IOWA DEPARTMENT OF NATURAL RESOURCES

PROJECT MANUAL

SPIRIT LAKE FISH HATCHERY

UPGRADE FOR RAS REBID

DICKINSON COUNTY, IOWA

ATTENTION BIDDERS

ALL SUBSTITUTION REQUESTS AND QUESTIONS MUST BE SUBMITTED BY 12:00PM THE FRIDAY PRIOR TO THE BID LETTING TO BE CONSIDERED.

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PREPARED BY

IOWA DEPARTMENT OF NATURAL RESOURCES
ENGINEERING BUREAU
502 E 9TH ST
DES MOINES IA 50319-0034

PROJECT N0. 21-01-30-11

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

SPIRIT LAKE FISH HATCHERY
UPGRADE FOR RAS REBID
DICKINSON COUNTY, IOWA
PROJECT NO. 21-01-30-11

Section Number

END OF SECTION 00002

SPIRIT LAKE FISH HATCHERY
UPGRADE FOR RAS REBID
DICKINSON COUNTY, IOWA
PROJECT NO. 21-01-30-11

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Notice to Bidders - Iowa Department of Natural Resources

Sealed bids will be received by the Iowa Department of Natural Resources by email, at procurement@dnr.iowa.gov until **11:00 am, February 18, 2021** for the public improvement projects listed below. In an effort to mitigate the spread and effects of the COVID-19, the Department of Natural Resources will ONLY be accepting proposals submitted via email for these projects. The subject line of the email containing the proposal, with the proposal guarantee, must include the **Project Number, Project Title, and the Bid Date and Time**. No bids shall be accepted by FAX, mail or hand-delivery. After the bid opening, information concerning bid results may be obtained by visiting the Department's website at www.iowadnr.gov.

> **Note:** The bid opening for this project will be held by conference call only. No facilities will be available for an in-person meeting. Interested parties may call in to the following number to listen to the bid opening:
>
> Conference call number: +1 (505) 738-1452
> PIN: 886 923 111#
>
> In order to improve sound quality, please mute your phone by pressing ***6**. If you have questions, you can unmute your phone by pressing ***6**.
>
> While bids are due by 11:00 am CST, the bid opening teleconference will not begin until 11:30 am to allow staff ample time to print bids before reading them aloud.

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 scanned copy of the bid security as defined in Iowa code section 26.8. Additionally, bid securities in the form of a certified check, cashier's check, or money order must also be mailed to the Department at the Wallace State Office Building, 502 East 9th Street, Des Moines, IA 50319. 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 (30) 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

Contractor is responsible for contacting State Stormwater program coordinator (515-725-8417) for information relating to stormwater permit that is necessary if construction activities disturb one acre or more.

Project Estimate: $876,440.00
Funding Source: Federal DJ and REAP OS

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

Heath Delzell
Project Manager
Wallace State Office Building
502 E 9th St
Des Moines, Iowa 50319-0034
Phone: (515) 979-0104
Fax: (515) 725-8202
Heath.delzell@dnr.iowa.gov

Direct questions concerning Site Review and Project Inspection to:

Jeff Felts
District Engineer
Phone: (515) 250-3712
Jeff.felts@dnr.iowa.gov

Direct questions concerning Bidding and Contract Procedures to:

Kim Bohlen, DNR Procurement
Wallace State Office Building
502 E 9th St
Des Moines, Iowa 50319-0034
Phone: (515) 344-0055
Fax: (515) 725-8202

In accordance with House File 2622 implemented by Iowa Code Sections 442.42 (15) & (16) and 422.47.47(5), 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 at www.state.ia.us/tax, the Iowa Department of Revenue and Finance (IDRF) Web site. Links are found in the Business Taxes and Local Government categories. 701 IAC 19.1-20 is found in Tax Research/Tax Research Library.***

Recorded bid results can be accessed at *https://programs.iowadnr.gov/engreal/projectlist.asp*. Printed bid tabs will not be available for 3 working days after the Letting date.

Time and Date of Letting **11:00 AM, February 18, 2021**

PROPOSAL

Project Description and Location

Project No. **21-01-30-11**

UPGRADE FOR RAS REBID
SPIRIT LAKE FISH HATCHERY
DICKINSON 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
$50,000.00	February 14, 2022	N/A	$500.00

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

UPGRADE FOR RAS, SPIRIT LAKE FISH HATCHERY, DICKINSON 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	Lump Sum		
2	Demolition	1	Lump Sum		
3	Structural	1	Lump Sum		
4	Architectural	1	Lump Sum		
5	Plumbing & Process	1	Lump Sum		
6	Electrical	1	Lump Sum		
				Total	

Bidder Acknowledges Receipt of Any Issued Addenda Below (Number and Date)		List of Subcontractors (Attach additional pages, if necessary)

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 form Puerto Rio, 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 a 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 of 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 contacts;
   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. OSBDU 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/offerors. (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/offeror 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/offerors 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/offeror). 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/offeror;
      4) 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.

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 of 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 FFOR 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 flied 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.

(See reverse for public burden disclosure)

1. Type of Federal Action:	**2. Status of Federal Action:**	**3. Report Type:**
☐ a. contract b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	☐ a. Bid/Offer/Application b. Initial Award c. Post-award	☐ a. Initial/Filing b. material change **For Material Change Only:** year _____ quarter _____ date of last report _____

4. Name and Address of Reporting Entity:	**5. If Reporting Entity in No. 4 is Subawardee, enter name and Address of Prime:**
☐ Prime ☐ Subawardee Tier_____, *if known* **Congressional District**, *if known*	 **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:** _____

Approved By OMB
0348-0046

DISCLOSURE OF LOBBYING ACTIVITIES
CONTINUATION SHEET

Reporting Entity: _____ Page _____ of _____

Authorized for Local Reproduction
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.

STATE OF IOWA
DEPARTMENT OF NATURAL RESOURCES

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:

Fifty thousand _____ Dollars $ 50,000.00

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 _____ , 20 _____ , the name and corporate seal of each party being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

PRINCIPAL:	SURETY:
_____	_____
_____	_____
_____	_____
_____	_____

If a partnership all partners must sign.

STATE OF IOWA
DEPARTMENT OF NATURAL RESOURCES

CONTRACT (Capital Improvement)

SPIRIT LAKE FISH HATCHERY
UPGRAGE FOR RAS REBID
PROJECT NO. 21-01-30-11
DICKINSON 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:
The purpose of this contract is to upgrade the existing Recirculating Aquaculture System (RAS).

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 G-1 Through E-4 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 February 14, 2022

The **CONTRACTOR** hereby agrees that liquidated damages in the amount of Five hundred Dollars $ 500.00 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. _____

STATE OF IOWA
DEPARTMENT OF NATURAL RESOURCES

PERFORMANCE 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:

_____ 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 _____ , 20 _____ , the name and corporate seal of each party being hereto affixed and 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 5/13/2020)

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

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 persons firms 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, films 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 change of the work.
56. Proposal - The formal offer of a bidders 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 his/her proposal for a projects as guarantee he/she 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 Department of Economic Development.
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 proceeds 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 a 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 of 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 projects an example of which is bound in this specification volume. One separate, unbound copy of the standard proposal forms which has been specifically prepared for this projects is supplied by the Department of Natural Resources with the contract documents. Only proposals which are submitted on this form will be considered.
B. One copy of the proposal shall be submitted.
C. No proposa1 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 bidders 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. The subject line of the email containing the proposal, with the proposal guarantee, must include the Project Number, Project Title, and the Bid Date and Time. The bidder shall be responsible for emailing the proposal, with the proposal guarantee to the place designated for the bid submission 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 retailers 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 442.42 (15) & (16) and 422.47 (5), the DEPARTMENT will issue a Sales Tax Examption Certificate to CONTRACTOR and each approved contractor 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 purchase 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 thst do 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 enticipate that the sale and use tax couild increase the cost of non-exempted services and material by at least 5% andmake the necessary llowance 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 first 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 contracts, 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 of Natural Resources to the Contractor after award of the contract. One executed copy of the bond must be returned to the Department of Natural Resources 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 of Natural Resources 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 of Natural Resources 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 Department of Economic Development 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 as 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 contractors 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. Proposal guaranties will be returned to the unsuccessful bidder 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 five thousand ($5,000.00) 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 in on the standard form of the Contracting Authority, contractor shall provide one (1) original. 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 Department of Economic Development 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 four copies of 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 awards 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 and a copy of each subcontract 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 consider 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 error or unforeseen contingency.

