclosures require plug-in transformers/power supplies, the receptacle shall be utilized. One (1) power strip with integrated circuit breaker shall be located in the bottom of the enclosure as needed.
9. Power to the locking devices shall be provided by a power distribution board with no fewer than four (4) outputs. Each lock shall be individually protected. The power distribution board shall:
 - a. Provide protection with fuses or positive temperature coefficient (PTC) devices.
 - b. Provide control so that each output is individually selectable as latching or non-latching with fire alarm activation.
 - c. Provide control so that each output shall have Fail Safe and Fail Secure terminals.
 - d. Provide a fire alarm input with associated trigger LED.

- e. Provide an individual LED per output to indicate when an input has been triggered and the associated output has been activated.
 - f. Accept a dry, closed contact input to activate the individual lock outputs.
 - g. Provide a dry, Form C relay that energizes on activation of the fire alarm input. This output may then be used as a fire alarm input to other power distribution boards in the same or a different enclosure, or may provide input to another device such as a multi-pole relay.
 - 10. A minimum of four (4) 12V 7 AH rechargeable, sealed, lead acid batteries shall be located in the bottom of the enclosure. Two of the batteries shall be connected in series for 24V devices, and two batteries shall be connected in parallel for 12V devices. Contractor shall provide additional batteries as needed to power all devices for a minimum of 24 hours. Connections to the batteries shall be made with appropriate terminals crimped on the connecting conductors. Batteries shall be clearly labeled in a permanent manner with the date of installation.
 - 11. Power to control boards, readers and auxiliary devices such as request-to-exit motion detectors shall be provided by a power distribution board with no fewer than four (4) outputs. All devices powered by the same voltage at an individual portal shall be protected by the same fuse or PTC unless current requirements dictate otherwise. Individual fuses or PTCs may protect more than one control board.
 - 12. All access control panels, when populated with control boards and power supplies, shall have the following capacities:
 - a. Control of a minimum of two (2) portals.
 - b. Spare capacity of a minimum of one (1) access control portal, two (2) auxiliary inputs and two (2) auxiliary outputs greater than the requirements of the project at the time of system specification.
 - c. Five (5) spare fuses of each type used, to be in their original packaging, to be located in each power supply enclosure.
 - d. 50% spare current capacity on all power supplies located in unconditioned spaces and 40% spare capacity for those in conditioned spaces. Lower spare capacities are allowable based on prior approval of Contractor-provided power calculations.
 - 13. Locations where enclosures may be mounted are shown on the plans. Final location, with approval of Owner's representative, shall be selected by Contractor based on distribution of controlled portals and devices.
 - 14. At time of Substantial Completion, Contractor shall furnish a schematic diagram of intra-enclosure wiring and a complete bill of materials for the enclosures and the devices located within. This documentation shall include a schedule of fuses and the device(s) that each fuse protects. This documentation shall be placed by Contractor in a Contractor-furnished print pocket located on the inside of the enclosure door.
- B. Intelligent System Controllers (ISC):
- 1. The controller shall communicate with the host via an on board 10/100/1000 Base T Ethernet port.
 - 2. The controllers shall be a distributed architecture with full peer-to-peer networking capability. Parent/Child controller configurations are not acceptable. All controllers in the system shall be capable of operating in a standalone mode if communication is lost with the server or main controller. In no case shall a controller depend on communication with an upstream controller for proper standalone operation.

3. The communications bus shall be supervised for wiring integrity. If a communication failure is detected, the system shall report the loss. All controllers unable to receive communication shall operate as standalone devices including grant/deny decisions, complete with event buffers. All events shall be uploaded to the server upon restoration of communications.
 4. Controllers shall be AES 128-bit symmetrical block encryption devices conforming to FIPS-197.
 5. Controllers shall support a minimum of SHA-2 authentication security.
 6. The controllers shall utilize flash memory or similar technology, allowing program updates to be downloaded from the server. Program storage shall be in ROM.
 7. The controllers shall have the capacity for 15,000 cardholders and 45,000 transactions. All access decisions involving these cardholders shall be made at the lowest controller level without communication to the server.
 8. Handle all non-host related access control monitoring and decision making.
 9. LED indicators for power, fault and communications.
 10. Provide for local and global input/output linking:
 - a. The SMS shall support a global linkage feature whereby any input/output/event shall be linked to any other input/output/event in the SMS. Input/output linkages shall be able to span across intelligent system controllers.
 - b. System administrators shall be able to create global input/output function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-pass back areas. Each function list may include up to six actions.
 11. Reporting of transactions and status information to the server.
 12. Interface with standard reader technologies without special interface hardware, additional logic panels or other integrators. Supported technologies shall include:
 - a. 13.56 MHz Contactless Smart with or without biometrics or keypad
 - b. 13.56 MHz Multi-technology Smart
 - c. Proximity, with or without keypad
 - d. Magnetic stripe, with or without keypad
 - e. Wiegand
 - f. QR Code/Bar code
 - g. Keypad
 - h. Biometric, with Wiegand output
 - i. OSDP
- C. Reader Interface Module (RIM):
1. Reader interface modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of reader interface modules required based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
 2. RIM shall interface with and accept data from TTL, OSDP, Wiegand and RS-485 type readers and door hardware.
 3. RIM shall provide a minimum of three (3) inputs per portal for portal position, request to exit and auxiliary input.

4. RIM shall provide a minimum of two (2) outputs per portal for locking device and auxiliary output. Each output shall be Form C and shall be rated at 3A at 28VDC.
5. RIM shall communicate to controller by RS-485.
- D. Input Control Module (ICM):
 1. The input control module shall provide supervised and non-supervised alarm input zones and monitor/report line fault conditions, alarm conditions, power faults and tampers.
 2. Input control modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of input control modules required, based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
 3. UL 294 and 1076 listed.
 4. Each input configurable for normally open or normally closed.
 5. Each input configurable for timing.
 6. Each input configurable for end of line resistance.
 7. Status LEDs for communication to the host, heartbeat and input status.
 8. Communications line supervision.
 9. AES 128 bit encryption.
 10. 2-wire RS485 communications.
 11. No fewer than eight (8) inputs per board/control module.
 12. Alarm Masking: The ability to mask the alarm input on a time zone basis.
 13. Activate Output: The ability for any input to activate any output.
 14. Configuration of Debounce Time: The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
 15. Elevator control support for number of floors shown on the drawings.
 16. Global Linkage: The ability to link outputs with inputs that are attached to any ICM/output control module (OCM).
 17. Checkpoint: The ability to configure an input as a designated stop on one or more guard tours.
 18. Entry/Exit Delay: The ability to set up entry/exit delays for inputs that are attached to any ICM. This shall include:
 - a. Non-Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report.
 - b. Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires and the alarm has not been masked, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report.
 - c. Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.

2.05 APPLICATION SOFTWARE

A. General Performance:

1. The application software, in conjunction with the associated hardware, shall have the following features, functionality and capabilities. The functions that are to be implemented shall be determined in the planning conference between Contractor and Owner referenced in Part 3 of this section.
2. All Users:
 - a. All users shall be capable of being authenticated against Active Directory using LDAP before being granted system access. Should the Owner not use Active Directory, the system shall provide a built-in login and credential management tool to permit rules-based access rights on a per-user basis.
 - b. The access rights shall be selectable on a per-user basis. In addition, user groups shall be capable of being assigned whereby each user group has a common set of access rights. Users shall be capable of being assigned to these user groups by the system administrator.
3. Logs, Status, Maintenance, Diagnostics:
 - a. Historical Log: The system shall allow event history to be written to the hard disk in an archive format. At a minimum, the system shall support 500,000 transactions. Warning messages shall be generated at a user defined level of capacity. The system shall have the ability to offload the archive files to removable media automatically or manually.
 - b. System Status: The system shall query the status of any or all of the system's access control points, inputs and outputs.
 - c. System Maintenance/Diagnostics: The system shall provide for remote diagnostic capabilities. In addition, online diagnostics and communications maintenance shall be able to be activated from the operator interface.
4. Administrator:
 - a. The SMS shall provide system administrators with the ability to segment their access control SMS field hardware devices into various zones or areas where alarm monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to a minimum of 64 characters.
 - b. The SMS shall allow other devices such as card readers, input and output modules and intelligent system controllers to be automatically part of the monitoring zone when an intelligent system controller is selected, and it shall allow the system administrator to define which devices such as card readers, etc. belong to that monitor zone.
 - c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.
5. General:
 - a. Elevator control support for the number of floors and cabs shown on the drawings.
 - b. The SMS shall use an open architecture where all data must reside on a single database and must be accessible in real time to every SMS workstation or web-based client connected to the network. The system database shall be used to create and maintain the cardholder database. A screen designer module shall allow the creation and editing of custom database tables and data entry screens.

- c. The SMS shall be able to connect to and interface bi-directionally with external data sources using all of the following methods:
 - 1) ASCII with support for XML-formatted text exchange of data activated both manually and automatically.
 - 2) ASCII with support for XML-formatted text exchange of data using a direct table interface activated both manually and automatically.
 - 3) Real time exchange of data via Active Directory/LDAP utilizing an API supported by the SMS manufacturer. The live exchange of data shall permit exposure of SMS events and transactions to other data sources in real time and allow for receipt of data into the SMS, permitting this data to be acted upon and trigger linked events in the SMS in real time.
 - d. Security: Access privileges within the application software shall be permitted by use of a password protection system. The cardholder database shall have the following password security levels.
 - 1) A minimum of six (6) unique operator access levels
 - 2) Ability to view only the database fields
 - 3) Ability to restrict operator viewing to any of the individual database screens within a record
 - 4) Ability to restrict operator viewing to any of the database partitions
 - e. Cardholder Configurations: Each cardholder shall be capable of having up to five (5) access levels actively assigned to their account.
 - f. The system shall have cardholder identifications for "Visitor" and "Escort", with an associated optional validity period assignable with an activation and deactivation date.
 - g. The cardholder database screen shall have the following data associated with each cardholder:
 - 1) Last edit by operator with edited date and time
 - 2) Last date/time card was used
 - 3) Last reader giving valid access
 - 4) Last reader denying access
 - 5) Anti-pass back status
 - h. The system shall provide advanced query capability with the following search criteria: equal to, not equal to, greater than, greater than or equal to, less than, less than or equal to, like, is empty, is not empty, is between, and, or, not.
 - i. Access Control Configuration: The configuration application shall be password protected, restricting what each individual may edit or display inside the configuration application.
 - j. Text descriptions of access points such as doors.
6. Time Zones:
- a. The SMS shall be capable of creating and storing up to 255 time zones. Each time zone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
 - b. Each time zone shall be assignable to an alphanumeric name. Time zones shall be applied to access levels, card reader modes, alarm inputs, alarm outputs, and alarm masking and logging functions. Time zones shall be allowed to belong to any or all access levels so that the time zone only has to be defined once.

7. Access Levels:
 - a. The SMS shall be capable of defining a minimum of multiple access levels per cardholder.
8. Temporary Access Levels:
 - a. The SMS shall be capable of assigning temporary access levels inclusive of the assignable access levels.
9. Access Groups:
 - a. The SMS shall be capable of assigning access groups.
 - b. Each access group shall be assignable to an alphanumeric name.
10. Field Hardware Communications:
 - a. The SMS shall support communications with the intelligent system controllers (ISCs) by the following protocols:
 - 1) RS-232
 - 2) RS-485
 - 3) TCP/IP
 - 4) Open Supervised Device Protocol (OSDP)
 - b. Upon loss of communications between the SMS server and the ISC, an alarm shall be created with a time stamp. Upon re-established communication, the SMS and the ISC shall automatically re-synchronize from the point of communication loss without operator intervention.
11. Area Control:
 - a. Area control shall be a security method of preventing a person from passing their credential to another person for dual entry into a single location using one card. The SMS shall support the following area control features.
 - b. Global Hard Anti-Pass Back:
 - 1) The Global Hard Anti-Pass Back feature shall require that a credential always be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Hard Anti-Pass Back shall work in the following manner:
 - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be denied access and an alarm shall be reported to the alarm monitoring client workstation. Nested control areas (areas inside areas) shall be definable with a minimum of 64 entry and exit card readers. It shall be possible to have an area within an area and/or multiple areas that are independent of each other in which Global Hard Anti-Pass Back rules shall apply.

c. Global Soft Anti-Pass Back:

- 1) The Global Soft Anti-Pass Back feature shall require that a credential be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Soft Anti-Pass Back shall work in the following manner:
 - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be allowed access (if that cardholder has the appropriate access level to access the new area), and an alarm shall be reported to the alarm monitoring client workstation. It shall be possible to have an area within an area and/or multiple areas that are independent of each other.

d. The following summary criteria shall apply under Global Hard or Soft Anti-Pass Back:

- 1) Initially all card holders are reset to Area 0.
- 2) Any cardholder shall enter a controlled area any time after Time 0 by presenting a credential to a SMS entry card reader.
- 3) A cardholder shall not exit the controlled area unless he/she has entered the area presenting a credential to the SMS entry card reader.
- 4) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
- 5) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
- 6) These options shall include a "forgiveness" feature that will allow the system administrator to reactively reset the anti-pass back of all cardholders to Area 0, either through a manual override or a time zone command.
- 7) The SMS shall provide an anti-pass back exempt option for privileged or VIP cardholders. Cardholders with this option will not have anti-pass back rules applied to them.
- 8) The SMS shall also have a "forgiveness" feature that will allow the system administrator to proactively assign an automatic reset to an individual cardholder. This shall allow the system administrator to reset the anti-pass back of an individual cardholder to Area 0 automatically for a defined number of times.

e. Timed Anti-Pass Back:

- 1) Timed Anti-Pass Back shall allow the system administrator to decide how long after a cardholder has presented their credential that they will have to wait before the same credential will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.

- f. Two-Person Control:
 - 1) Two-Person Rule shall be provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two-Person Rule, the following criteria shall prevail:
 - a) The card reader shall grant access only if two valid cardholders (with authorized access levels) swipe their credentials one after the other. In the event a second authorized card is not presented within 10 seconds of the first authorized credential, the card reader shall reset and the first card will have to be swiped again.
 - b) Once two people occupy an area, individual access shall be granted.
 - c) Individual exit shall be permitted until an area is occupied by only two cardholders, at which point the Two-Person Rule applies for exit.
- g. Occupancy Limit:
 - 1) Occupancy Limit shall restrict the number of cardholders that shall be present in an area at any given time. The Occupancy Limit area shall be able to be defined by the system administrator up to the limits of the cardholder capacity of the system. Once the occupancy limit has been reached, a cardholder must swipe out of the exit card reader before the next cardholder may enter. Each area for which Occupancy Limit is enabled shall be definable with up to 64 entry/exit card readers. Multiple Occupancy Limit areas shall be definable.
- h. Mustering:
 - 1) The SMS shall support Mustering functionality. The Mustering function shall provide an automatic capability for registering cardholders that are on site during an incident. Designated exit and entry card readers shall be used to enter and leave hazardous locations and safe locations. When an incident occurs, a muster report shall be generated that consists of a listing of all personnel that are within the hazardous locations, as well as all personnel that have registered in a safe location.
- i. Alarm Masking Groups:
 - 1) The SMS shall support a group alarm masking feature whereby system administrators shall be able to create groups of alarm inputs that enable them to mask or unmask multiple input control module inputs and card reader inputs simultaneously.
 - 2) The following events shall have the ability to be part of an alarm masking group:
 - a) Input Control Module Events
 - b) Alarm Input Active
 - c) Card Reader Events
 - d) Auxiliary Input Active
 - e) Denied Count Exceeded
 - f) Door Contact Tamper
 - g) Door Forced Open
 - h) Door Held Open
 - i) Card Reader Input Tamper

- 3) Alarm Masking Groups shall be able to be masked as a group or as individual points.
 - 4) Alarm Masking Groups must support the ability to be masked multiple times. Alarm Masking Groups shall be able to be masked and/or unmasked via alarm monitoring commands by guards, via card reader keypad function keys, or via global linkage commands.
 - 5) The SMS shall support "2-man control" for masking Alarm Masking Groups.
 - 6) The SMS shall support an Alarm Masking Group status change (masked to unmasked or unmasked to masked) action to be linked to a function list that is capable of performing many system actions, such as activating a relay output. The SMS shall support a minimum of 64 Alarm Masking Groups per intelligent system controller. with a minimum of 200 alarm inputs per Alarm Masking Group.
- j. Cardholder Escort Control:
- 1) The SMS shall support comprehensive escort functionality based upon access levels. Access levels shall include options for "Escort Required", "Designated Escort", "Not an Escort" and "Does not require an Escort." Contractor shall integrate escort level and designation into badge design in cooperation with Owner.
 - 2) The escort feature shall be capable of one-to-one and one-to-many Escort to Escorted functionality.
- k. Cardholder Use Limits:
- 1) The SMS shall support a Cardholder Use Limit feature that shall allow system administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the SMS.
- l. Extended Individual Strike Times:
- 1) The SMS shall support Extended Individual Strike Times that allows a card reader's strike to be active for an extended period of time beyond the pre-determined standard strike time on a per cardholder basis. The extended strike time shall be user definable up to 255 seconds. Extended strike times shall be set on a card reader by card reader basis.
- m. Extended Individual Door Held Open Times:
- 1) The SMS shall support Extended Individual Door Held Open Times that allow a card reader's door to be held open for an extended period of time beyond the pre-determined standard held open time on a per cardholder basis. The extended held open time shall be user definable up to eight (8) hours. Extended held open times shall be set on a card reader by card reader basis.
- n. Extended, On Demand, Door Held Open Times:
- 1) The SMS shall support Extended, On Demand, Door Held Times via a command keypad located in the field. The Extended Held Open command configuration shall consist of a command key sequence that shall be from three to six keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre-alarm time (from 0 to 30 minutes).

- 2) Only those cardholders having command authority at a given card reader configured for 'Allow User Commands' shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid cardholder has received an access grant at the card reader. The cardholder shall have a period of 15 seconds after the access grant to enter the extended held open command sequence.
- o. Graphical System Overview Tree:
 - 1) A Graphical System Overview Tree shall display a graphical representation of all field hardware including hardware from other systems which are interfaced. System administrators shall be able to modify a device that is depicted on the Graphical System Overview Tree or see its properties by double clicking on the icon, and the SMS shall bring them to the appropriate form.
- p. Pre-Alarm:
 - 1) The SMS shall support a Pre-Alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up the maximum allowable door hold open time.
- q. Alarm/Event Logging:
 - 1) All alarms and events in the SMS shall, by default, always be recorded in the database. The SMS shall give system administrators the ability to select, on a time-zone basis, the times that they require the SMS to log specific events to the database.
 - 2) System administrators shall have the option for particular alarm/events to be set to log or not to log on any individual reader and/or input.
- r. Scheduling Utility:
 - 1) The SMS shall provide an integral Scheduling Utility. The Scheduling Utility shall allow system administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
 - 2) The Scheduling Utility shall be available from both the system administration and alarm monitoring modules.
 - a) The types of actions that shall be schedulable include, but are not limited to:
 - b) Action Group
 - c) Event Archiving/Purging
 - d) Arm/Disarm Area
 - e) Start of Guard Tour
 - f) Execution of Scripts
 - g) Activate, Deactivate, Pulse Device Output and Device Output Groups
 - h) Global Anti-Pass back Reset
 - i) Download Firmware to equipment.
 - j) Download Database to ISCs
 - k) Execute Function List
 - l) Mask/Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open

- m) Open Door, Open Door Group
 - n) Change Reader Mode
 - o) Automatic Reports
 - p) Reset Use Limit
 - q) Move Bulk Credentials from an Area
 - r) Deactivate Credentials
 - s) Logout Visitors
 - t) Schedule PTZ Presets
 - 3) The Scheduling Utility shall maintain a history log in the database for actions that it executes.
12. Multiple Card Formats:
- a. Each ISC shall support a minimum of eight (8) access control card formats and, if applicable, eight (8) asset formats.
13. Card Reader Cipher Mode:
- a. The SMS shall support a Card Reader Cipher Mode that shall allow authorized cardholders to enter their credential ID by typing it into a card reader keypad, thus emulating the presentation of the credential to the card reader.
14. Denied Access Attempts Counter:
- a. The SMS shall support a Denied Access Attempts Count on a per card reader basis. The "Denied Attempts Count" value shall be configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented:
 - 1) Unknown PIN entry at a card reader configured as 'PIN or Card' mode.
 - 2) Invalid cipher entry at a card reader in Cipher Mode.
 - 3) Invalid PIN entered for a given card at a card reader configured as 'Card and PIN' mode.
 - 4) Non-matching biometric presented for a given card at a card reader in Biometric Verify mode.
15. Card Reader Time Zone Overrides:
- a. The SMS shall allow for the pre-defined default card reader settings to be overridden or temporarily changed on a time-zone basis. At the beginning of the selected time zone, the selected card reader's operational mode shall be modified from its default mode to any one of the following modes: Locked, Unlocked, Facility Code, Card Only, Card or PIN, Card and PIN, Card and Biometric, Card or PIN and Biometric, and/or Card and PIN and Biometric. The aforementioned options shall be available depending on the type of card reader used.
 - b. Each card reader shall have the ability to have multiple time zone setting overrides assigned to them as required by the system administrator.
16. Alarm/Event Routing:
- a. The SMS shall be capable of allowing system administrators to route alarms and events to various alarm monitoring client workstations on the network. The SMS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device-by-device level.
 - b. The SMS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user definable time period.

- c. The SMS shall implement network synchronization such that in the event that an alarm is routed to multiple client workstations, once the first client workstation acknowledges the alarm, the alarm shall be cleared from all other client workstations. As such, alarms that are routed to an Alarm Monitoring client workstation that does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the SMS. Alarms/Events shall be routed based on default settings or time zone control.
17. Alarm Attributes:
- a. The system administrator shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis. Each alarm and/or event shall have the option(s) to:
 - 1) Display at one or more alarm monitoring client workstation.
 - 2) Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
 - 3) Require the field device that generated the alarm to be restored to its normal state before the alarm is cleared.
 - 4) Print the alarm to the local event printer.
 - 5) Have a customized voice message annunciate at the client workstation.
 - 6) Have the alarm breakthrough to the alarm monitoring window should the system operator be working in another application
 - 7) Allow system operators to change the journal entry once the alarm has been acknowledged.
 - 8) Ensure that the alarm will not be able to be deleted from the alarm monitoring window upon acknowledgment.
 - 9) Display text and audio instructions outlining the procedures to follow when responding to the alarm.
 - 10) Automatically call-up associated maps.
 - 11) Automatically call up the associated cardholder record.
 - 12) Automatically call up the associated cardholder photo using the video verification function.
 - 13) Require a password to view the alarm.
 - 14) Require a password to acknowledge the alarm.
 - 15) Require acknowledgment to clear.
 - 16) Allow mandatory journal entry upon acknowledgment.
 - 17) Use pre-defined journal entries for alarms.
 - 18) Select the option for journal entry based upon the specific alarm.
 - 19) Send surveillance interface commands to the surveillance system.
 - 20) Automatically send an e-mail message.
 - 21) Automatically send an alphanumeric page.
 - 22) Have the alarm appear on the alarm monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
 - 23) Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
 - 24) Trigger a function list(s) when the alarm is acknowledged.

- 25) Require user logon for acknowledgment.
 - 26) Have the ability to mark an alarm as "In Progress" where the system shall silence any repeating audio notifications on the workstation where the alarm was routed, and remove the alarm sprite notification on the graphical map. Additional operators' monitoring alarms shall be notified that the alarm has been marked "In Progress".
18. Alarm-Event Mappings:
- a. The SMS attributes in Alarm Attributes shall be assignable on a 'global' basis to all devices that share an alarm description. Thus, the 'Door Forced Open' alarm attributes shall apply to any door with a card reader that is forced open in the SMS. The SMS shall have the capability to assign a unique group of alarm attributes to specific device/alarm combinations to override the global settings for specific case settings. Each device/alarm combination shall have the ability to have its own unique attribute set if the system administrator desires.
19. System Downloads:
- a. The SMS shall provide for the downloading of data to the ISCs. Downloads shall load SMS information such as time zones, access levels, alarm configurations, cardholder information and card reader configurations.
 - b. All ISCs on the SMS shall be capable of either full or selective downloads to individual intelligent system controllers, and bi-directionally so that alarms will still report to their respective alarm monitoring client workstations as cardholder information is being downloaded.
 - c. Information on cardholder status, credential status, time zones or access levels shall download in real time as they are added, modified, or deleted from the SMS.
20. Portal Configuration Options:
- a. The SMS shall include the following options for each portal on the system:
 - 1) Allow user commands such as manual door unlock
 - 2) Rename auxiliary inputs
 - 3) Rename auxiliary outputs
 - 4) Independently supervise REX and DPS
 - 5) Configure REX and DPS as Normally Open or Normally Closed
 - 6) Deny if duress
 - 7) Assume door used
 - 8) Alarm masking
 - 9) Activate outputs
 - 10) Two card control
 - 11) Checkpoint
 - 12) Do not activate strike on REX
 - 13) The ability to allow system administrators to determine on a time-zone basis to log or not to log on a card reader by card reader basis
 - 14) Access grants
 - 15) Access denied
 - 16) Card reader status alarms
 - 17) The SMS shall allow for user definable door strike functionality for each card reader in the SMS

- 18) The SMS shall allow for each card reader to be selected as either an 'In' reader, 'Out' reader, or 'None' to allow for ease of reporting time and attendance basic 'Time In' and 'Time Out' data.
- 19) Enforce Use Limit: This option shall enable card use limits at the card reader. limiting the number of times that cardholders may use their credential to gain access at the card reader
- 20) Supervise Door: Sets the SMS so that the card reader door contact is wired as a supervised input

2.06 ACCESS CONTROL GRAPHICAL USER INTERFACE (GUI)

- A. A workstation based custom GUI shall be provided for complete display of real time system activity.
- B. The GUI shall provide the following features:
 1. Display in real-time, the status of devices by dynamically changing shape or color to indicate status.
 2. Acknowledge alarm conditions.
 3. Perform manual operations on all monitor and control points.
 4. Perform graphic editing functions.
 5. Customization of icons color or shape based on status.
- C. Graphical representations shall be made of the following activity:
 1. Cardholder Activity: Access granted (including duress), access denied, lost card used, stolen card used, inactive card used, unescorted visitor.
 2. Input Point Activity: Input condition (normal, abnormal, cut, short, shunt, unshunt).
 3. Output Point Activity: On status (automatic, by operator, by link), off status (automatic, by operator, by link), access level on, access level off.
 4. Door Activity: Auto unlock, auto lock, closed, opened, forced open, left open, door switch cut, door switch shorted, REX status (cut, shorted, normal, abnormal), input unlock, operator lock, operator unlock.
 5. Controller Activity: Controller on-line, controller off-line, controller communications normal, communications cut.
 6. System Activity: System error, workstation start, workstation stop, printer off-line, printer unavailable, printer overflow, unknown card.
 7. Regional Group Activity: Occupancy restriction (high limit, low limit), anti-pass back (entry, exit), policy violation, escort left, number of escorts, numbers of users, number of visitors.
- D. The GUI shall display custom graphical screens, developed by the SMS vendor with electronic maps provided by Owner.
- E. The system shall have the ability to automatically call up specific maps. Each input point shall be linked to a primary map.
- F. Graphical editing software shall be included, allowing the Owner to create and edit the graphical screens.
- G. Graphics screens shall be developed using a minimum of eight (8) colors from a palette of 64 available.
- H. The system shall operate on a Windows workstation as provided and recommended by the SMS vendor.