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 events 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, as its agent, a competent superintendent, 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 Contractors 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 insure 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 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 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 distance, 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, bogy, 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 effects 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 73 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 73 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 contractors 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 327, 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 - $100,000.00
Each occurrence - $300,000.00
Property Damage Insurance
Each occurrence - $50,000.00

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 additions the Contractor shall provide such additional safeguards as deemed necessary to protect equipment, the work, and the public at the Contractors 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 provides 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 Contractors 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 publics 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 be 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 do 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 costs 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 starting 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 predetermined, 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 at 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 Engineers 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 percent 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. Five percent (5%) 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 contact 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 cases 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 articles 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 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 1ncorporate 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 or 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 I slander** (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 farther 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 M inority 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 what 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 EM PLOYM ENT OPPORTUNITY CONSTRUCTI ON CONTRACT SPECI FICATIONS (EXECUTIVE ORDER 11246).

A. Whenever the Contractors 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 form 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 form 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.

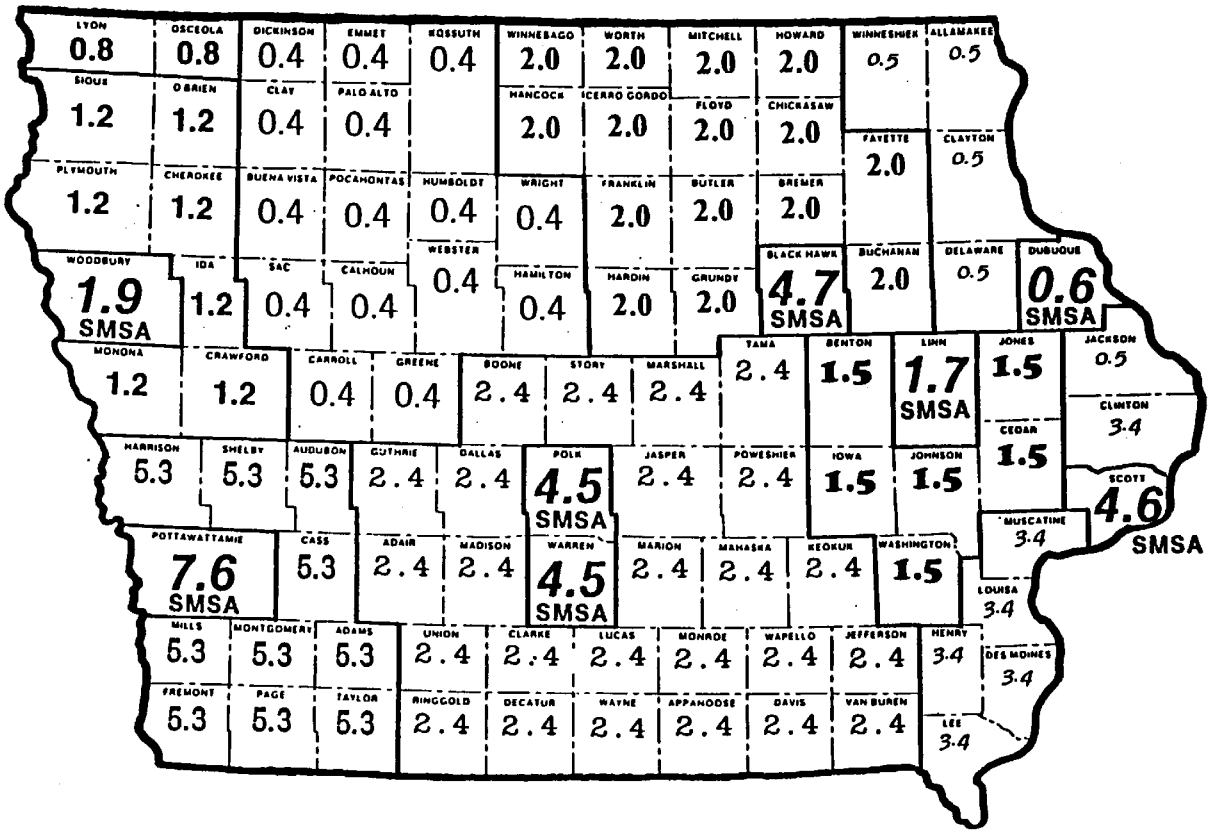
N. Nothing herein provided shall be construed as a limitation upon the application of other Iowa which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

VI. SUPPLEM ENTAL REPORTING REQUIREM ENTS.

A. The Contractor and subcontractors are required to make available upon request its Affirmative Action Program containing goals and time specifications. These contractual provisions shall be fully enforced. Any breach of the provisions shall be regarded as a material breach of contract.

B. The Contractor will keep such records as are necessary to determine compliance with equal employment opportunity obligations. The records kept by the Contractor will be designed to indicate the number of minority and nonminority group members and women employed in each work classification on the project. All such records must be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the Department of Natural Resources and any Federal Agency funding any part of this project.

"Minority employment goals are expressed as a percentage (%) of total hours worked for each craft and/or trade in each county."



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, 502 E 9th St, Des Moines Iowa, 50319. (Tel. (515) 725-8417)

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 5O8 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 and the Supplementary Covenants and Provisions.

1.02 SUMMARY OF WORK:

A. Work Covered by Contract Documents:
   1. Name of the project is "Upgrade for RAS Rebid", Project Number 21-01-30-11. Drawings and Specifications are dated January 2021.
   2. Briefly and without force and effect upon contract documents, work of the contract can be summarized as follows:
      a. The purpose of this contract is to upgrade the existing Recirculating Aquaculture System (RAS).

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

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 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

Iowa Department of Natural Resources

Spirit Lake State Fish Hatchery - Fish Hatchery Incubator System - Rebid

Construction Documents
Project Manual

1/14/2021

DNR Project No. 21-01-30-11

HDR Project No. 10232924

TABLE OF CONTENTS

DIVISION 01

GENERAL REQUIREMENTS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:
   1. Furnish all labor, materials, tools, equipment and services as indicated in accordance with provisions of Contract Documents.
   2. It is the intent of the Contract Documents to describe a functionally complete project. Furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, complete, and functional installation.

1.2 LOCATION

Spirit Lake State Fish Hatchery

Iowa Department of Natural Resources

122 252nd Ave

Spirit Lake, IA 51360

A. Contractor should verify site access and haul routes for materials and concrete delivery prior to bidding.

1.3 WORK COVERED BY CONTRACT

A. The Work of this Contract under the Base Bid generally includes the following:

- General: Renovation of a portion of an existing facility and new construction at the same facility.
- Renovation:
  - Partial demolition of existing egg incubation and fry capture room.
  - Installation of new water recirculation treatment equipment inclduing items such as pumps, pipelines, stacked disc filters, ultraviolet disinfection and chillers.
  - Electrical upgrades to power water treatment equipment and instrumentation.
  - Installation of new fish egg incubation jar racks and capture tanks
  - Construction of a wall with viewing windows to separate visitors from the egg incubation space

1.4 WORK BY OTHERS

A. Coordinate the construction with the utilities and Contractor shall provide adequate notice to the utilities of any work required in advance or requiring presence of their personnel.

1.5 WORK SEQUENCE

A. The Contractor shall organize and plan the construction activities to minimize disruption to ongoing fish hatchery operations.

B. Organize and plan the construction activities to assure the safety and reliability of and to minimize the interruption to the electric system and all other utilities.

C. The proposed Work sequence shall be submitted to the Engineer in the Schedule of Construction.

1.6 OWNER OCCUPANCY

A. Owner will occupy the premises during the entire period of construction for the conduct of his normal operations. Coordinate with Owner in all construction operations to minimize conflicts and to facilitate Owner usage.

1.7 OUTAGES

A. Organize and plan the construction activities so that the number and length of any required outages shall be minimized.

B. An outage to any customer shall require specific approval of the Owner. The Owner reserves the right to reject any request for an outage.

C. In some cases it may be necessary, at Contractor's expense, to either install temporary facilities for service or schedule the Work during a period when the outage would have minimal impact on the customer.

D. Provide the Owner at least 48 HRS notice in advance of any requested outage so that the Owner may advise and coordinate the outage with the customers.

1.8 OWNER-FURNISHED PRODUCTS

A. Products furnished and paid for by Owner shall be as follows: None.

1.9 CONTRACTOR-FURNISHED PRODUCTS

A. Furnish all products, other than Owner-furnished products designated above.

B. Components required to be supplied in quantity within a specification section shall all be the same and shall be interchangeable.