2.07 PORTAL DEVICES

A. Credential Readers:

1. Manufacturers:
 - a. Refer to drawings for approved manufacturers.
2. Multi-Technology:
 - a. Compatible with 125 kHz proximity, 13.56 MHz Contactless Smart card, MIFARE, DESFire EV1.
 - b. Backwards compatibility with legacy 13.56 MHz Contactless Smart cards and 125 kHz proximity access control formats, including 26, 32, 35, 37 bit as well as HID Corporate 1000 format.
3. Card readers manufactured specifically for non-access control applications shall not be acceptable.
4. FIPS 201 compliant.
5. Provide compatibility with most access control systems by providing card data outputs in Wiegand.
6. Compatible with OSDP access control systems.
7. Allow the firmware to be updated in the field without the need to remove the reader from the wall.
8. Secure mounting methods using tamper resistant screws.
9. An audio beeper that provides various tones to signify access granted, access denied, power up and diagnostics.
10. Tri-color LED or three (3) LEDs for visual notification of various conditions.
11. ISO1443A, 1443B and 15693 compliant.
12. The ability to transmit an alarm from an integrated tamper switch.
13. Support dual authentication of identity through the combined use of access badge and personal identification number (PIN) on an integrated 12 key keypad.
14. PBT polymer or UL94 polycarbonate.
15. Read Range:
 - a. Using 125 kHz cards or 13.56 MHz Contactless Smart cards, minimum operational read range shall not be less than one (1) inch after the readers have been installed in their permanent locations.
16. Operational voltage of 5-16 VDC, with operating temperature range of -31° F to 150° F, and rated for outdoor use with a minimum rating of IP55.
17. Readers and credentials shall be compatible with each other and shall be from the same manufacturer.
18. Available in sizes to be mounted to a standard single gang box or to a mullion. Maximum sizes:
 - a. Single gang box mount, with or without keypad: 5.1" x 3.1" x 1.1"
 - b. Mullion mount: 6.0" x 1.9" x 0.9"
19. Lifetime warranty against defects in material and workmanship.

B. Request-To-Exit Motion Detector:

1. Manufacturers:
 - a. Bosch DS 160 Series
 - b. Pre-approved equal
 - c. Refer to drawings for approved manufacturers.
2. Door monitor with sounder alert. Sounder alert shall have adjustable volume.
3. Adjustable latch time.
4. Selectable fail safe/fail secure.
5. Activation LED.
6. 12 or 24 VDC operation.
7. Sequential logic input.
8. Two (2) Form C contacts.
9. Tamper switch.
10. Field of view masking.

C. Door Position Switch:

1. Manufacturers:
 - a. GE
 - b. GRI
 - c. Honeywell
 - d. Pre-approved equal
2. Interior or Perimeter Door:
 - a. One (1) inch or 0.75 (3/4) inch diameter, recessed
 - b. DPDT contacts
 - c. 0.75" to 1.25" (3/4" to 1-1/4") gap for wood door
 - d. Maximum 0.375" to 0.625" (3/8" to 5/8") gap for steel door
 - e. Basis of Design: UTC/GE/Sentrol 1076D

D. Cable:

1. Composite cable is allowed, although sufficient conductors may not be available in composite cables for all portal configurations. Contractor shall be responsible for additional required cables beyond one composite cable to each portal to meet functional requirements of the system.
 - a. OSDP Reader: 18 AWG, 2 pair, stranded, twisted pair, overall shield. Shield shall be grounded at control panel end only.
 - b. Door Position Switch: 22 AWG, 2 conductor, stranded.
 - c. Lock: Minimum 18 AWG, 4 conductor, stranded.
 - 1) Lock may require heavier gauge cable depending on door hardware solution power requirements. Contractor shall coordinate with door hardware provider for higher current devices and shall adjust the gauge of the lock cable accordingly.
 - d. Auxiliary Devices: Refer to plans for requirements.

- E. Locks and Door Hardware:
 - 1. Electric/electronic locks shall be furnished and installed by the door hardware provider.
 - 2. Access Control Contractor shall interface with and terminate cables to locks.
 - 3. Access Control Contractor shall coordinate with door hardware provider for specified sequences of operation at the various portals.
 - 4. Electrified cylindrical and electrified mortise locks shall have an integrated request-to-exit device.
 - 5. Electric strikes shall have an integrated latch bolt monitor, and the dead latch shall be seated properly so that the strike cannot be defeated by manipulation.
 - 6. Magnetic locks shall have a magnetic bond sensor.
 - 7. Refer to architectural specifications and/or the architectural door schedule.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as shown on the project drawings or as directed by the manufacturer, whichever is the more stringent requirement.
- C. Network controllers shall be installed centralized in the nearest telecommunications room(s). Mount controllers to the structural walls in a location coordinated with other utilities. Coordinate exact location with Owner prior to installation. Provide dedicated +120 VAC emergency power circuit to the controllers using #12 AWG wiring from the nearest emergency electrical power distribution panel board.
- D. Provide wiring and connection to all electrified locking hardware devices. Complete programming and testing of all electrified locking hardware devices.
- E. Install all credential readers in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all credential readers. Complete programming, adjustment, and testing of all credential readers.
- F. OSDP Configuration: All OSDP devices shall be configured to use secure channel encryption and secure channel requirements when available and installation mode is to be turned off after installation. Follow SIA recommendations for configuring secure OSDP devices.
- G. Provide wiring and connection to all hardware request-to-exit devices that are integral to electrified door hardware. Provide wiring and connection to all request-to-exit motion detectors. Complete programming and testing of all integrated request-to-exit devices. Where possible, avoid false activation by persons passing by but not exiting.
- H. Install all door alarm contacts in accordance with manufacturer's instructions either recessed in the door header or surface mounted as required. Provide wiring and connection to door alarm contact devices. Complete programming, adjustment and testing of all door alarm contacts.
- I. Install all duress switches in accordance with manufacturer's instructions, surface mounted under counter in locations shown on plans. Verify exact mounting location with Owner prior to cable rough-in or installation. For hard wired devices, provide wiring and connection to duress switch devices. For wireless duress switch devices, mount receivers in accessible locations. Complete programming, adjustment and testing of all duress switch devices. Wireless testing shall include signal reception when transmitter is in all sections of the area in which it will be used in normal operations.
- J. Install, wire, configure, adjust, program and test all access control system servers, workstations, badging workstations and other user interfaces.

- K. Install, wire, configure, adjust, program, and test all specified interfaces and integrations between access control and other systems. Contractor shall provide all cabling, wiring, terminations, components, devices, accessories, hardware, software and other material and accessories necessary to complete all specified interfaces and integrations and make them fully operational.
- L. All low voltage access control cabling shall be routed and supported completely separate from any and all other telecommunications or other low voltage system cabling.
- M. Electronic access control system cabling shall not be spliced.
- N. Flexible conduit is not allowed except with prior approval. Refer to Section 260533 for conduit requirements. Refer to Section 270528 for cable hanger and support requirements.
- O. Each cable shall be appropriately identified, as defined on the record documents, at each end's termination point using pressure sensitive label strips.
- P. The conductor color code used in terminating system cabling at system devices shall remain consistent from device to device for each unique device type throughout the project.
- Q. Install and tighten all connectors in accordance with manufacturer's instructions using the appropriately designed tools recommended by the manufacturer for that purpose. Do not strip or damage connectors, terminals, or equipment by over tightening termination fasteners.
- R. Grounding and Bonding Requirements:
 - 1. Provide a minimum of 6AWG bonding conductor from each electronic access control system control panel, power supply and surge suppression device to the nearest telecommunications grounding busbar. Actual bonding conductor size is determined by its length; refer to Section 270526 for grounding and bonding conductor sizing criteria.
 - 2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the control panel end.
- S. Coordinate installation of all devices with other trades and utilities in the vicinity.
- T. Cabling shall be plenum rated when installed outside conduit in plenum ceilings.

3.02 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications as supplied and warranted by the system manufacturer. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system manufacturer.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL) as suitable for purpose specified and indicated.

3.03 MANUFACTURER AND INTEGRATOR COMBINED FIELD SERVICES

- A. Installation shall be performed by a factory-trained and certified Contractor.
- B. The Contractor shall provide a comprehensive, site-specific customer planning guide for the system. The Contractor shall conduct conference(s) with the Owner prior to any installation to discuss the programming and configuration options of the system and the planning guide.
- C. The Contractor shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point and each operator and administrator. Any software programmable access policy, within the bounds of the hardware specified, shall be included.

- D. It shall be the responsibility of the Contractor to provide a complete, functional system as described by the design documents. These responsibilities include:
 - 1. Complete hardware setup, installation, wiring and software configuration of the system server, all workstations and all peripheral hardware.
 - 2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference(s).
 - 3. Configuration of the network software for operation of the system. Templates shall be established representative of all user access right levels.
 - 4. Programming of all custom graphic GUI screens including devices.
 - 5. Complete system diagnostic verification.
- E. The SMS Installation Contractor shall be present at meetings to coordinate all door hardware requirements with the door hardware vendor.

3.04 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system
 - 2. Complete documentation of programming and access policies
 - 3. Complete operating instructions for all hardware and software
- B. The following sections shall be provided in the system documentation:
 - 1. System Administrator Manual: Provides an overview and a step-by-step guide and instructions detailing all system administrator responsibilities and functions.
 - 2. User Manual: A step-by-step guide and instructions detailing all system user functions.
 - 3. Alarm Monitoring Manual: A step-by-step guide and instructions detailing all alarm monitoring system functions and responsibilities.
 - 4. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
 - 5. Refer to Part 1 for details.

3.05 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Coordinate training days and times with Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. System Administrators: A course detailing the system functions, configurations and operations. Provide training on all aspects of the system including data import/export, report, cardholder management, system workstation and server configuration and maintenance, software and hardware configuration and peripheral hardware operation.
 - 2. Operators: A course detailing the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control, operation of integrated systems interface, and general overview of the report hardware.
 - 3. GUI Editing: Conduct detailed training on using the GUI editing software. Topics shall include the editing of existing graphical maps and the creation of new graphical maps.

- E. Minimum on-site training times shall be:
1. System Administrators: Eight (8) hours.
 2. Operators: Eight (8) hours.
 3. GUI Editing: Eight (8) hours.
 4. Integrations: Eight (8) hours.
 5. Badging System: Eight (8) hours.
 6. Four (4) additional hours of training each quarter for the 12-month period of the project warranty shall be provided. A minimum of half of this additional training shall be on site; the remainder may be support by telephone or email. Contractor shall document this training, including dates performed, trainer and Owner representative(s) present. Each phone call or email shall be documented as a minimum of 15 minutes duration.
 7. Operators and administrators are present 24 hours a day, 7 days a week. Contractor shall coordinate with Owner to provide training for all appropriate personnel, which may require Contractor to be present on site during non-business hours. Therefore, the hours in any or all categories defined above may be divided among the various shifts.

3.06 SYSTEM ACCEPTANCE

- A. The SMS vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components, software and functionality. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's systems engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.
- C. The system shall not be accepted until all requirements of system documentation and training have been completed.

END OF SECTION 281300

SECTION 282300
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Network Video Management System (NVMS).
- B. Video Storage Solution
- C. Cameras and Accessories.
- D. Cabling.

1.02 RELATED WORK

- A. Section 260533 - Conduit and Boxes
- B. Section 260513 - Wire and Cable
- C. Section 271500 - Horizontal Cabling Requirements
- D. Section 280500 - Basic Electronic Safety and Security System Requirements
- E. Section 283100 - Fire Detection and Alarm Systems
- F. Section 281300 - Electronic Access Control

1.03 QUALITY ASSURANCE

- A. NVMS Software Developer (Manufacturer): The NVMS system shall be a single-source manufacturer such that the single manufacturer develops, supports, and warranties the NVMS software solution. The manufacturer shall have three (3) years documented experience.
 - 1. The software developer shall be, at a minimum, a Microsoft Gold Certified Integrator and Partner for systems that reside in a Microsoft environment.
 - 2. The software developer shall be an active ONVIF member with current available product recognized by ONVIF as a Conformant Product.
- B. Integrator/Installer (Contractor): The Contractor must be a NVMS-certified installation, service, and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.
 - 1. The installer shall retain a Microsoft MCSE or equivalent technician for the purposes of server deployment, software configuration, and system integration.
 - 2. The integrator must have local service representatives within 100 miles of the project site.

1.04 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. Electronic Industries Association (EIA) Video Surveillance Equipment Standards
- C. UL 2044 - Standard for Commercial Closed Circuit Television Equipment
- D. UL 3044 - Standard for Safety for Surveillance Closed Circuit Television Equipment

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 280500.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage.
 - 4. Heat generation for all power consuming devices.

5. All required wiring shall be identified.
6. Number of IP addresses that will be required from the Owner's Information Systems Department.
7. Statement of Acceptability of Designed Server:
 - a. If the Contractor agrees that the server(s) designed and described herein is acceptable for the chosen manufacturer's solution and meets the demand of the application, this shall be stated in writing and submitted as part of the shop drawing submittal.
 - b. If the Contractor does not agree that the server(s) designed and described herein is acceptable for the chosen manufacturer's solution, Contractor shall itemize the quantity, technical specifications, and capacities of the servers required to support the functionality and device quantities required by the project drawings. Indicate the capacity utilization factor for each server.
 - c. Contractor's bid shall include any required changes in server(s) capacity.
8. Calculation for storage required using the criteria contained in the project drawings.
9. Provide annual cost and all terms and conditions for the NVMS Software Maintenance Agreement. Include all additional costs and terms and conditions for any Annual Service Contracts provided by the Contractor for all services that are not included in the Software Maintenance Agreement.
- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical cameras), the diagram may show one device and refer to the others as "typical" of the device shown.
- D. Sample format of site specific programming guides to be used for system planning/programming conference with Owner.
- E. Meeting agenda for planning/programming conference required in Part 3 of this specification.
- F. Submit detailed description of Owner training to be conducted at project end, including specific training time.
- G. Quality Assurance:
 1. Provide materials documenting experience requirements of the manufacturer and installing contractor.
 2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.
- H. Coordination Drawings:
 1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 280500 for coordination drawing requirements.

1.06 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey, video surveillance system.
- B. Performance Statement: This specification section and the accompanying project drawings are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

- C. Refer to the project drawings for model numbers for the Basis of Design for all equipment.

1.07 OWNER-SUPPLIED MATERIALS

- A. Verkada Administration accounts.

1.08 LICENSING REQUIREMENTS

- A. All licenses required for system operation shall be included in the Contractor's bid. Licenses shall include, but not be limited to, server and workstation software, cameras, encoders/decoders, and any other licensing that is required by the manufacturer for operation of any system component.
 - 1. Camera licenses shall be provided for all cameras listed on the Equipment Schedule whether cameras are new or existing.
 - 2. The system described herein is an extension of an existing Verkada system. All licensing shall be new for each installed device. Without Owner's written approval, Contractor shall not use any of the Owner's existing (spare) licenses for any new components.
 - 3. The Contractor shall fill out the NVMS Bid Inventory Form located herein and provide at the time of bid.

1.09 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 280500.
- B. Provide final system block diagram showing any deviations from shop drawing submittal.
- C. Provide statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.
- D. Provide final camera type and camera requirements schedules documenting all changes made during construction.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance manuals as described below.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 280500.
- B. Manuals: Final copies of the manuals shall be delivered within 14 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the manufacturer for each piece of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:
 - 1. Hardware Manual: The manual shall describe all equipment furnished including:
 - a. General description and specifications.
 - b. Installation and check out procedures.
 - c. System layout drawings and schematics.
 - d. Alignment and calibration procedures.
 - 2. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper installation, testing, and operation. The manual shall include:
 - a. Definition of terms and functions.
 - b. System use and application software.

- c. Graphical user interface use.
 - d. Reports generation.
- 3. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - a. Computers and peripherals.
 - b. System startup and shutdown procedures.
 - c. Use of system.
 - d. Recovery and restart procedures.
 - e. Use of report generator and generation of reports.
 - f. Data entry.
 - g. Operator commands.
 - h. Alarm messages.
 - i. System permissions functions and requirements.
- 4. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.11 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
 - 1. Inspections: Perform one minor inspection six-months after Substantial Completion and one major inspection prior to the expiration of the warranty.
 - 2. Minor Inspections: Inspections shall include:
 - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
 - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
 - c. Install all available software updates, patches, or bug fixes available from the NVMS manufacturer.
 - 3. Major Inspections: Inspections shall include all work described under paragraph Minor Inspections and the following work:
 - a. Clean all equipment, including interior and exterior surfaces.
 - b. Perform diagnostics on all equipment, including all system software diagnostics, and correct all diagnosed problems.
 - c. Adjust all camera alignments that have become out of alignment from their documented position at Substantial Completion.
 - d. Install all available software updates, patches, or bug fixes available from the NVMS manufacturer.
 - e. All warrantable system deficiencies during the Major Inspection shall be remedied under warranty at no cost to the Owner.
- C. Operation: Upon the performance of any scheduled adjustments or repairs, verify operation of the NVMS system.

- D. Emergency Service: The Owner will initiate service calls when the NVMS system is not functioning properly. Qualified personnel shall be available to provide service within the distance defined above. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365.
- E. Records and Logs: Keep records and logs of each task completed under warranty. The log shall contain all initial settings upon Substantial Completion. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the NVMS system.
- F. Work Requests: Record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what must be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. Deliver a record of the work performed within five (5) days after work is accomplished.
- G. System Modifications: Make any recommendations for system modification in writing to the Owner. No system modifications shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected. To the fullest extent possible, the Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- H. Software: Provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with NVMS system operators, shall include training for the new changes/features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.
- I. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 - PRODUCTS

2.01 NETWORK VIDEO MANAGEMENT SYSTEM - GENERAL REQUIREMENTS

- A. The network video management system (NVMS) shall be a cloud-based software solution that provides management of digital video and data across a TCP/IP network.
- B. Provide a turnkey solution that includes furnishing, installation, and configuration of a separate IP network, complete with all required network electronics, switches, and other hardware.
- C. The NVMS system shall consist of the following hardware/software components:
 - 1. Software:
 - a. Cloud-based software
 - b. Recording services, archival services, and storage management
 - c. Configuration tools
 - 2. System storage as specified on the project drawings.
 - 3. Cameras and related hardware as specified on the project drawings.
 - 4. Network electronics and related hardware and software as specified on the project drawings.
- D. Video from any camera on the system (on the LAN, WAN or Internet) shall be capable of being viewed from single or multiple workstations simultaneously at any time, limited only by network bandwidth.
- E. The NVMS shall support simultaneous displaying of live (30 fps) video of a minimum of 16 cameras while the video monitoring screen is configured in a 16-camera split configuration. In no case shall the frame rate of the camera be required to be restricted to less than 30 fps to display a 16-camera split view.

- F. Simultaneous display and recording of every camera shall be supported with independent user-adjustable frame rates that can be set differently for the display stream and the recording stream. These independent settings shall be unique per camera.
- G. The NVMS monitoring software shall support any combination of recorded and live video in any multiple camera split view, including viewing recorded video and live video from the same camera.
- H. The NVMS shall support continuous recording and event-based recording simultaneously. This shall be capable of being set on a per camera basis.
- I. Viewing of video (live and recorded) shall be possible from client software from any client hardware that is connected to the security LAN/WAN or Internet (through appropriate firewalls). In addition, system administration shall be permitted from remote client hardware.

2.02 NVMS MANUFACTURERS

- A. Basis of Design:
 - 1. Verkada

2.03 NVMS CLIENT REQUIREMENTS

- A. The NVMS PC workstation(s) shall be provided by the Owner.
- B. The workstation(s) for the basis of design are as follows:
 - 1. Workstation Quantity and Location: Refer to project drawings for quantity of workstations required and their location.
 - 2. Workstation Hardware Specification:
 - a. Provide workstation with performance requirements that meet manufacturer's recommendation.
 - b. One (1) minimum 19" flat screen LCD monitor.
 - c. Operating System: Latest version of Microsoft Windows.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as shown on the project drawings or as directed by the manufacturer, whichever is the more stringent requirement.
- C. Mount all cameras in the approximate locations shown on the drawings. Coordinate installation with other trades and utilities in the vicinity. Cameras containing fixed lenses, moved by more than 1'-0" from their location shown on the drawings, shall have a new lens calculation performed by the Contractor. Provide Architect/Engineer with results of lens calculation before proceeding with installation.
- D. Coordinate with Owner's IT Department to acquire network connections as well as any network configuration information, such as IP numbers, that will be required to connect NVMS to Owner network (if applicable).
- E. Provide all low voltage and +120 VAC power to all devices as required for proper system operation. Refer to Division 26 specification sections for further requirements.
- F. All low voltage security wiring shall be routed and supported separately from all other telecommunications cabling.
- G. Cabling shall be plenum rated when installed outside of conduit in plenum ceilings.

3.02 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the project drawings.
- C. It shall be the Contractor's responsibility to correct all inadequate picture quality issues prior to acceptance of the system.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Installation shall be performed by a factory-trained and certified Contractor.
 - 1. Provide a comprehensive, site-specific customer planning guide for the system. Conduct a conference with the Owner prior to any installation to discuss the programming options of the system and the planning guide. The result of this planning guide shall be the determination of the system options for each device and for the software.
- B. Include labor for all planning and all programming activities required to implement the Owner's operational preferences for each device and software. Any software programmable option, within the bounds of the capabilities of the hardware specified, shall be included.
- C. Provide a complete, functional system as described by the project drawings. These responsibilities include:
 - 1. Complete hardware setup, installation, wiring, and software configuration of the system, including all remote operator locations and all peripheral hardware.
 - 2. Complete programming of all hardware and software options in accordance with the Owner's preferences as determined by the planning guide conference.
 - 3. Programming of all custom graphic GUI screens including devices.
 - 4. Complete system diagnostic verification.
- D. Provide an authorized manufacturer representative to commission the system and ensure that facility-wide standards and project setup procedures are adhered to.

3.04 SYSTEM ACCEPTANCE

- A. Submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components and software. Perform the tests and document all results under the supervision of the manufacturer's system engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.

3.05 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system.
 - 2. Complete documentation of all programming and options.
 - 3. Complete operating instructions for all hardware and software.
- B. The following sections shall be provided in the system documentation:
 - 1. System Administrator Manual: Provides an overview and a step-by-step guide and instructions detailing all system administrator responsibilities and functions.
 - 2. User Manual: A step-by-step guide and instructions detailing all system user functions.

3. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams, and schematic diagrams.

3.06 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two weeks advanced notice of training to the Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 1. System Administrators: A course detailing the system functions and operations. Provide configuration training on all aspects of the system.
 2. Users: Provide a detailed course outlining the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control, and general overview of the report hardware.
 3. GUI Editing: Conduct detailed training on using the GUI editing software. Topics shall include the editing of existing graphical maps and the creation of new graphical maps.
- E. Minimum on-site training times shall be:
 1. System Administrators: Three (3) days.
 2. Users: One (1) day.
 3. GUI Editing: One (1) day.

END OF SECTION 282300

SECTION 311000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of surface debris, structures, landscaping, fencing, pavement, sidewalk, trees, designated plant life, and grass.
- B. Removal of topsoil, subsoil, rough grading, and site contouring.

1.02 RELATED SECTIONS

- A. Section 312200 - Grading

1.03 REGULATORY REQUIREMENTS

- A. Conform to applicable local and state code for disposal of debris.
- B. Coordinate clearing work with utility companies.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify and protect utilities to remain from damage.
- B. Identify, tag, and protect trees, plant growth, and features designated to remain, as final landscaping.
- C. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.02 CLEARING

- A. Clear areas required for access to site and execution of work to a minimum depth of 6 in.
- B. Areas of sidewalk/pavement removal shall be saw cut to full depth of pavement prior to removal. Protect edge of pavements to remain.
- C. Remove trees and shrubs indicated. Remove stumps, main root ball and root system to a depth of 24 inches. Dispose of trees offsite per local ordinances.

3.03 CLEAN UP

- A. Dispose of all debris from site according to all State and Federal solid waste disposal laws and regulations and solid waste determinations of the EPA at the Contractor's expense.
- B. Remove demolished materials from site as work progresses.

END OF SECTION 311000

SECTION 312200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough grading the site for site structures, utilities and pavement.

1.02 RELATED SECTIONS

- A. Section 312301 - Excavation & Fill.
- B. Section 312500 - Erosion and Sediment Control

1.03 REFERENCES

- A. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.

1.04 PROJECT CONDITIONS

- A. Verify all existing utility locations prior to beginning earthwork operations.
- B. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs to remain from grading equipment and vehicular traffic.
- C. Protect above and below-grade utilities that remain.
- D. Promptly repair damage to adjacent facilities caused by earthwork operations. Cost of repairs at Contractor's expense.
- E. Promptly notify Engineer of unexpected sub-surface conditions.

1.05 QUALITY ASSURANCE

- A. Installer's qualifications: Contractor shall demonstrate at least 3 years of successful installation experience on projects with work similar to that required for this project.
- B. Record drawings: At project close-out, submit record drawings of installed work. Especially note located utilities, areas of over-excavation, removal of unsuitable soils, and backfill.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey benchmark 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 utilities that remain, from damage.
- D. Notify utility company to remove and relocate utilities as necessary.
- E. Protect plant life, lawns, and other features remaining as a portion of the finish landscaping.
- F. Provide separate stockpiles for different soils material types as required.
- G. Protect benchmarks and survey control point.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated or areas to receive structures, or pavement.
- B. Identify required lines, levels, contours, and datum.
- C. Cut and fill to transform site to indicated elevations and contours. Elevations listed on the plans are to top of pavement or top of finished grade for landscape areas. Establish rough grades at

proper elevations to receive indicated thicknesses of topsoil, base fill material, slabs, concrete surfacing and other finished materials.

- D. When excavating through roots, perform work by hand and cut roots with sharp axe.
- E. Prepare subgrade in accordance with Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- G. Density Testing: Contractor provided testing agency will verify testing as work proceeds. Standard Density requirement is 95% ASTM D-698.
- H. Slope grades so as to provide positive drainage. Remove large stones, boulders and debris from the site. Rough grading shall be finished by blading to reasonably smooth contours with uniform transitions and slopes.