C. Unless otherwise indicated in the Contract Documents, provide materials and equipment that:
   1. Is produced by reputable manufacturers having adequate experience in the manufacture of these items; and
   2. Is designed for the service intended; and
   3. have not been previously been incorporated into another project or facility; and
   4. have not changed ownership since their initial production or fabrication and shipment from the manufacturer’s factory or facility; and
   5. if stored since their manufacture or fabrication, have, while in storage, been properly maintained and serviced in accordance with the manufacturer’s recommendations for long-term storage; submit documentation under the relevant technical section that such maintenance and service has been performed; and
   6. have not been subject to degradation or deterioration since manufacture; and
   7. are the current model(s) or type(s) furnished by the Supplier and only modified as necessary to comply with the design.

1.10 UNDERGROUND UTILITIES

A. Utilities known to the Engineer who may have underground facilities in the vicinity of the Work, may be contacted as follows:
   1. Alliant Energy
   2. City of Spirit Lake Water Department

1.11 PERMITS AND LICENSES

A. The Owner has applied for and obtained, at Owner's expense, the following permits and approvals for the Work:

B. Obtain, at his expense, all other permits and licenses necessary for the construction of the Work in accordance with the General Conditions.

1.12 TREE TRIMMING, CLEARING, AND TREE REMOVAL

A. None

1.13 FENCES

A. All fences affected by the Work shall be maintained by the Contractor until completion of the Work. Fences disturbed by the construction shall be restored by the Contractor to their original or better condition and to their original location unless otherwise indicated.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 26 13
REQUESTS FOR INTERPRETATION (RFI)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines the process for handling Requests for Information (RFI) or Requests for Interpretation (RFI).

B. RFIs are intended to provide clarifications and interpretations of the Contract Documents and maintain progress of Work.

C. RFIs are not intended for general communication, requesting substitutions, requesting proposed changes, resolution of nonconforming work, or coordination between contractors.

1.2 RFI SUBMITTAL PROCEDURE

A. All RFIs shall be submitted on the form included with this Section, or on mutually agreeable forms.

B. When needed, the RFI shall include backup information to clarify the request.
   1. Backup information can include verified field measurements, quantities, dimensions, photos showing existing conditions, and any other information that will assist the Engineer or Owner in reviewing and responding to the RFI.

C. Within ten (10) working days of receipt of RFI, Engineer will return a response to the RFI, request additional information, or will provide a schedule of when a response will be issued.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 REQUESTS FOR INFORMATION OR INTERPRETATION

A. Review of Contract Documents and Field Conditions:
   1. Before starting each portion of Work, carefully study and compare drawings, specifications and other contract documents, coordination drawings, shop drawings, prior correspondence or documentation relative to that portion of Work, and any other information furnished by Engineer and Owner.
   2. Evaluate field conditions and take field measurements related to that portion of Work.
   3. Any inconsistencies discovered in the above review of the contract documents and field conditions should be submitted to the Engineer in an RFI.

B. Contractor's Responsibilities:
   1. When interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor or its Subcontractor, Vendor or Supplier, the request shall be processed through the Contractor.
      a. Review the RFI for completeness, quality, proper referencing drawings, specification or other contract documents.
      b. When submitting RFI's generated from subcontractors, suppliers, and others, make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions before transmitting to the Engineer.
      c. If the RFI is not clear, concise, complete and easily understood, do not submit the RFI to Engineer for response.
   2. Follow these procedures in developing an RFI:
      a. List relevant Contract Documents when seeking information being requested.

1) Reference all applicable Contract Drawings by sheet number.
2) Specifications by section and paragraph number
3) Reference any other relevant documents.

b. Clearly state any additional information needed so request can be fully understood, including sketches, photos or other reference material.
c. Suggest any reasonable solutions and recommendations which will aid in determining a solution or response.
d. Any critical RFI's requiring a rapid response shall clearly indicate such with an explanation as to why RFI is critical.
e. Priority for responses shall be indicated when multiple RFI's are submitted within short period of time.

3. A response to RFI shall not be considered a notice to proceed with a change that may revise the Contract Sum or Contract Time, unless authorized by Owner in writing.
4. If response to RFI is determined incomplete, it shall be resubmitted with reason response is unacceptable and any necessary additional information within five (5) days of time of receipt of response to RFI.

C. RFI Submittal Numbering:
1. RFI's shall be assigned unique numbers in sequential order (1, 2, 3, 4, etc.).
2. A resubmitted RFI or a previously answered RFI requiring revising or further clarification shall be submitted using original RFI number proceeded by ".1 IN to indicate revision one of RFI (i.e.: RFI No. 34.1 for revision 1 to RFI No. 34).

D. Invalid RFI
1. Engineer may return RFI without response for following reasons:
a. Request is unclear or incomplete.
b. Request was answered in a previous RFI.
c. Requested information is readily available in the Construction Documents.
d. Request is related to construction means, methods or techniques.
e. Request is related to health or safety measures.
f. Request is due to Contractor's lack of adequate coordination.
g. Issue relates to coordination between Subcontractors.
h. Request is a "Substitution Request."
i. Request is a "Contractor Proposed Change."
j. Request is due to non-conformance.

2. Should the invalid RFIs continue to be provided, the Owner may deduct the cost of the Engineer's time to process, review and return the RFI's.

END OF SECTION

EXHIBIT A

Request for Interpretation Form

Contractor's RFI No. _____ Engineer's RFI No. _____

Contract: _____

Contractor: _____

Owner: _____ Owner's Contract No._____

Engineer **HDR Engineering, Inc.** Engineer's Contract No._____

THIS REQUEST BY:_____ cc to:_____
(Name of the Contractor's Representative)

REFERENCE: DIVISION _____ SECTION _____ PLAN SHEET NO. _____

_____

_____

_____

_____

_____

ATTACHMENTS _____

INTERPRETATION BY: _____Date: _____, 20____
(Name of the Engineer's Representative)

_____

_____

_____

_____

_____

ATTACHMENTS_____

The General Conditions (GCs) specify that once the Engineer provides a response to a Contractor's RFI, that determination shall be final and binding on the Contractor unless the Contractor delivers to the Owner written notice of a change in the work within a certain period of time of receipt of that determination. See the GCs for further clarification.

cc to: _____

_____

SECTION 01 30 00
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for:
      a. Project Signs.
      b. Temporary sanitary facilities.
      c. Contractor's Superintendent's Field Office.
      d. Drawings and Contract Documents for CONTRACTOR use.
      e. Project Photographs.
      f. Utilities for construction.
      g. Site restoration.
      h. Site access.
      i. Produced water.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 01 – General Requirements.
   2. Division 33 – Utilities.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Project Sign Layout and mounting design.

1.3 PROJECT SIGNS

A. Within 10 days after receipt of Notice to Proceed, furnish, install, and maintain a Project Sign as defined herein. No other signs will be allowed on the project unless approved in writing by the Owner.

B. Project Sign Materials:
   1. The Project Sign will be produced by an experienced professional sign company.
   2. The Project Sign shall be structurally adequate and suitable for exterior application.
   3. The Project Sign paint shall be exterior quality, as specified in Division 09 or as a minimum, primer and finish coat: exterior, semi-gloss, enamel. Colors for the sign and structure, framing, sign surfaces, and graphics shall be as shown on the Drawings or as selected by the Owner.
   4. Prior to producing the sign, submit a layout of the sign to the Engineer for review and approval. The layout shall include content, lettering style and color and background colors.

C. Information to be included on the Project Sign will include:
   1. Project Name.
   2. Owner's Name.
   3. Engineer.
   4. Contractor.
   5. Construction Manager.
   6. Funding Agencies (if required by the funding agreement).
   7. Construction dollar amount (if required by the funding agency and/or client).
   8. Company and Agency Logos (if approved by the Engineer).

D. Installation of the Project Sign:
   1. The Project Sign shall be constructed with new materials and kept clean throughout the project duration.
      a. Install Project Sign as shown herein.
   2. The Project Sign shall be mounted to resist wind loads as required by authorities having jurisdiction but not less than wind velocity of 50 MPH.
   3. Prior to installing the sign, submit mounting design to the Engineer for review and approval.
   4. The Project Sign shall be erected level and plumb.

E. Remove signs, framing, supports, and foundations to a depth of at least 2 FT upon completion of Project. Restore area to a condition equal to or better than before construction.

1.4 TEMPORARY SANITARY FACILITIES

A. Provide temporary sanitary facilities for use of construction workers during construction, remodeling or demolition activities.

B. Do not use existing toilet facilities in occupied areas or new toilet facilities in construction area without Owner’s written consent.

C. Provide facilities complying with local, State and Federal sanitary laws and regulations.

D. Follow facility provider's minimum maintenance frequency or service more frequently to keep in clean and sanitary condition.