3.04 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify 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.

3.05 CLEANING AND PROTECTION

- A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.
- B. Remove all excess materials and debris from site to proper disposal location according to all state and local ordinances.
- C. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 312200

SECTION 312300
EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough grading and filling the site for future base course and paving.

1.02 RELATED SECTIONS

- A. Section 312500 - Earthwork - Erosion and Sediment Control

1.03 REFERENCES

- A. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- B. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
- D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2000a.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994 (2001).
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
- G. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2001.
- H. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2001.
- I. ASTM D4253 - Standard test Method for Maximum Index Density and Unit Weight of Soils Using a vibratory Table.
- J. ASTM D4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

1.04 PROJECT CONDITIONS

- A. Contractor is to provide construction layout stakes for all necessary grading, lines, and control points for the work.
- B. Mark and protect above and below grade utilities that remain.
- C. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs to remain from grading equipment and vehicular traffic.
- D. Protect materials from tracking off site.

1.05 SUBMITTALS

- A. Submit catalog cut sheets for intended products,
- B. Submit sources for aggregates including gradations.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General Fill: Suitable Subsoil from on site, off-site borrow, or Contractor Furnished borrow.
 - 1. Free of organic soil lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 - 2. Off Site Borrow: Conforming to ASTM D 2487 Group Symbol GC, GW, GM, SC, SM, SW, and SP or a combination of these groups. Soils classified with ASTM D 2487 Group Symbol CL, CL-ML, OR ML may also be used. When using soil classified as CL the liquid

limit and plasticity index shall be less than 45 and 20 respectively.

3. Soil conforming to ASTM D 2487 Group Symbol OL, OH, MH, CH, or PT shall not be used under paving, structures, or as backfill around foundations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.
- B. Fill areas in the order shown on the drawings. Other fill sources: Excavations from on-site provided they meet the requirements of 2.1 Materials above.
- C. Topsoil - Salvage from on-site sources unless off site sources are approved.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect utilities that remain, from damage.
- D. Notify utility company to remove and relocate utilities as necessary.
- E. Mark and verify removal items and limits.
- F. Protect plant life, lawns, and other features remaining as a portion of the finish landscaping.
- G. Provide separate stockpiles for different soil material types as required.
- H. Comply with the site erosion control plan and permit requirements.
- I. Clean and maintain a tire cleaning area at the entrance to the site during operations.
- J. Protect benchmarks, survey control points, fences, paving, and curbs to remain from excavating equipment and vehicular traffic. Prevent fill materials from tracking off site.

3.03 ROUGH GRADING

- A. Identify required lines, levels, contours, and datum.
- B. Before placing additional fill, smooth and level the surface of the existing soil and compact using heavy vibratory equipment until there is no loss of elevation. Remove any debris, vegetation, or organic material.
- C. Do not remove wet subsoil unless it is subsequently processed to obtain optimum moisture content.
- D. Prepare subgrades in accordance with Iowa DOT: Standard Specifications for Highway and Bridge Construction, Latest Edition.
- E. In general, areas within the influence lines of building foundations, walks, and other hard features (cohesive soils) will require 95% Standard Proctor density. Non-cohesive soils in these areas will require 98% Standard Proctor density, (ASTM D698).
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- G. Remove large stones, boulders and debris from the site. Rough grading shall be finished by blading to reasonably smooth contours with uniform transitions and slopes.
- H. Place and maintain silt fence and other erosion control items to prevent silt from entering adjacent properties or ROW. Comply with erosion control requirements and permit.

3.04 SOIL REMOVAL

- A. In areas to receive new construction and where grades are changed, remove all organic soils (topsoil) and fill materials placed without adequate compaction. Store materials for reuse.
- B. Stockpiles: Use areas designated on site or as agreed to; pile depth not to exceed 8 feet; protect from erosion. Grade stockpile area to prevent standing water.

3.05 FINAL GRADING

- A. Before Final Grading:
 - 1. Verify subgrade backfilling has been inspected.
 - 2. Verify subgrade has been contoured and compacted.
 - 3. Verify utility excavation is complete, utilities are installed, tested, and are ready for use.
- B. Remove any subgrade debris, roots, branches, stones, in excess of 3 inch in size.
- C. Verify landscape locations and depths to receive topsoil.

3.06 TOLERANCES

- A. Top Surface of Subgrade areas: Plus or minus 0.08 foot from required elevation.
- B. Grading around buildings, between curbs, adjacent to sidewalks as final surfaces, slope to drain and plus or minus .05 foot.

3.07 TESTING

- A. Verify soil materials comply with Section 2.1 above.
- B. Verify that the Owner's testing agency has moisture density curves for the material and is ready to perform testing.
- C. Spread soils in loose lifts not to exceed 6" in depth. Disk or dry soils to optimum moisture plus or minus 2% prior to applying compactive effort. Roll as required to obtain density. Adjust moisture content by adding water or disking as needed to reach moisture required. No additional pay allowance will be made for moisture adjustment.
- D. Shape fills such that water does not pond.
- E. Additional lifts may not be made unless the density requirements are met on the in-place lift.
- F. Density testing will be performed once areas have been cleared and ready to receive fills or specified surfaces, aggregates or pavements. Initially testing will be required continuously until the required densities are achieved and a workable process is in place over a fill area. A fill area consists of a parking lot, playing field, ball field or areas to receive buildings or structural surfaces. The testing will be performed to develop a consistent positive result. Once a consistent density method is established testing will be required daily as Quality Assurance testing during production of 250 cubic yards of fills or 250 square yards of aggregate bases. Continuous testing will start again if the material source changes or the quality assurance testing indicates the results are failing.

3.08 CLEANING AND PROTECTION

- A. Leave site clean uniform, ready to receive future work or temporary seeding. Clean mud from the tire cleaning area and the access way periodically during the work.
- B. Rake and clean entire disturbed areas for seeding.

END OF SECTION 312300

SECTION 312500
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of soils, collection and management of surface water and erosion.
- B. Implementation of Construction Storm Water Pollution Prevention Plan (SWPPP) in compliance with site permitting.

1.02 RELATED SECTIONS

- A. Section 312200 - Grading
- B. Section 312300 - Excavation and Fill

1.03 REFERENCES

- A. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- B. SUDAS Standard Specifications Section 9040-Erosion and Sediment Control.
- C. Scott County regulations.
- D. Storm Water Pollution Prevention Plan and Erosion Control Plan.
- E. Erosion Control Testing Council (ECTC.)
- F. Iowa NPDES permit requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Erosion Control Materials, Section 4169 of the Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- B. Temporary Erosion Control Seeding: IDOT Standard Specifications, see Table 4169.02-02, 65% Rye, 35% Oats.
- C. Permanent Seeding: By Contractor
- D. Silt Filter Fence: Section 4196.01,B. and I.M. 496.01.
- E. Perimeter and Slope Sediment control: IDOT Section 4169.12 A, Waddles and Sediment Logs, B, Filter Socks, or C, per I.M. 469.10, appendix E.
- F. Netless Erosion Control Blanket: Futerra F4 Netless or Equivalent having the following characteristics:
 - 1. Mass per Unit Area: 5 oz/yd²
 - 2. Thickness: 0.2 in.
 - 3. Tensile Strength: 4.3 lb/ft
 - 4. % Ground Cover: 79%
 - 5. Flexural Rigidity: 0.006 oz-in
 - 6. Water Absorption: 395%
 - 7. Shear Stress: 1 lb/ft²
 - 8. Functional Longevity: ≤ 12 months

PART 3 EXECUTION

3.01 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

- A. Erosion Control Plan Sheets: A general approach is included in the project plan sheets and SWPPP binder. A narrative is included on the plan sheets to provide a description for the work. This description is furnished to establish a level of effort needed to achieve permit compliance. It is understood and expected that actual conditions during construction will require ongoing

adjustments to the Erosion Control Plan (ECP) and ultimately the Storm Water Pollution Prevention Plan (SWPPP) for this project.

- B. Responsibility: Scott County, Iowa, and the Iowa DNR, through the NPDES and COSESCO permits, are the jurisdictional controls for this project. All persons performing surface disturbing activities on the site to take responsibility for their actions by conforming with the plan as permitted, or by adjusting the plan to accommodate schedule and method changes. Persons performing work on site are required to log in to the plan and log out when they have completed their activities. Changes to the plan are permitted, and various controls are shown in the ECP to allow flexibility of the plan without violating the permit.
- C. Plan Modifications: Changes to the ECP must be in compliance with the conditions of the prevailing permit. These changes, along with periodic inspection reports mandated by time and rainfall events during construction are subject to inspection by Scott County, Iowa and the IEPA/EPA. Failure to keep the appropriate records and failure to comply with the permit are reasons for enforcement action involving all parties.

3.02 INSTALLATION

- A. Per Manufacturer's Instructions.

3.03 SCHEDULE

- A. Refer to the Erosion Control drawings for project details and schedule for seeding, silt filter fence locations, and temporary drainage provisions.
- B. Refer to plans for details on for utilities.
- C. All materials are to be installed in accordance with the manufacturer's guidelines.
- D. Temporary Seeding: 100 lbs per acre application and reseeded at 7-day intervals on bare areas regardless of weather conditions.

3.04 SUBMITTALS

- A. All seed material is to be certified as meeting the above criteria prior to incorporation in the project.
- B. Erosion Control items require product certification for their intended use.

END OF SECTION 312500

SECTION 321313
CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. PCC sidewalk, curb and pavements.
- B. Compacted granular base.
- C. Backfilling form lines with appropriate material.
- D. Miscellaneous site concrete paving, pads and curbs.

1.02 RELATED SECTIONS

- A. Section 312200 - Grading
- B. Section 312300 - Excavation and Fill
- C. Section 312500 - Erosion and Sediment Control
- D. Section 334100 - Storm Utility Drainage Piping

1.03 REFERENCES

- A. Iowa Department of Transportation (IDOT): Standard Specification for Highway and Bridge Construction, Latest Edition.

1.04 PROJECT CONDITIONS

- A. Verify that subgrade elevations meet tolerances in Section 312300 - Excavation and Fill.
- B. Provide sufficient paving operations to meet project schedule and requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All products must meet or exceed the requirements of the Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- B. Portland Cement Concrete Pavements and Sidewalks as per Section 2511 of the Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- C. Miscellaneous Concrete shall conform to Section 2403, of the Iowa Department of Transportation (IDOT); Standard Specifications for Highway and Bridge construction, Latest Edition.
- D. Aggregate Base: Gradation #12 as per Section 4121 (quality) of the Iowa Department of Transportation (IDOT) Standard Specifications for Highway and Bridge construction, Latest Edition. Recycled concrete is acceptable providing it meets gradation and quality requirements.
- E. Provide from an Iowa DOT certified source, P.C. concrete meeting all of the following characteristics:
 - Compressive Strength at 28 days: 4,000 psi.
 - Slump: 4 inches maximum.
 - Air Entrainment: 5 - 8 percent.

2.02 ACCESSORIES

- A. Miscellaneous rebar as detailed. Rebar shall be grade 60 of the shape and size specified.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify gradients and elevations of base.

- B. Verify compacted sub-grade is dry and ready to support paving and imposed loads.
- C. Verify that all utilities within the work area have been installed, tested, and are ready to be paved over.

3.02 PREPARATION

- A. Scarify sub-grade surface to a depth of 6 inches in all areas compacted by construction activities prior to placing fill.
- B. Cut out soft areas of sub-grade not capable of compaction in place. Backfill with general fill.
- C. Compact sub-grade to density equal to or greater than the requirements for subsequent fill material.
- D. Moisten substrate to minimize absorption of water from fresh concrete.

3.03 BASE CONSTRUCTION

- A. Fill areas to contours and elevations using unfrozen materials.
- B. Place aggregate fill materials in continuous layers not exceeding 8" on top of geotechnical fabric (if specified).
- C. Compact aggregates in 8" deep lifts maximum, within 0 to +4% above optimum moisture content, and compact each lift by approved methods to not less than 95% of the maximum density given by ASTM D698 (Standard Proctor Density). Keep compacted lifts relatively smooth and level
- D. Maintain optimum moisture content of fill materials to attain required compaction density.

3.04 FORMING

- A. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Select form materials to obtain required finishes.

3.05 JOINTS

- A. Locate and install construction, isolation, and control joints as indicated or required. Locate construction joints so they do not impair strength and appearance of structure. Place isolation and control joints in slabs-on ground to stabilize differential settlement and prevent random cracking.
- B. Contraction Joints: In sidewalks joints shall be hand troweled or sawcut at 5 feet on center. Create a uniform, even joint pattern that follows a right angle from the form line.
- C. Pavement Joints:
 - 1. In Sidewalks construction joints shall be placed every 100' and/or at intersecting sidewalks. Joint patterns shall be uniform spaced, approximately the width of the walk but limited to 6'.
 - 2. In Paved Areas: Contraction Joints for 6" paving shall be at 10 minimum pattern.

3.06 PLACING CONCRETE

- A. Mixing and handling of fresh concrete, including transit time, shall be as per Section 2301 of the Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- B. Place Portland Cement Concrete in accordance with Section 2301 of the Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- C. Special scoring, architectural joint treatment, color, or special surface treatments as specified.

3.07 FINISHING

- A. Paving shall be finished according to Section 2301 of the Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.
- B. Sidewalks: Standard, Light broom, radiused and trowel joint edges. Joint pattern shall be

uniform and not exceeding the sidewalk width unless specified elsewhere.

- C. Sidewalk ramps: Finish per ADAAG Standards.
- D. Architecturally treated surfaces must be water cured unless membrane curing can be demonstrated which does not alter the appearance of the work. Adjacent facilities and vehicles must be protected if membrane curing is used.

3.08 TOLERANCES

- A. Flatness: Maximum variation of one-quarter inch in ten feet as measured with a ten-foot straight edge.
- B. Compacted Scheduled Thickness (sub-grades): Within one-quarter inch of design thickness.
- C. Variation from True Elevation: One half inch.

END OF SECTION 321313

SECTION 331000
WATER UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide all materials and labor necessary to furnish and install new lines, valves, and accessories, as indicated on the drawing or as in this Section; and connect said system to the existing mains as shown.
- B. Coordinate connections with the local water company. Contractor must conform to the Scott County Iowa and Iowa DNR requirements for all construction, pressure testing, and disinfection operations.

1.02 RELATED SECTIONS

- A. Section 312300 - Excavation and Fill
- B. Section 312500 - Erosion and Sediment Control
- C. Section 321313 - Concrete Pavement

1.03 REFERENCES

- A. City of Long Grove and Scott County Plumbing Code Ordinance
 - 1. Water: the local water company standards
 - 2. Fire Protection: NFPA 24 and 13
- B. Scott County Standard Specifications and Details, Latest Edition.
- C. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.

1.04 SUBMITTALS

- A. Submit catalog cuts for intended use products for approval.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe: Comply with ASTM D2241 for nominal sizes less than 4 inches.
- B. Butt-Fused Polypropylene (PP) Water Service Pipe: shall meet the requirements of AWWA C906 and ASTM F2880. The pipe shall be manufactured from Polypropylene (PP) material that is resistant to the effects of chlorinated potable water, UV degradation, and environmental stress cracking.
- C. All materials shall conform to the latest editions of the relevant American water works association AWWA, ASTM, and NSF standards for potable water use. The pipe shall be suitable for use in both rural and urban environments, including cold climate conditions.
- D. Tracer Wire: A 12 AWG solid copper tracer wire shall be installed with all non-metallic water service pipe. The wire shall be installed along the entire length of the pipe, with continuous connections to ensure it is detectable for future locating.
- E. Backfill Materials: Materials meeting the requirements of Section 312300 - Excavation and Fill.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Excavate trench to uniform widths to provide for a maximum twelve (12) inches of Working clearance on each side of the pipe. Ditch excavations must conform to OSHA safety requirements. Ditch must provide 5.5 feet of cover when measured from finished surface to the top of the pipe.
- B. Saw cut existing pavement, PCC sidewalk, and PCC curb and gutter, as necessary to provide true edge for restoration and sufficient width for trench and City of Newton requirements for restoration. Main Street section may include HMA over PCC material.
- C. Trench wall shall be vertical from trench bottom to a point twelve (12) inches above the bottom of the pipe.
- D. Trench bottom shall provide a smooth, firm, stable, and rock free foundation for the entire length of the pipe.
- E. Trench Backfill for pipe and other water service features placed under pavements.
 - 1. Place and compact to at least 95% of the material's maximum standard proctor density according to ASTM D 698.
 - 2. Backfill to the proposed sub-grade of the finished pavement's aggregate base.
 - 3. Place all materials in layers or lifts of not more than eight (8) inches loose measure and compact by hand-operated tampers to required elevations.
 - 4. See Section 312300 - Excavation and Backfill for additional requirements.

3.02 GENERAL

- A. Connections to existing main:
 - 1. Connect to existing main as directed by the local water company, and as shown on the Site Utility Plan.
 - 2. Contractor to notify City of and obtain any necessary permits, inspections, and tapping fees for in street work.
 - 3. Above work is incidental to the water system work.
 - 4. Additional fittings may be required to vertically clear other utilities as part of the work.
- B. Restoration of surfaces: Existing surfaces shall be replaced as directed. Site restoration per these specifications and City of Long Grove and Scott County requirements.

3.03 TESTING

- A. Testing and Disinfection:
 - 1. The Contractor shall perform pressure and leakage test, flush and disinfect all in accordance with the local water company and DNR policy. A hydrostatic pressure test shall be performed on the completed water main with a minimum pressure of 150 psi. for a period of not less than 1 hour and not more than 6 hours. The basic provisions of AWWA C-600 and C-603 shall be applicable for the test.
 - 2. Contractor is responsible for any fees regarding testing and/or disinfection.

END OF SECTION 311000

SECTION 32 21 00
WATER SUPPLY WELL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work includes necessary labor, materials, and equipment to construct one 6" diameter non-public potable water supply well approximately 147' deep, PVC casing, well development, testing, submersible pump, and discharge head.
- B. Electrical controls, wiring, and equipment will be provided by others.

1.3 PERMITS, CERTIFICATES, LAWS AND ORDINANCES

- A. Contractor shall, at their own expense, procure all permits, certificates and licenses required of them by law for the execution of their Work, including NPDES permit for Water Well Construction Related Wastewater. Contractor shall comply with all federal, state or local laws, ordinances or rules and regulations relating to the performance of the Work. Well construction shall meet applicable parts of AWWA A-100 and Ten States Standards.
- B. Owner will obtain the County permit for well construction, excluding NPDES permit listed under Contractor responsibilities above.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specifications Sections.
- B. Submit the manufacturer's literature, technical data, and recommendations for the system as specified including:
 - 1. Casing pipe
 - 2. Pump and motor
 - 3. Well head
- C. Water Quality Sampling and Testing
 - 1. Microbiological Quality
 - a. After disinfection and pumping of the chlorinated well water to waste, two or more water samples shall be collected by Contractor and tested for bacteriological (coliform and E-coli) analysis in accordance with the analytical procedure defined in the Iowa Administrative Code.
 - 2. Physical, Chemical, and Radiological Quality
 - a. Water samples shall be collected by Contractor and examined for nitrate.

- b. Samples shall be collected at the conclusion of the yield-drawdown pumping procedure and examined by a certified laboratory as soon as possible. Samples shall be collected at least 10 days after placing the well into service and not more than 30 days.
- c. Reports of the analysis shall be submitted to Scott County prior to placing the well into service.

D. Yield and Drawdown

- 1. Yield and drawdown tests shall be performed by the Contractor after construction, subsequent to redevelopment or chemical conditioning.
- 2. The test pump capacity, at maximum anticipated test pumping head, shall be at least 1.5 times the design yield of each well.
- 3. Yield and drawdown tests shall be conducted during a continuous test pumping period of at least 24 hours or until stabilized drawdown has been maintained for at least 6 hours when pumping at a constant rate.
- 4. Records of the following shall be obtained:
 - a. Test pump capacity and head characteristics
 - b. Static water level
 - c. Depth of test pump setting
 - d. Time of starting and ending each test cycle
- 5. Provide recordings and graphic evaluation of the following at intervals of 15 minutes or less for the first 2 hours, then at intervals of 1 hour or less until the conclusion of the test pumping:
 - a. Pumping rate
 - b. Pumping water level
 - c. Drawdown
- 6. Upon completion of the test pumping, well water recovery rates and levels shall be taken at sufficient intervals to allow graphing of the recovery curve.
- 7. A copy of the yield-drawdown test records shall be submitted to Owner.
- 8. Contractor shall provide generator for operation of test pump.

E. Drilling Samples and Driller's Log

- 1. Geological formation samples shall be collected at intervals of 5' and at each pronounced change in formation and submitted to the Iowa Geological Survey.
- 2. Complete driller's logs shall be submitted to the IDNR as required by the Iowa Administrative Code and shall include:
 - a. Reference point for all depth measurement
 - b. Depth at which each change of formation occurs
 - c. Depth at which the water was first encountered
 - d. Identification of the material of which each stratum is composed
 - e. Depth at which hole diameters (bit sizes) change
 - f. Nominal hole diameter of the well bore
 - g. Total depth of the completed hole

- h. Depth or location of any lost drilling fluids, drilling materials, or tools
- i. Depth and description of the well casing and liner pipe

1.5 JOB CONDITIONS

- A. Contractor shall carefully examine the work site, local conditions, specifications and plot plan for any existing conditions and limitations that may apply to the work. Submission of a proposal shall be considered evidence that an examination has been conducted and that any questions and/or concerns have been satisfied.

1.6 PROTECTION OF WELL

- A. Precautions To Be Taken - Contractor shall also take all necessary precautions during construction period to prevent contaminated water, gasoline, or any other contaminant from entering the well, either through the opening or by seepage through the ground surface.
- B. Corrective Work - In the event that well becomes contaminated or that water having undesirable physical or chemical characteristics enters the well because of Contractor's negligence, Contractor shall, at Contractor's own expense, perform such work or supply such casings, seals, sterilizing agents or other material as may be necessary to eliminate the contamination or shut off the undesirable water.
- C. Freedom From Sand and Turbidity - Contractor shall exercise care in the performance of their Work in order to prevent the breakdown or caving in of strata overlying that from which the water is to be drawn. Contractor shall develop, pump, or bail well by such methods as may be approved by Owner, until the water pumped from the well shall be substantially free from sand and turbidity.

1.7 TEMPORARY CAPPING

- A. At all times during the progress of the Work, the Contractor shall protect well in such manner as effectively to prevent either tampering with well, or the entrance of foreign matter into well. Upon completion of well, Contractor shall provide and set a substantial screwed, flanged, or welded cap satisfactory to Owner.

1.8 ABANDONMENT OF WELL

- A. In the event that Contractor shall fail to sink well to the depth specified or to such lesser depth as ordered by Owner, or should abandon well because of loss of tools or for any other cause, Contractor shall, if requested, and as directed by Owner, plug the abandoned hole according to current state regulations for plugging domestic wells. Salvaged material furnished by Contractor shall remain their property. Abandonment shall meet requirements of Iowa Administrative Code 567, Chapter 39.

PART 2 - PRODUCTS

2.1 OPERATING CONDITIONS

- A. The well and pump provides potable water to a non-public county owned facility.

2.2 WELL CONSTRUCTION

- A. Total depth of well: 146 feet.
- B. Construct well using rotary method; meet requirements of AWWA A-100.
- C. Drilling fluids: Meet requirements of Ten States Standards 3.2.4.1 and AWWA A100-06 4.3.1 and 4.7.3.
- D. Install casing pipe in 10" and 8" borehole with full depth grouting to bottom of casing, meeting requirements of AWWA A-100. Provide centralizers every 100 ft.
 - 1. Grouting: Meet requirements of Ten States Standards 3.2.4.9 and AWWA A100 4.3.7 and 4.7.8.
- E. Casing pipe:
 - 1. Diameter: 6" (6.625" outside diameter)
 - 2. Wall thickness: Schedule 80
 - 3. Material: PVC meeting Type 1, Grade 1, PVC compound with a cell classification of 12454-B per ASTM D1784.
 - 4. Meet requirements of AWWA A-100 and ASTM F480.
 - 5. NSF 61 certified.
- F. Drill open borehole below screen additional 5 feet.
- G. Install telescoping screen with 2 rubber packers to seal between casing and screen. Well screen shall be 10ft, stainless steel, slotted as recommended by well driller based on local experience and aquifer formation conditions.
- H. Install solid wall pipe to 5ft below well screen with bottom cap.
- I. Develop well according to Ten States Standards 3.2.4.11 and AWWA A100-06 4.8.2.
- J. Disinfect well meeting requirements listed in Part 3.
- K. Cap well according to Ten States Standards 3.2.4.13.

2.3 DISCHARGE COLUMN

- A. Diameter: 1-1/2", provide reducer to fit pump discharge.
- B. Material: PVC, threaded, ASTM D1785, Schedule 120 column pipe, NSF 61 certified.
- C. Couplings: Stainless steel Type 304 threaded couplings, NSF/ANSI 372 certified.

2.4 WELL HEAD

- A. Standard pitless adapter with check valve for threaded column pipe with submersible pump.
- B. Pitless adapter and accessories shall meet requirements of the Iowa Administrative Code 567, Chapter 49 and Pitless Adaptor Standard 97 of the Water Systems Council.
- C. Standard 6" vented cast iron well cap with sealed electrical connection.
- D. Provide down-turned vent with 24-mesh, corrosion resistant bug screen.
- E. NSF 61 certified.

2.5 PUMP AND MOTOR

- A. Provide submersible-motor, vertical, multi-stage pump for design operating point and 1-1/2" discharge column.
 - 1. Pump shall have integral check valve for antibackspin protection.
 - 2. Water lubricated
- B. Design flowrate: 10 gpm.
- C. Design head: 163 ft total dynamic head, based on the following conditions:
 - 1. Top of casing: Minimum 24" above finished ground surface.
 - 2. Pitless adapter discharge pipe elevation: Minimum 5ft below finished ground surface.
 - 3. Static water elevation: 592 ft.
 - 4. Drawdown: 5 ft.
 - 5. Pump setting elevation: 550 ft
 - 6. Discharge pressure at discharge head: 60 psi.
- D. Minimum shut-off head: 275 ft.
- E. Pump construction: stainless steel.
- F. Provide double-jacketed cable, sufficient length from pump setting elevation, through well head to control panel, attached to pump column every 10ft.
- F. Electrical: 1/2hp, 230-volt, 1-phase, rated for variable frequency drive.
- G. Manufacturer: Goulds 10GS05; or equal.
- H. NSF 61 certified.

2.6 ELECTRICAL AND CONTROLS

- A. Constant speed controller intended for use with well pump. 5psi pressure drop before restarting pump. Low pressure shut-off.
- B. Control range: pressure set point adjustable from 20-100 psi.
- C. Pressure transducer: Measure continuous range of pressure from 0-170 psi.
- D. Cabinet: Wall-mounted for interior location.
- E. Manufacturer: Compatible with pump and motor manufacturer.
- F. Electrical contractor to provide wire sizing, voltage drop calculations, and breaker protection.