E. Provide adequate supplies of toilet paper, cleaning supplies, and other required items.

1.5 CONTRACTOR'S SUPERINTENDENT'S FIELD OFFICE

A. Establish at site of Project.

B. Equipment: Telephone, telecopy, mailing address, and sanitary facilities.

C. Ensure attendance at this office during the normal working day.

D. At this office, maintain complete field file of Shop Drawings, posted Contract Drawings and Specifications, and other files of field operations including provisions for maintaining "As Recorded Drawings."

E. Remove field office from site upon acceptance of the entire work by the Owner.

1.6 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE

A. Refer to General Conditions.

B. CONTRACTOR shall pick up all "no-charge" documents within 10 days from date of Notice to Proceed.

1.7 PROJECT PHOTOGRAPHS

A. At least once each month during construction of the Work, provide progress pictures as directed by Engineer.
   1. Pictures shall be digital and provided on disk with thumbnail index.
   2. Provide number of photographs as follows:
      a. 24 ground level color photos per month.
      b. Three color aerial photos taken at each of the following:
         1) At 0 PCT complete.
         2) At three six month intervals after initial set.
         3) At 100 PCT complete.
   3. Schedule and coordinate photographer with Engineer's Field Representative.
   4. Photographically impose a site plan key map on each photograph in the upper right hand corner and show by arrow the subject and the direction from which the photograph was taken.
      a. Date all photographs.

1.8 UTILITIES FOR CONSTRUCTION

A. Arrange and pay for all temporary electric utility service required for execution of the Contract.

B. Wastewater service is not available. Furnish portable toilets for the use of CONTRACTOR's personnel.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preconstruction, progress and other project meetings.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 PRECONSTRUCTION MEETING

A. Meet with the Owner and Engineer for a pre-construction conference at a time mutually agreed upon after the contract is awarded, but before any work is performed,

B. The Owner's Site Representative will schedule a meeting of the Owner, Contractor, Contractor's Subcontractors, and their respective representatives.
   1. The purpose of the meeting will be to clarify construction contract administration procedures, to establish lines of authority and communication and identify duties and responsibilities of the parties.

C. The Owner's Site Representative will schedule the pre-construction conference after receipt of the Contractor's draft proposed schedule.

D. The agenda for the meeting shall cover at least the following items:
   1. Use of site and special concerns regarding adjacent properties.
   2. Organization of the Contractor's forces and personnel, including all subcontractors, and materials suppliers.
   3. Channels and procedures for communication.
   4. Contractor's construction schedule, including sequence of critical work.
   5. Contract documents, including distribution of required copies and revisions.
   6. Processing of shop drawings and other data.
   7. Processing of Requests for Information (RFI), Construction Change Directives (CCD) and Change Orders and distribution of related forms.
   8. Rules and regulations applicable to the performance of the work, such as quality control, testing and startup.
   9. Contractor's site safety and security protocols.
   10. Procedures for quality control, housekeeping and related matters.

E. The Owner's Site Representative will compile meeting minutes from the transcribed record of the meeting and electronically distribute copies to all participants.

F. Pre-construction conference submittals:
   1. The names and telephone numbers of Contractor's Superintendent and Office Manager.
   2. List of personnel authorized to sign change orders and receive progress payments.
   3. The name, address and telephone numbers of two or more persons employed by the Contractor who can be reached at any time of the day or night to handle emergency matters.
   4. A list of all subcontractors that will work on the project, a description of work they will perform, and a contact list for each subcontractor with phone numbers and address.
   5. A list of materials suppliers and products over $20,000.
   6. A draft proposed Construction Schedule.
   7. Material Safety Data Sheets for all hazardous chemical products to be used by the Contractor on this project.
   8. Temporary Erosion and Sediment Control Plan.

9. Traffic Control Plan.

1.3 PROGRESS MEETINGS

A. Progress meetings will be held a location determined by the Owner's Site Representative, unless otherwise arranged.

B. Attendees will include the Owner, Engineer (periodically), Contractor, subcontractors, and suppliers' representatives as may be needed, other Contractors working at the site, and other interested or affected parties.

C. The specific purpose of the meetings is to coordinate the efforts of all concerned so that the project progresses without delay to completion, with the least inconvenience.

D. Bring a three week look ahead schedule to each weekly meeting, including the following items:
   1. Work completed last week.
   2. Work anticipated for the next two weeks ("Look Ahead").
   3. Subcontractors on site the prior week.
   4. Subcontractors scheduled on site for the next two weeks.
   5. Contract document deficiencies or questions noted during prior week.
   6. Anything that could impede the progress of the work or affect the critical path on the project schedule.
   7. Corrective measures and procedures planned to regain planned schedule, cost or quality assurance, if necessary.
   8. Report of any accidents, and any site safety issues that need to be addressed.

E. Other Agenda items to be discussed:
   1. Review and revise as necessary and approve minutes of previous meetings.
   2. Status of submittals of equipment and shop drawings.
   3. Identify problems that impede planned progress.
   4. Other current business.

F. Revision of Minutes:
   1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
   2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
   3. Challenge to minutes shall be settled as priority item of "old business" at the next regularly scheduled meeting.

G. Minutes of Meeting:
   1. The Owner's Site Representative will compile minutes of each project meeting and will furnish electronic copies to the Contractor.

1.4 OTHER MEETINGS

A. Other meetings will be required to facilitate progress of the Work. These include, but are not limited to the following:
   1. Pre-Installation Conferences:
      a. Coordinate and schedule with Owner's Site Representative for each material, product or system specified.
         1) Conferences to be held prior to initiating installation, but not more than two (2) weeks before scheduled initiation of installation.
         2) Conferences may be combined if installation schedule of multiple components occurs within the same two (2) week interval.
         3) Review manufacturer's recommendations and Contract Documents Specification Sections.
   2. Facility Startup Planning and Coordination Meeting. See Section 01 75 00.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 32 17
CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Specific requirements for the preparation, submittal, updating, and status reporting of the construction Progress Schedule.

B. Related Specification Sections include, but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

C. Review of the CPM Schedule:
   1. In so far as the Contractor is solely responsible for its means and methods and the CPM schedule represents in part its means and methods, the review of the CPM schedules (preliminary, baseline, updates, revisions, etc.) is for compliance with the requirements as defined in the contract documents.
   2. The review of the CPM schedule is not intended to be complete or exhaustive or check every activity and its relation to the work.
   3. The Owner's Site Representative will provide comments on the CPM schedule compliance with those contract requirements and anomalies that might appear to the Engineer/Owner's Site Representative.
   4. If the Contractor fails to include contract requirements (e.g. specified cure times, commissioning periods) in the CPM schedule, or the Owner's Site Representative fails to notify the Contractor of anomalies the Contractor is not relieved of the contract requirements.
   5. Acceptance of the CPM schedule does not imply that the Owner has approved or accepted the Contractor's means and methods or sequence for performing the work to construct the project.
   6. If the Contractor has questions or concerns about comments, the Contractor and Owner's Site Representative shall meet to resolve those issues prior to issuance of future updates or revisions.

1.2 DEFINITIONS

A. The following definitions shall apply to this Specification Section:
   1. EXECUTION OF THE CONTRACT: The date the contract is signed by the last party, either the Owner or the Contractor.
   2. WORKING DAYS: Monday through Friday except holidays as directed by the Owner.
   3. BASELINE SCHEDULE: The initial detailed Progress Schedule prepared by the Contractor defining its plan for constructing the Project in accordance with the Contract Documents.
   4. SCHEDULE UPDATE: The initially accepted Baseline Schedule, or subsequently approved Revised Baseline Schedules, updated each month to reflect actual start and finish dates of each schedule activity and the remaining duration of activities that began during the period.
   5. CURRENT SCHEDULE: The current schedule is either the Baseline Schedule or Revised Baseline Schedule including and incorporating Schedule Updates.
   6. REVISED BASELINE SCHEDULE: The initially accepted Baseline Schedule revised to reflect approved contract change orders and modifications.
   7. RECOVERY SCHEDULE:
      a. A schedule indicating the Contractor's plan for recovering lost time.

b. A recovery schedule will be requested when the Contractor is forecasting at least 10 working days or more delays in meeting a contract milestone or the contract completion date.

8. SHORT INTERVAL SCHEDULE:
   a. Schedule prepared by the Contractor reflecting the work planned for the coming weeks.
   b. This is also known as a Look-Ahead Schedule.

1.3 SUBMITTALS

A. Baseline Schedule:
   1. Submittal and review:
      a. Submit within 30 days after Execution of the Contract or the effective date of the contract, whichever is earlier.
      b. The Owner's Site Representative shall review the baseline schedule and provide comments to the Contractor within twenty (20) working days after receipt of the schedule.
      c. After receiving comments, the Contractor and Owner's Site Representative shall meet to review the comments within five (5) working days.
      d. After the meeting, the Contractor will modify the schedule as agreed and resubmit the baseline schedule within 5 working days.
      e. After the Owner's Site Representative confirms that the Contractor has made the changes as agreed, the schedule will become the baseline schedule.
   2. Submittal package:
      a. CPM time-scaled network diagram:
         1) A printed logic diagram and PDF that include the following information:
            a) Unique activity number/identifier; numeric, alpha or combination of numeric/alpha.
            b) Activity description.
            c) Activity duration.
            d) Early start and early finish for each activity.
            e) Late start and late finish for each activity.
            f) Total float (TF) for each activity.
            g) Predecessor activities.
            h) Successor activities.
            i) Cost/budget to complete the work in the activity.
            j) Resources needed to complete the activity.
            k) Bar showing the early start and completion dates of each activity.
         2) The activities will be sorted by area, trades, and subcontractors as agreed on with the Owner's Site Representative.
         3) Print the CPM time-scaled network diagram on minimum sheet size of 11 IN x 17 IN.

B. Schedule Updates:
   1. Submittal and Review:
      a. Provide a Schedule Update on the 4th of each month after the Baseline Schedule is completed.
      b. The Owner's Site Representative shall provide comments to the Contractor on the Schedule Update.
      c. Incorporate the Owner's Site Representative comments into the next Schedule Update.
   2. CPM time-scaled network diagram as described for the Baseline Schedule:
      a. Do not change the description of an activity number.
         1) Any activity added to the schedule shall have a new unique activity number and description.
         2) If activities are deleted, the deleted activity number(s) will not be used again.

C. Recovery Schedule:
   1. When the activities on the critical path or the completion milestones appear to be fifteen (15) working days beyond the contract time, the Owner's Site Representative may request and provide a Recovery Schedule demonstrating how the Contractor will recover the lost time so that the Work will be completed within the Contract Time.
   2. Provide the Recovery schedule within ten (10) working days after requested by the Owner's Site Representative.
   3. Activities will be added or the durations modified to reflect the changes to the work.
   4. The Owner's Site Representative will review and provide comments to the Contractor on the Recovery Schedule within five (5) working days.
   5. Incorporate the Owner's Site Representative comments into the Recovery Schedule.
   6. After acceptance by the Owner's Site Representative, the Recovery Schedule use for future Schedule Updates.
   7. CPM time-scaled network diagram as described for the Baseline Schedule:
      a. Do not change the description of an activity number.
         1) Any activity added to the schedule shall have a new activity number and description.
         2) If activities are deleted, the deleted activity number(s) will not be used again.
   8. Provide a narrative with an explanation of the changes in logic and/or activity durations.

D. Short Interval Schedule:
   1. Provide a four-week schedule each week during the Contract Time. This schedule can be reviewed at each progress meeting.
      a. Provide an accurate representation of the work performed the previous week and work planned for the current week and subsequent weeks.
   2. Provide in a tabular format with bars or other graphic representing work duration.
      a. Reference activity ID numbers on the Baseline, Revised Baseline, or Updated Schedule, whichever is being currently used.
      b. Note by color, highlight or underscore all activities on the critical path.
   3. Identify inspection hold points including special inspections needed before the Contractor can move forward with the work.
   4. Identify the day materials provided by the Owner or others needed on site.
   5. Identify utility tie-ins and traffic changes including road and/or lane closures.

1.4 GENERAL REQUIREMENTS

A. Prepare and submit construction progress schedules as specified herein.
   1. Develop and maintain Baseline, Updates and Recovery schedules using Microsoft Project or equal as approved by the Owner's Site Representative.
   2. Include the following information:
      a. Construction start dates (Award date, Notice(s) to Proceed date).
      b. Procurement activities.
      c. Preparation of key submittals for materials and equipment.
      d. Engineers review and approval of key submittals.
      e. Material and equipment fabrication lead times.
      f. Material and equipment deliveries for Contractor, Owner and third parties.
      g. Water curing of concrete after placement for all structures.
      h. Shutdowns.
      i. Utility tie-ins.
      j. Plant tie-ins.
      k. Traffic changes and closures.
      l. Inspections and hold points.
      m. Start up of equipment.
      n. Testing of equipment and systems.
      o. Training
      p. Commissioning.

q. Contract milestones:
    1) Intermediate milestones.
    2) Substantial Completion Date.
    3) Physical Completion Date.

3. The following CPM schedule outputs will be rejected without further review:
    a. Schedules indicating the start of the critical path at a date point or activity beyond the date of Notice to Proceed, or schedules indicating a discontinuous critical path from Notice to Proceed to Contract completion.
    b. Schedules defining critical activities as those on a path or paths having some minimum value of float.
    c. Schedules with multiple critical paths.
    d. Schedules indicating a completion date beyond the contractual completion date.

B. The number of activities shall be sufficient to assure adequate planning of the project, to permit monitoring and evaluation of progress, and to do an analysis of time impacts.
1. Work activities shall not exceed durations of 10 days or 2 weeks.
    a. Procurement and fabrication activity durations may exceed 10 days or 2 weeks.
2. Schedule activities shall include the following:
    a. A clear and legible description.
    b. At least one (1) predecessor and one (1) successor activity, except for project start and finish milestones.

C. Early Completion Schedule:
1. Contractor may show early completion time on any schedule provided that the requirements of the contract are met.
2. Contractor may increase early completion time by improving production, reallocating resources to be more efficient, performing sequential activities concurrently or by completing activities earlier than planned.
3. Any time between the Contractor's early completion and the Contract Time will be considered float.

D. Plan working durations to incorporate the effects of normal weather impacts.

E. Float:
1. The project owns the float, therefore neither the Owner nor the Contractor has exclusive use of the float; the float can used by either party.
2. Once float is used, liability for delay of the project completion date rests with the party actually causing delay to the project completion date.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanics and administration of the submittal process for:
      a. Shop Drawings.
      b. Samples.
      c. Informational submittals.
   2. General content requirements for Shop Drawings.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Construction Progress Schedule submittal requirements are specified in Specification Section 01 32 17.
   4. Operations and Maintenance Manual submittal requirements are specified in Specification Section 01 33 04.
   5. Technical Specification Sections identifying required submittals.

1.2 DEFINITIONS

A. Shop Drawings:
   1. Product data and samples are Shop Drawing information.

B. Informational Submittals:
   1. Submittals other than Shop Drawings and samples required by the Contract Documents that do not require review and/or approval by the Owner's Site Representative.
   2. Representative types of informational submittal items include but are not limited to:
      a. HVAC test and balance reports.
      b. Installed equipment and systems performance test reports.
      c. Manufacturer's installation certification letters.
      d. Instrumentation and control commissioning reports.
      e. Warranties.
      f. Service agreements.
      g. Construction photographs.
      h. Survey data.
      i. Health and safety plans.
      j. Work plans.
      k. Delegated designs per performance specification requirements
   3. For-Information-Only submittals upon which the Owner's Site Representative is not expected to conduct review or take responsive action may be so identified in the Contract Documents.

1.3 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:
   1. Submitted and approved within 20 days of receipt of Notice to Proceed.
   2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.

B. Shop Drawings: Submittal and approval prior to 30 percent completion of project.

C. Informational Submittals:
   1. Reports and installation certifications submitted within seven (7) days of conducting testing, installation, or examination.
   2. Submittals showing compliance with required qualifications submitted twenty (20) days prior to any work beginning using the subject qualifications.