2.7 HYDROPNEUMATIC PRESSURE TANK

- A. Refer to mechanical/plumbing specifications.

PART 3 - EXECUTION

3.1 TESTING AND STARTUP

- A. Disinfection:
 - 1. Disinfect well in accordance with Iowa Administrative Code 567, Chapter 49.

2. Well shall be disinfected again following test pumping and following installation of permanent pumping equipment.
 3. Disinfect permanent pumping equipment prior to installation.
 4. Disinfect tanks and water main system in accordance with AWWA C652.
- B. Provide sampling and testing described in Part 1 of this specification.
- C. Pressure test: Test completed tanks, pipe and valve system at 90 psi for 2 hours.

END OF SECTION

SECTION 32 36 00
ONSITE WASTEWATER TREATMENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Septic Tank.
2. Sand Filter

1.2 DESIGN PARAMETERS

A. Design Population:

1. Population Equivalent: 0.7 PE

B. Design Flow:

1. Maximum day: 174 gallons/day.
2. Average day: 74 gallons/day.

PART 2 - PRODUCTS

2.1 PIPES

- A. Sewers: PVC, ASTM D3034, SDR 23.5, 153psi pipe stiffness, integral bell and spigot rubber gasket joints.
- B. Force main: ASTM D1785, Schedule 40 PVC, solvent welded joints; or minimum SDR 25, gasketed joints. Pressure test at 50 psi for 1 hr.
- C. Distribution laterals: Same material as force mains; drill and debur 3/16" orifices at 2.0ft spacing pointing down.

2.2 VALVES

- A. Check valve: Schedule 40 PVC, swing check valve, designed for vertical installation.
- B. Ball valve: Schedule 40 PVC ball valve with union connections.

2.4 SEPTIC AND PUMP TANK

- A. Type: Three-chamber, precast reinforced concrete septic tank, meeting ASTM C1227 and Iowa DNR requirements.

- B. Septic Volume: two chambers; minimum 1,250 gallons to invert of outlet pipe.
- C. Pump Chamber Volume: one chamber; 250 gallons.
- D. Option: At contractor's option, separate septic and pump tanks.
- E. Septic partition wall shall be designed with at least three 4" penetrations evenly spaced across the tank and approximately 40" above the floor.
- F. Dimensions
 - 1 Minimum liquid holding depth = 40"
 - 2 Maximum liquid holding depth = 78"
 - 3 Minimum length of tank = 60" and at least 1.5 times tank width
 - 4 Minimum width of tank = 36"
- G. Design tank with adequate reinforcing for the burial depth shown on the plan.
- H. Connections: Cast-in Fernco coupling for 4" PVC inlet. 2" drop from inlet invert to outlet invert. Sealed outlet for 1-1/2" pump discharge pipe.
- I. Effluent filter: 8" diameter tube effluent filter; removable filters; 1.6mm opening size; Orenco Commercial Biotube Effluent Filter, or approved substitution.
- J. Accessories: Plastic riser and lids to ground surface
- K. Manufacturer: Wilkinson Precast Model 1250, or approved substitution.

2.5 PUMP

- A. Meyers Submersible Effluent Pump
- B. Model: ME3H
- C. Electrical: 1-Phase, 60 Hz, 115-volt, 0.33 hp, 12 amps
- D. Pump operating point on system head curve: 25 gpm @ 20 ft TDH
- E. Min. shut-off head: 35 ft
- F. Discharge: 1 1/2" diameter
- G. Impeller: Semi-open, non-clog, solids handling.
- H. Body and volute: cast iron.
- I. Motor: oil filled, sealed motor, stainless steel shaft.
- J. Quantity: 2 (1 for septic effluent, 1 for sand filter effluent)
- K. Cord length: 20 ft min.
- L. Accessories: Wide-angle float switch with piggy-back plug to control pump without a separate control panel. Float switch and pump shall be hard wired in junction box adjacent to pump chamber per manufacturer's instructions.

2.6 HIGH LEVEL ALARM

- A. Audible and visual alarm based on float switch (separate from pump float).
- B. Mount alarm panel inside building.
- C. Float switch: Mercury-free float switch with 100 ft cord. Mount float to pump discharge pipe approximately 1-ft above normal operating range of pump. Cord runs into building where it connects to alarm panel.
- D. Electrical: 110-volt.
- E. Quantity: 2 (1 for septic pump tank, 1 for sand filter effluent pump manhole)

2.7 MATERIALS:

- A. Filter sand: Concrete sand, washed coarse sand, meeting requirements of Iowa Administrative Code 567-69 Appendix F.
- B. Filter gravel: Washed gravel, meeting requirements of Iowa Administrative Code 567-69 Appendix F.
- C. Pea Gravel: Washed pea gravel, meeting requirements of Administrative Code 567-69 Appendix F.
- D. Engineering fabric: cover top of gravel layer with permeable filter fabric meeting the requirements of Administrative Code 567-69 Appendix F.
- E. Geotextile liner: impermeable 36mil polypropylene sheeting. Follow manufacturer instructions for sealing liner seams.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Meet requirements of Iowa Administrative Code 567 Chapter 69 and Scott County.

END OF SECTION

Swisher Pleasant Hill Water System
Ground Storage Tank and Booster Pumps
Swisher, Iowa

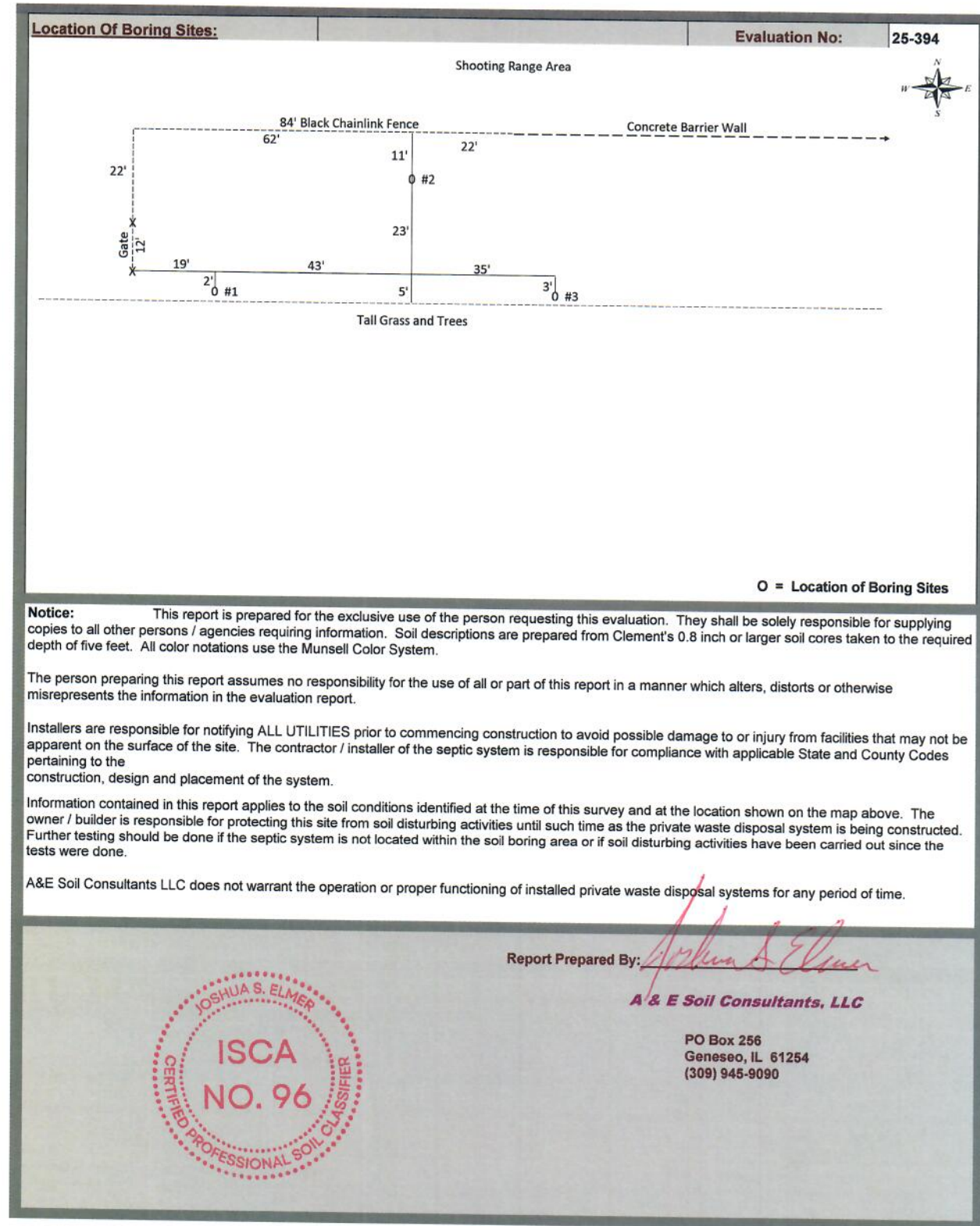
ATTACHMENT

SOILS REPORT

Soil Evaluation Report							
in accordance with 77 Illinois Admin. Code, Chapter 1, Section 905, Subsection r							
Report Prepared For:				Evaluation No: 25-394		Date: 9/25/2025	
Name/Address/City, State & Zip:				Property Owner:			
Watersmith Engineering 1029 Hershey Avenue Muscatine, IA 52761							
Location of Site:							
County	Scott	Soil Map	7				
Township Name	Butler	Section	11				
Legal Description or Address	302445 220th Avenue Long Grove	T	80N				
		R	4E				
BUILDING SITE CHARACTERISTICS							
Boring Sites Selected By:	Contractor	☒	A&E Soil Consultants	☒	Other	☐	
System:	New	☒	Replacement:	☐			
Type of Establishment:	Residence	☐	Commercial	☒	Outbuilding	☐	Other
Remarks:							
This soil investigation was for a planned new construction septic system at the Cody Shooting Complex. The engineer provided drawings indicating the general preferred location for the soil borings and new septic system leach field. A&E located, cored, and described three soil borings accordingly.							
The primary limitations in the Orthents soil at Boring #1 are Seasonal Saturation beginning at 33" and Permeability from 0-33".							
The primary limitations in the Orthents soil at Boring #2 are Seasonal Saturation beginning at 30" and Permeability from 0-30".							
The primary limitations in the Orthents soil at Boring #3 are Seasonal Saturation beginning at 31" and Permeability from 0-31".							
Soil Properties Summary							
Boring #	Soil Name	Map Unit	Design Group	Most Limiting Loading Rate Within 60 inches	Sq. Ft. / Bedroom	Seasonal Saturation	Permeability Limitation Depth
1	Orthents	802A	6M (1)	<.20 very slow	NR	33"+	0-33"
2	Orthents	802A	5M (1)	<.20 very slow	NR	30"+	0-30"
3	Orthents	802A	6M (1)	<.20 very slow	NR	31"+	0-31"
Detailed Soil Description-Test Site No. 1							
Depth	Matrix Color	Texture	Mottles and Coatings	Structure Shape/Class	Moist Consistency	Permeability & Loading Rate GPD/ft2	Notes
0-33"	10YR2/2 & 10YR4/2	silty clay loam	-	massive	firm	<.20 (1)(2) NR	Compacted Old Fill Material
33-57"	10YR5/4 & 2.5Y5/2	loamy sand	-	single grain	loose	1.00 rapid	
57-72"	5Y5/2	sand	7.5YR5/6	single grain	loose	1.00 rapid	3% Gravel
Most Limiting Layer:			Seasonal Saturation and Permeability		Seasonal Saturation:	33"+	Permeability: 0-33"
Probable Soil Type:			Orthents 802A		Soil Group:	6M (1)	Slope: 0%
Probable Drainage Class:			Moderately Well Drained		Compaction:	Yes	Depth: 0-33"
Remarks: (1) Loading Rate reduced due to disturbed and compacted soil.							
(2) NR = Not Recommended Layer							

Detailed Soil Description-Test Site No. 2							Evaluation No: 25-394	
Depth	Matrix Color	Texture	Mottles and Coatings	Structure Shape/Class	Moist Consistency	Permeability & Loading Rate GPD/ft2	Notes	
0-30"	10YR2/2 & 10YR4/2	silt loam	-	massive	firm	<.20 (1)(2) NR	Compacted Surface Layers	
30-36"	10YR5/4	silty clay loam	7.5YR5/6 & 2.5Y5/2	moderate medium prismatic	firm	.52 low moderate		
36-64"	10YR5/4 & 2.5Y5/2	loamy sand	7.5YR5/6	single grain	loose	1.00 rapid		
Most Limiting Layer:		Seasonal Saturation and Permeability			Seasonal Saturation:		30"+	Permeability: 0-30"
Probable Soil Type:		Orthents 802A			Soil Group:		5M (1)	Slope: 0%
Probable Drainage Class:		Moderately Well Drained			Compaction:		Yes	Depth: 0-30"
Remarks: (1) Loading Rate reduced due to compacted soil.								
(2) NR = Not Recommended Layer								

Detailed Soil Description-Test Site No. 3								
Depth	Matrix Color	Texture	Mottles and Coatings	Structure Shape/Class	Moist Consistency	Permeability & Loading Rate GPD/ft2	Notes	
0-31"	10YR2/2 & 10YR4/2	silty clay loam	-	massive	firm	<.20 (1)(2) NR	Compacted Old Fill Material	
31-41"	2.5Y5/2	silty clay loam	7.5YR5/6	moderate medium prismatic	firm	.52 low moderate		
41-72"	10YR5/4 & 2.5Y5/2	loamy sand	7.5YR5/6	single grain	loose	1.00 rapid		
Most Limiting Layer:		Seasonal Saturation and Permeability			Seasonal Saturation:		31"+	Permeability: 0-31"
Probable Soil Type:		Orthents 802A			Soil Group:		6M (1)	Slope: 0%
Probable Drainage Class:		Moderately Well Drained			Compaction:		Yes	Depth: 0-31"
Remarks: (1) Loading Rate reduced due to disturbed and compacted soil.								
(2) NR = Not Recommended Layer								



SECTION 333000
SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide all materials and labor necessary to install new sanitary sewer pipe as required to connect the proposed concession building to the existing sanitary sewer system as indicated on the drawing or as in this Section.
- B. Coordinate connection with Owner.