D. The submittal schedule shall include the following columns as a minimum:

Submittal Section	Submittal Description	Planned Submittal Date	Submittal Need Date	Actual Submittal Date	Actual Return Date	Disposition

1.4 PREPARATION OF SUBMITTALS

A. General:
   1. All submittals and all pages of all copies of a submittal shall be completely legible.
   2. Submittals which, in the Owner's Site Representative's sole opinion, are illegible will be returned without review.
   3. Minimize extraneous information for equipment and products not relevant to the submittal.
   4. Contractors or vendors written comments on the submittal drawings shall be in green

B. Shop Drawings, Product Data, and Samples:
   1. Scope of any submittal and letter of transmittal:
      a. Limited to one (1) Specification Section.
      b. Submittals with more than one Specification section included will be rejected.
      c. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Specification Section.
   2. Numbering letter of transmittal:
      a. Include as prefix the Specification Section number followed by a series number, "-xx", beginning with "01 IN and increasing sequentially with each additional transmittal for that Specification Section.
      b. If more than one (1) submittal under any Specification Section, assign consecutive series numbers to subsequent transmittal letters.
   3. Describing transmittal contents:
      a. Provide listing of each component or item in submittal capable of receiving an independent review action.
      b. Identify for each item:
         1) Manufacturer and Manufacturer's Drawing or data number.
         2) Contract Document tag number(s).
         3) Unique page numbers for each page of each separate item.
      c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
   4. Contractor certification of review and approval:
      a. Execute Exhibit AA, Contractor's Submittal Certification form, to indicate Contractor has reviewed and approved the submittal contents.
         1) Clearly identify the person who reviewed the submittal and the date it was reviewed."
      b. Submittals containing multiple independent items shall be prepared with each item listed on the letter of transmittal or on an index sheet for all items listing the discrete page numbers for each page of each item, which shall be stamped with the Contractor's review and approval stamp.
         1) Each independent item shall have a cover sheet with the transmittal number and item number recorded.
            a) Provide clear space of 3 IN SQ for Owner's Site Representative stamping.

2) Individual pages or sheets of independent items shall be numbered in a manner that permits the entire contents of a particular item to be readily recognized and associated with Contractor's certification.

5. Resubmittals:
   a. Number with original Specification Section and series number with a suffix letter starting with "A" on a (new) duplicate transmittal form.
   b. Do not increase the scope of any prior transmittal.
   c. Provide cover letter indicating how each "B", "C", or "D" Action from previous submittal was addressed and where the correction is found in the resubmittal.
   d. Account for all components of prior transmittal.
      1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
         a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
      2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
         a) Obtain Owner’s Site Representative's approval to exclude items.
6. Do not use red color for marks on transmittals.
   a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
   b. Owner’s Site Representative will use red marks or enclose marks in a cloud.
7. Transmittal contents:
   a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Owner’s Site Representative.
   b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.
      1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.
   c. Identify equipment or material project use, tag number, Drawing detail reference, weight, and other Project specific information.
   d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
   e. Do not modify the manufacturer's documentation or data except as specified herein.
   f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets not exceeding 11 x 17 IN pages.
      1) Indicate exact item or model and all options proposed by arrow and leader.
   g. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
      1) Arrange data and performance information in format similar to that provided in Contract Documents.
      2) Provide, at minimum, the detail specified in the Contract Documents.
   h. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Owner’s Site Representative shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.

8. Samples:
    a. Identification:
        1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, Specification Section or Drawing detail reference, color, range, texture, finish and other pertinent data.
        2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
    b. Include application specific brochures, and installation instructions.
    c. Provide Contractor's review and approval certification stamp or Contractor's Submittal Certification form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
    d. Resubmit revised samples of rejected items.

C. Informational Submittals:
1. Prepare in the format and detail specified in Specification requiring the informational submittal.

1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings, Informational Submittals and Samples:
1. Transmit all submittals to:

HDR Engineer, Inc.
5201 South Sixth Street Road
Springfield, IL 62703
Attn: Matt Cochran
Email: matt.cochran@hdrinc.com

2. Utilize one (1) copy of attached Exhibit A to transmit all Shop Drawings and samples.
3. All submittals must be from Contractor.
    a. Submittals will not be received from or returned to subcontractors.

B. Electronic Transmission of Submittals:
1. Transmittals shall be made electronically.
    a. Use HDR's Project Tracker Collaboration System (PTCS) or mutually agreed upon equivalent.
    b. Protocols and processes will be determined at the Pre-Construction Conference.
2. Provide documents in Adobe Acrobat Portable Document Format (PDF), latest version.
3. Do not password protect or lock the PDF document.
4. Drawings or other graphics must be converted to PDF file format from the original drawing file format and made part of the PDF document.
    a. Scanning of drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 dpi or greater.
    b. Required signatures may be applied prior to scanning for transmittal.
5. Electronic drawings shall be formatted to be at full-scale (or half-scale when printed to 11x17).
    a. Do not reduce drawings by more than 50 PCT in size.
    b. Reduced drawings shall be clearly marked "HALF-SIZE" and shall scale accurately at that size.
6. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
7. Create bookmarks in the bookmarks panel for the cover, the Table of Contents, and each major section of the document.
8. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
    a. Select File →Properties→Initial View.

b. Select the Navigation tab: Bookmarks Panel and Page.
c. Select the Page layout: Single Page.
d. Select the Magnification: Fit Page.
e. Select Open to page: 1.
f. Set the file to open to the cover page with bookmarks to the left, and the first bookmark linked to the cover page.

9. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
   a. To do this:
      1) Select Edit→Preferences→ Documents→Save Settings.
      2) Check the Save As optimizes for Fast Web View box.
10. File naming conventions:
    a. File names shall use a "ten dot three" convention (XXXXXX-YY-Z.PDF) where XXXXXX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.
11. Labeling:
    a. As a minimum, include the following labeling on all CD-ROM discs and jewel cases:
       1) Project Name.
       2) Equipment Name and Project Tag Number.
       3) Project Specification Section.
       4) Manufacturer Name.
       5) Vendor Name.
12. Binding:
    a. Include labeled CD(s) in labeled jewel case(s).
       1) Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.
       2) Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

1.6 REVIEW ACTION

A. Shop Drawings and Samples:
   1. Items within transmittals will be reviewed for overall design intent and will receive one (1) of the following actions:
      a. A - FURNISH AS SUBMITTED.
      b. B - FURNISH AS NOTED (BY OWNER'S SITE REPRESENTATIVE).
      c. C - REVISE AND RESUBMIT.
      d. D - REJECTED.
      e. E - REVIEW NOT REQUIRED.
   2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
      a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned rejected.
   3. In relying on the representation on the Contractor's review and approval stamp, Owner and Owner's Site Representative reserve the right to review and process poorly organized and poorly described submittals as follows:
      a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
         1) Review and approval will be limited to the single item described on the transmittal letter.
         2) Other items identified in the submittal will:
            a) Not be logged as received by the Owner's Site Representative.
            b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.

c) Be submitted by the Contractor as a new series number, not as a re-submittal number.

b. Owner's Site Representative, at Owner's Site Representative's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
   1) Unless Contractor notifies Owner's Site Representative in writing that the Owner's Site Representative's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.

4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
   a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
   b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
   a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
      1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
         a) Correct and resubmit items so marked.
   b. Items marked "A" or "B" will be fully distributed.
   c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
      1) This is at the sole discretion of the Owner's Site Representative.
      2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
      3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
7. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been stamped by the professional as defined in the specifications and for limited purpose of checking conformance with given performance and design criteria. The Owner's Site Representative is not responsible for checking the accuracy of the calculations and the calculations will be returned stamped "E. Review Not Required" to acknowledge receipt.
8. Furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Owner's Site Representative will record Owner's Site Representative's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Owner's Site Representative's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
9. Transmittals of submittals which the Owner's Site Representative considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" action in a prior submittal, will be returned with action "E. Review Not Required."
10. Samples may be retained for comparison purposes.
    a. Remove samples when directed.
    b. Include in bid all costs of furnishing and removing samples.
11. Approved samples submitted or constructed, constitute criteria for judging completed work.

a. Finished work or items not equal to samples will be rejected.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

EXHIBIT A

Shop Drawing Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn:	Attn:	1st. Sub	ReSub.
Date Transmitted:	Previous Transmittal Date:		

Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*

Remarks:

* The Action designated above is in accordance with the following legend:

A - Furnish as Submitted

B - Furnish as Noted

C - Revise and Submit
1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
4. Not enough copies submitted.
5. Wrong sequence number.
6. Wrong resubmittal number.
7. Wrong spec. section.
8. Wrong form used.
9. See comments.

D - Rejected

E - Engineer's review not required
1. Submittal not required.
2. Supplemental Information. Submittal retained for informational purposes only.
3. Information reviewed and approved on prior submittal.
4. See comments.
5. Delegated Design - Submittal received as requested by the Contract Documents. The Engineer did not review the engineering or technical content of the submittal.

Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other

EXHIBIT AA

Contractor's Submittal Certification

Shop Drawing Transmittal No.: _____

Contract/Project Name: _____

_____

Company Name: _____

has

1. reviewed and coordinated this Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

3. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

☐ This Submittal **does not** contain any variations from the requirements of the Contract Documents.