1.02 RELATED SECTIONS

- A. Section 312300 - Excavation and Fill
- B. Section 312500 - Erosion and Sediment Control

1.03 REFERENCES

- A. City of Long Grove and Scott County, Iowa Plumbing Code Ordinance
 - 1. Wastewater: Ten States Standards
<http://10statesstandards.com/wastewaterstandards.html>
- B. City of Long Grove and Scott County, Iowa, Department of Public Works, Engineering Division,
- C. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition.

1.04 SUBMITTALS

- A. Class 350 Ductile Iron Pipe: Catalog cuts with ASTM/ANSI certification and manufacturer/producer listed.
- B. Mechanical Joint Ductile Iron Fittings: Catalog cuts with ASTM/ANSI certification and manufacturer/producer listed.
- C. Schedule 40 PVC pipe and fittings: Catalog cuts with ASTM/ANSI certification and manufacturer/producer listed.
- D. Sanitary Manhole, 4' Diameter: Shop drawings with wall thickness, material, producer/manufacturer, key dimensions and penetrations located.
- E. Frame and Lid: Catalog Cut showing ASTM/ANSI certifications, manufacturer, key dimensions and weight.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Laterals connecting to the proposed building and extending to the existing lateral connection point. Pipe shall be diameters as shown, Class 350 Ductile Iron pipe or Schedule 40 PVC.
- B. Backfill Materials: Materials meeting the requirements of the City of Long Grove and Scott County, Iowa Plumbing Code Ordinance
- C. Incidental Concrete shall be in accordance with Section 321313 - Concrete Pavement.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Excavate trench to uniform widths to provide for a maximum twelve (12) inches of Working clearance on each side of the pipe. Refer to standard drawings.
 - 1. Trench wall shall be vertical from trench bottom to a point twelve (12) inches above the bottom of the pipe.
 - 2. Trench bottom shall provide a smooth, firm, stable, and rock free foundation for the entire length of the pipe.
- B. Trench Backfill for pipe placed under pavements.

1. Place and compact to at least 98% of the material's maximum standard proctor density according to ASTM D 698.
2. Backfill to the proposed sub-grade of the finished pavement's aggregate base.
3. Place all materials in layers or lifts of not more than twelve (12) inch loose measure and compact by hand-operated tampers to required elevations.
4. See Section 312300 - Excavation and Fill for additional requirements.
5. Refer to City requirements when within ROW.

3.02 GENERAL

- A. Install pipe in proper alignment and continuous grade.
- B. Test completed installation in accordance with the City of Long Grove and Scott County Plumbing Code Ordinance
- C. Clean interior of pipe prior to installation and flush clean when work is complete to remove miscellaneous debris.
- D. Contractor shall remove and reinstall, at his expense, any piping and / or backfill not meeting the Owner's approval due to the following:
 1. Poor alignment.
 2. Failure of testing requirements.
 3. Improper backfill procedures.
 4. Pipe material defects.
- E. Contractor shall place piping in accordance with City of Long Grove and Scott County, Iowa Plumbing Code Ordinance
- F. Contractor shall provide and maintain the temporary surface over the sewer trench until such time final restoration or project construction is complete and ready for the public's use.
- G. Restoration of surfaces: Section 312500 - Erosion and Sediment Control.

3.03 TESTING

- A. Testing: The contractor shall be responsible for testing sanitary sewer according to the requirements of the City of Long Grove and Scott County, Iowa Plumbing Code Ordinance
- B. Contractor is responsible for any fees or other costs regarding testing.

END OF SECTION 333000

SECTION 334100
STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide all materials and labor necessary to furnish and install new storm sewer system and accessories as indicated on the drawings or in this Section.

1.02 RELATED SECTIONS

- A. Section 312300 - Excavation and Fill
- B. Section 312500 - Erosion and Sediment Control
- C. Section 321313 - Concrete Pavement

1.03 REFERENCES

- A. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition, Section 4146 Plastic Pipe. Polyvinylchloride with a smooth interior and corrugated exterior, using matching fittings.
- B. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Edition. (Precast storm inlets, precast manholes comply with Section 4149.04, ASTM C-478).
- C. Castings, frames and grates comply with Section 4149.04, Part I.
- D. Area Drains: 12-30 inch diameter solid wall PVC riser with attached PVC bell/spigot connections to receive storm pipe of the specified diameter. Area drains include a PVC inlet grate rated for pedestrian traffic and for H-10 loading. Area Drains to be Nyloplast 2812AG with Nyloplast 1299CGP grates or equivalent product.

1.04 SUBMITTALS

- A. Submit shop drawing and specification sheet for pipe materials, precast concrete and PVC inlet and manhole components, castings, and special pipe fittings.

PART 2 PRODUCTS

2.01 STORM SEWER

- A. Reinforced Concrete Pipe and end sections meeting the requirements of ASTM C-76: Reinforced Concrete Pipe (R.C.P.).
- B. High Density Polyethylene Pipe (HDPE): ASTM D-3350
 - 1. Use pipe complying with the following:
 - a. AASHTO M 294, Type S corrugated exterior and smooth interior.
 - b. ASTM D 3350 minimum resin Cell Classification 335420 C.
 - c. Minimum pipe stiffness at 5% deflection according to ASTM D 2412.
 - d. Integral bell and spigot joints with elastomeric seals complying with ASTM F 477.
- C. Polyvinyl Chloride Pipe (PVC):
 - 1. Use pipe complying with the following:
 - a. Types of PVC pipes:
 - 1) Corrugated exterior, smooth interior, ASTM F 949.
 - 2) Solid wall, ASTM D 3034 or ASTM F 679.
 - 3) Closed profile, ASTM F 1803.
 - 4) Composite, ASTM D 2680.
 - b. PVC plastic meeting ASTM D 1784, Cell Classification 12454. Do not exceed 10 parts by weight per 100 of PVC resin in the compound for additives and fillers, including but not limited to stabilizers, antioxidants, lubricants, and colorants.
 - c. Minimum pipe stiffness of 46 psi.

- d. Integral bell and spigot joints with elastomeric seals according to ASTM D 3212 and ASTM F 477.
- D. Precast Inlets and Manholes: Iowa DOT Section 4149.04, ASTM C-478
- E. Manhole and Inlet Castings: As shown on the plans. Size and flow capacities are specific to the castings and or-equal substitutions must comply with the same characteristics. Holes for various connections, underdrain, surface drains, and future roof drains are to be precast into the inlet structures. Manholes used for regulating discharges shall include provision and allowance for orifice/tee restriction fitting installation as detailed.

2.02 BACKFILL

- A. Bedding Materials: See details and Section 312300 - Excavation and Backfill.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Excavate trench to uniform widths to provide for a maximum twelve (12) inches of working clearance on each side of the pipe. Trench wall shall be vertical from trench bottom to a point twelve (12) inches above the top of the pipe. Trench construction must meet applicable OSHA safety standards. Trench bottom shall provide a smooth, firm, stable, and rock free foundation for the entire length of the pipe.
- B. Remove unsuitable materials from the trench, when deemed necessary by the Engineer, and provide, furnish and install bedding material of an approved aggregate for proper bedding and support.
- C. Utility Trench Backfill for pipe placed under pavements: Place and compact material from the bottom of the pipe to the bottom of the proposed sub-grade of the finished pavement's aggregate base according to the appropriate paving specification.
- D. Surface stabilization, in accordance to the site ECP, shall be constructed once the installation has been completed.

3.02 GENERAL

- A. Install pipe beginning at the low point of the pipe run, Place bell joint ends of pipe facing upstream. Set Pre-cast flared end sections per standard with toe support.
- B. Pipe bedding shall be as per contract documents or manufacturer's specifications. The more stringent requirements shall govern.
- C. Pipe installation and storm water inlets must be protected from infiltration of mud, silt and debris in accordance with the site Erosion Control Plan (ERC).
- D. Install pipe in proper alignment and continuous grade.
- E. Install gaskets or sealant in accordance with manufacturer's recommendations.
- F. Clean interior of pipe prior to installation and flush clean when complete to remove miscellaneous debris.
- G. Contractor shall remove and reinstall, at his expense, any piping and / or backfill not meeting the Architect's approval due to any of the following:
 - 1. Poor alignment.
 - 2. Failure of testing requirements.
 - 3. Improper backfill procedures.
 - 4. Pipe material defects.
- H. Contractor shall place piping in accordance with all federal, state and local requirements.
- I. Contractor shall provide and maintain the temporary surface over storm sewer trenches until such time final restoration or project construction is complete and ready for use in accordance with Section 312300 - Excavation and Backfill.

- J. Contractor shall install manholes, inlets and castings to the elevations shown on the Site Grading Plan. Fill areas or Cut and Fill areas shall be compacted and tested at the direction of the Engineer prior to the installation of structures and pipe.
- K. Restoration of surfaces: per Section 312500 - Erosion and Sediment Control.

3.03 SCHEDULE

- A. Per Plan Sheet

END OF SECTION 334100

SECTION 334616
SUB-DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide all materials and labor necessary to furnish and install new flat-panel profile sub-drainage piping system and accessories as indicated on the drawings or in this Section.
- B. Provide connection or interface points with the main or collector storm sewer.

1.02 REFERENCES

- A. Iowa Department of Transportation (IDOT): Standard Specifications for Highway and Bridge Construction, Latest Series.
- B. Trench bedding and backfill for drainage pipe, see Section 312300 - Excavation and Fill.

1.03 RELATED SECTIONS

- A. Section 312300 - Excavation and Fill
- B. Section 312500 - Erosion and Sediment Control
- C. Section 334100 - Storm Utility Drainage Piping

1.04 SUBMITTALS

- A. Submit specification sheet for pipe materials and any special pipe fittings and connectors.
- B. Submit material certification with aggregate gradation and source.

PART 2 PRODUCTS

2.01 SUBDRAIN SYSTEM

- A. Subdrain system is comprised of nominal 4" specified perforated pipe. Pipe material shall be the following or equal material.
 - 1. Perforated, corrugated, high density polyethylene pipe with a filter fabric wrapped exterior.
 - 2. Filter Fabric wrap shall be 100 lbs Grab Tensile (ASTM D4632) and an AOS of 60 to 70.

2.02 BACKFILL

- A. Bedding Materials: Envelop bedding shall be Iowa DOT gradation 12 crushed limestone. Provide bedding beneath subdrain installation per typical section details. Subdrain pipe is not to be directly backfilled with soil.
- B. Backfill Materials: See details and Section 312300 - Excavation and Backfill for Storage Aggregate and Storage Aggregate filter layer requirements.

PART 3 EXECUTION

3.01 EXCAVATION

- A. General excavation is limited to providing a smooth continuous flow line for the pipe by laying it out in a uniform slope and placing aggregate along the length to stabilize the alignment. Excavate trench at connection points as needed. Trench bottom shall provide a smooth, firm, stable, and obstruction free foundation for the entire length of the pipe.
- B. Remove unsuitable materials from the trench, when deemed necessary by the Architect, and provide, furnish and install bedding material of an approved aggregate for proper bedding and support.
- C. Utility Trench Backfill for pipe placed under pavement: Place and compact material from the bottom of the pipe to the bottom of the proposed sub-grade of the finished pavement's aggregate base according to the appropriate paving specification.
- D. Surface stabilization, in accordance to the site ECP, shall be constructed once the installation has been completed.

3.02 GENERAL

- A. Install drain pipe beginning at the discharge point of the pipe run.
- B. Pipe installation and storm water inlets must be protected from infiltration of mud, silt and debris in accordance with the site Erosion Control Plan (ERC).
- C. Install pipe in proper alignment and continuous grade.
- D. Install any fittings in accordance with manufacturer's recommendations.
- E. Clean interior of pipe prior to installation and clean when complete to remove miscellaneous debris.
- F. Contractor shall remove and reinstall, at his expense, any piping and / or backfill not meeting the Architect's approval due to any of the following:
 - 1. Poor alignment.
 - 2. Failure of testing requirements.
 - 3. Improper backfill procedures.
 - 4. Pipe material defects.
- G. Contractor shall place piping in accordance with all federal, state and local requirements.
- H. Contractor shall provide and maintain the temporary surface over storm sewer trenches until such time final restoration or project construction is complete and ready for use in accordance with Section 312300 - Excavation.
- I. Contractor shall install any required manholes, inlets and castings to the elevations shown on the Site Grading Plan. Fill areas or Cut and Fill areas shall be compacted and tested at the direction of the Engineer prior to the installation of structures and pipe.
- J. Restoration of surfaces: per Section 312500 - Erosion and Sediment Control.

3.03 SCHEDULE

- A. Refer to plans.

END OF SECTION 334616