☐ This Submittal **does** contain variations from the requirements of the Contract Documents. A separate description of said variations and a justification for them is provided in an attachment hereto identified as:

"Shop Drawing Transmittal No. _____Variation and Justification Documentation"

Insert picture file or electronic signature of Authorized Representative

_____ _____

Authorized Representative Date

SECTION 01 33 04
OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administration of the submittal process for Operation and Maintenance Manuals.
   2. Content requirements for Operation and Maintenance Manuals.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. General submittal requirements are specified in Specification Section 01 33 00 - Submittals.
   4. Technical Specification Sections identifying required Operation and Maintenance Manual submittals.

1.2 DEFINITIONS

A. Equipment Operation and Maintenance Manuals:
   1. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

B. Building Materials and Finishes Operation and Maintenance Manuals:
   1. Contain the information required for proper installation and maintenance of building materials and finishes.

1.3 SUBMITTALS

A. List of all the Operation and Maintenance Manuals required by the Contract as identified in the Technical Specification Sections. These may be referred to as "Operation and Maintenance Data" submittals.

B. Operation and Maintenance Manuals:
   1. Draft and final electronic copies.
   2. Final paper copies: Two (2).

1.4 SUBMITTAL SCHEDULE

A. List of Required Operation and Maintenance Manuals:
   1. Submit list with Specification Section number and title within 90 days after Notice to Proceed.

B. Draft Operation and Maintenance Manuals:
   1. Submit approvable draft manuals in electronic format (PDF) within 30 days following approval of the respective Shop Drawing.
      a. Include placeholders or fly sheet pages where information is not final or is missing from the draft manual.
   2. All Draft Operation and Maintenance Manuals shall be received by no later than 75 PCT project completion.

C. Final Operation and Maintenance Manuals:
   1. Final approval of Operation and Maintenance Manuals in electronic format (PDF) must be obtained 45 days prior to equipment start-up.
   2. Provide paper copies and CD-ROMs/flash drive of approved final Operation and Maintenance Manuals in electronic format (PDF), a minimum of 30 days prior to equipment start-up.

3. Issue addenda to Final Approved Operation and Maintenance Manual to include:
    a. Equipment data that requires collection after start-up, for example but not limited to HVAC balancing reports, electrical switchgear, automatic transfer switch and circuit breaker settings.
    b. Equipment field testing data.
    c. Equipment start-up reports.

1.5 PREPARATION OF SUBMITTALS

A. General:
1. All pages of the Operation and Maintenance Manual submittal shall be legible.
    a. Submittals which, in the Owner's Site Representative's sole opinion, are illegible will be rejected without review.
2. Identify each equipment item in a manner consistent with names and identification numbers used in the Contract Documents, not the manufacturer's catalog numbers.
3. Neatly type any data not furnished in printed form.
4. Operation and Maintenance Manuals are provided for Owner's use, to be reproduced and distributed as training and reference materials within Owner's organization.
    a. This requirement is:
        1) Applicable to both paper copy and electronic files.
        2) Applicable to materials containing copyright notice as well as those with no copyright notice.
5. Notify supplier and/or manufacturer of the intended use of Operations and Maintenance Manuals provided under the Contract.

B. Operation and Maintenance Manual Format and Delivery:
1. Draft electronic submittals:
    a. Provide manual in Adobe Acrobat Portable Document Format (PDF), latest version.
    b. Create one (1) PDF file for each equipment Operation and Maintenance Manual.
    c. Do not password protect or lock the PDF document.
    d. Scanned images of paper documents are not acceptable. Create the Operation and Maintenance Manual PDF file from the original source document.
    e. Drawings or other graphics must be converted to PDF file format from the original drawing file format and made part of the PDF document.
    f. Scanning of drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 dpi or greater.
    g. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
    h. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual cover, the Table of Contents and each major section of the Table of Contents.
    i. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
        1) Select File →Properties→Initial View.
        2) Select the Navigation tab: Bookmarks Panel and Page.
        3) Select the Page layout: Single Page Continuous.
        4) Select the Magnification: Fit Page.
        5) Select Open to page: 1.
        6) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.
        7) Window Options: Check the "Resize window to initial page" box.
    j. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
        1) To do this:
            a) Select Edit→Preferences→ Documents→Save Settings.
            b) Check the "Save As optimizes for Fast Web View" box.

k. PDF file naming convention:
    1) Use the Specification Section number, the manufacturer's name and the equipment description, separated by underscores.
    2) Example: 46 51 21_Sanitaire_Coarse_Bubble_Diffusers.pdf.
    3) Do not put spaces in the file name.

2. Final electronic submittals:
    a. Submit two (2) copies in PDF file format on two (2) CD-ROM discs (one (1) copy per CD-ROM), each secured in a jewel case or on a flash drive.
    b. CD-ROM Labeling:
        1) Provide the following printed labeling on all CD-ROM discs:
            a) Project name.
            b) Specification Section.
            c) Equipment names and summary of tag(s) covered.
            d) Manufacturer name.
            e) Date (month, year).
    c. CD-ROM Jewel Case Holder:
        1) Insert jewel cases containing labeled CD-ROM discs in three-ring binder holder (C-Line Products, www.c-lineproducts.com stock number CLI-61968 or equivalent) at the front of each final paper copy.
3. Final paper copy submittals:
    a. Quantity: Provide two (2) copies.
    b. Paper: 8.5 x 11 IN or 11 x 17 IN bright white, 20 LB paper with standard three-hole punching.
    c. 3-Ring Binder:
        1) Provide D-ring binder with clear vinyl sleeves (i.e. view binder) on front and spine.
        2) Insert binder title sheet with the following information under the front and spine sleeves:
            a) Project name.
            b) Specification Section.
            c) Equipment names and summary of tag(s) covered.
            d) Manufacturer name.
            e) Date (month, year).
        3) Provide plastic sheet lifters prior to first page and following last page.
    d. Drawings:
        1) Provide all drawings at 11 x 17 IN size, triple folded and three-hole punched for insertion into manual.
        2) Where reduction is not practical to ensure readability, fold larger drawings separately and place in three-hole punched vinyl envelopes inserted into the binder.
        3) Identify vinyl envelopes with drawing numbers.
    e. Use plastic coated dividers to tab each section of each manual in accordance with the Table of Contents.

C. Equipment Operation and Maintenance Manual Content:
1. Provide a cover page as the first page of each manual with the following information:
    a. Manufacturer(s) Name and Contact Information.
    b. Vendor's Name and Contact Information.
    c. Date (month, year).
    d. Project Owner and Project Name.
    e. Specification Section.
    f. Project Equipment Tag Numbers.
    g. Model Numbers.
    h. Engineer's Name.
    i. Contractor's Name.
2. Provide a Table of Contents for each manual.

3. Provide Equipment Record sheets as follows:
    a. Printed copies of the Equipment Record (Exhibits B1, B2 and B3), as the first tab following the Table of Contents.
    b. Exhibits B1-B3 are available as Fillable PDF Form documents from the Engineer.
    c. Each section of the Equipment Record must be completed in detail; simply referencing the related equipment Operation and Maintenance Manual sections for nameplate, maintenance, spare parts or lubricant information is not acceptable.
    d. For equipment involving separate components (for example, a motor and gearbox), a fully completed Equipment Record is required for each component.
    e. Submittals that do not include the Equipment Record(s) will be rejected without further content review.
4. Provide a printed copy of the Manufacturer's Field Services report as required by Specification Section 01 75 00 following the Equipment Record sheets.
5. Provide the following detailed information, as applicable:
    a. Use equipment tag numbers from the Contract Documents to identify equipment and system components.
    b. Equipment function, normal and limiting operating characteristics.
    c. Instructions for assembly, disassembly, installation, alignment, adjustment, and inspection.
    d. Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
    e. Lubrication and maintenance instructions.
    f. Troubleshooting guide.
    g. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project; delete or cross out information that does not specifically apply to the Project.
    h. Parts lists:
        1) A parts list and identification number of each component part of the equipment.
        2) Exploded view or plan and section views of the equipment with a detailed parts callout matching the parts list.
        3) A list of recommended spare parts.
        4) List of spare parts provided as specified in the associated Specification Section.
        5) A list of any special storage precautions which may be required for all spare parts.
    i. General arrangement, cross-section, and assembly drawings.
    j. Electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, and interconnection diagrams.
    k. Test data and performance curves.
    l. As-constructed fabrication or layout drawings and wiring diagrams.
    m. Copy of the equipment manufacturer's warranty meeting the requirements of the Contract.
    n. Copy of any service contracts provided for the specific piece of equipment as part of the Contract.
6. Additional information as required in the associated equipment or system Specification Section.

D. Building Materials and Finishes Operation and Maintenance Manual Content:
1. Provide a cover page as the first page of each manual with the following information:
    a. Manufacturer(s) Name and Contact Information.
    b. Vendor's Name and Contact Information.
    c. Date (month, year).
    d. Project Owner and Project Name.
    e. Specification Section.
    f. Model Numbers.
    g. Engineer's Name.
    h. Contractor's Name.
2. Provide a Table of Contents for each manual.

3. Building products, applied materials and finishes:
    a. Include product data, with catalog number, size, composition and color and texture designations.
    b. Provide information for ordering custom manufactured products.
4. Necessary precautions:
    a. Include product MSDS for each approved product.
    b. Include any precautionary application and storage guidelines.
5. Instructions for care and maintenance:
    a. Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
6. Moisture protection and weather exposed products:
    a. Include product data listing, applicable reference standards, chemical composition, and details of installation.
    b. Provide recommendations for inspections, maintenance and repair.
7. Additional requirements as specified in individual product specifications.

E. National Fire Protection Association 70 (National Electrical Code) Documentation:
1. Assemble documented calculations of Arc-Fault Current, Equipment Available Fault Current and Short Circuit Current Rating (SCCR) provided as part of equipment submittals into one O&M manual volume.

1.6 TRANSMITTAL OF SUBMITTALS

A. Operation and Maintenance Manuals.
1. Transmit all submittals to:
    a. The address specified in Specification Section 01 33 00 - SUBMITTALS.
2. Transmittal form: Use Operation and Maintenance Manual Transmittal, Exhibit A.
3. Transmittal numbering:
    a. Number each submittal with the Specification Section number followed by a series number beginning with "-01 IN and increasing sequentially with each additional transmittal, followed by "-OM" (for example: 43 23 14-01-OM).
4. Submit draft and final Operation and Maintenance Manual in electronic format (PDF) to Owner’s Site Representative, until manual is approved.

1.7 REVIEW ACTION

A. Draft Electronic (PDF) Submittals:
1. Owner’s Site Representative will review and indicate one of the following review actions:
    a. A - ACCEPTABLE
    b. B - FURNISH AS NOTED
    c. C - REVISE AND RESUBMIT
    d. D - REJECTED
2. Submittals marked as Acceptable or Furnish As Noted will be retained; however, the transmittal form will be returned with a request for the final paper and electronic documents to be submitted.
3. Copies of submittals marked as Revise and Resubmit or Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

B. Final Paper Copy Submittals:
1. Owner’s Site Representative will review and indicate one (1) of the following review actions:
    a. A - ACCEPTABLE
    b. D - REJECTED
2. Submittals marked as Acceptable will be retained with the transmittal form returned as noted.

3. Submittals marked as Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

EXHIBIT A **Operation and Maintenance Manual Transmittal _____-_____ - OM**
(Spec Section) (Series) .

Project Name: Date Received:

Project Owner: Checked By:

Contractor: Owner: Log Page:

Address: Address: HDR No.:

Attn: Attn:

1st. Sub. ReSub.

Date Transmitted: Previous Transmittal Date:

No. Copies	Description of Item	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

To: From:

HDR Engineering, Inc.

Date:

* The Action designated above is in accordance with the following legend:

A - Acceptable, provide one (1) additional paper copy and two (2) electronic copies on CD-ROM for final review.

B - ~~Furnish as Noted~~ - Not Used

C - Revise and Resubmit
This Operation and Maintenance Manual Submittal is deficient in the following area:

1. Equipment Records.
2. Functional description.
3. Assembly, disassembly, installation, alignment, adjustment & checkout instructions.
4. Operating instructions.
5. Lubrication & maintenance instructions.
6. Troubleshooting guide.
7. Parts list and ordering instructions.
8. Organization (binder, binder titles, index & tabbing).
9. Wiring diagrams & schematics specific to installation.
10. Outline, cross section & assembly diagrams.
11. Test data & performance curves.
12. Tag or equipment identification numbers.
13. Inclusion of all components & subcomponents.
14. Other - see comments.

D - ~~Rejected~~ - Not Used

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other

EXHIBIT B1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name	Specification Section:
Equipment Name	Year Installed:
Project Equipment Tag No(s).	
Equipment Manufacturer	Project/ Order No.
Address	Phone
Fax / Web Site / E-mail	
Local Vendor/Service Center	
Address	Phone
Fax / Web Site / E-mail	

MECHANICAL NAMEPLATE DATA

Equip.		Serial No.		
Make		Model No.		
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

ELECTRICAL NAMEPLATE DATA

Equip.			Serial No.					
Make			Model No.					
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

EXHIBIT B2

Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).	

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP							
	D	W	M	Q	S	A	RT	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *							
	D	W	M	Q	S	A	RT	Hours

***** **D = Daily** **W = Weekly** **M = Monthly** **Q = Quarterly** **S = Semiannual** **A = Annual** **Hours = Run Time I**

EXHIBIT B3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

SECTION 01 42 13
STANDARD ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.1 UNITS OF MEASUREMENT

A. Units of measurement abbreviations are defined on the drawings.

1.2 TERMINOLOGY

A. Abbreviations associated with terminology are defined in the Drawings, with the following exceptions:
   1. Typical equipment abbreviations are listed in 01 61 03 – Equipment: Basic Requirements.
   2. Piping system abbreviations are listed in 40 05 00 – Pipe and Pipe Fittings: Basic Requirements.

1.3 ORGANIZATIONS AND STANDARDS

A. Organizations associated with industry reference standards are defined in each Specification Section.

END OF SECTION

SECTION 01 45 00
QUALITY ASSURANCE AND CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quality assurance and control.
   2. Regulatory requirements.
   3. Tolerances.
   4. Mock-ups.
   5. Manufacturer's field services.

1.2 QUALITY ASSURANCE AND CONTROL

A. Monitor quality assurance and control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Comply with specified standards as minimum quality for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified and experienced to produce required or specified quality.

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

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

H. Materials shall be compatible with one another and with other materials with which they may come in contact.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of Products to produce approved Work.
   1. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances.
   1. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

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

1.4 MANUFACTURER'S FIELD SERVICES AND REPORTS

A. When field services are specified, have material or product suppliers, or manufacturers, provide technically competent staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and supervise installation where specified, as applicable and to initiate instructions when necessary.

B. Report observations, and site decisions or instructions given to applicators or installers which are supplemental or contrary to manufacturer's written instructions.

C. Submit report in duplicate within 30 days of observation.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual Specification Sections.

D. Verify that utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01 45 23
TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. General:
   1. Work shall be subject to inspection, testing and approval by testing agency, inspector and building official, or public authorities having jurisdiction.
   2. Approval as result of inspection or testing shall not be construed to be an approval of a violation of provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
   3. Testing, inspections and approvals presuming to give authority to violate or cancel provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations shall not be valid.
   4. It shall be duty of Contractor to cause Work to remain accessible and exposed for testing and inspection purposes.
   5. It shall be duty of Contractor to notify testing agency, inspector and building official or public authorities having jurisdiction when Work is in conformance with Contract Documents and is ready for testing and inspection.
   6. It shall be duty of Owner and Contractor to provide access to, and means for testing and inspections of such Work required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
   7. Any portion that does not comply shall be corrected and shall not be covered or concealed until authorized by testing agency, inspector and public authorities having jurisdiction.
   8. Tests, inspections and approvals of portions of Work required by Contract Documents or by codes, laws, ordinances, rules, regulations or orders of building official or public authorities having jurisdiction shall be made at an appropriate time.
   9. Contractor shall give testing agency, inspector, building official or public authorities having jurisdiction, and Architect/Engineer, if requested, timely notice of when and where tests and inspections are to be made so that they may be present for such procedures.
   10. In event such procedures for testing, inspection and approval reveal portions of Work fail to comply with requirements established by Contract Documents, or by governing codes, laws, ordinances, rules or regulations, costs made necessary by such failure, including those of repeated procedures and compensation for Architect/Engineer's services and expenses, shall be at Contractor's expense.
   11. Required certificates of testing, inspection and approval shall, unless otherwise required by Contract Documents, be secured by Contractor and promptly delivered to Architect/Engineer, inspector, building official and public authorities having jurisdiction.
   12. If Architect/Engineer, Owner, building official, public authorities having jurisdiction, testing agency or inspector is to observe tests, inspections and approvals required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations or orders of building official or public authorities having jurisdiction, they will do so promptly, and where practicable, at normal place of testing.
   13. Construction or Work for which a building permit is required shall be subject to inspections by building officials and such construction or Work shall remain accessible and exposed for inspection purposes until approved.
      a. Building officials is authorized to accept reports of approved inspection agencies, provided such agencies satisfy requirements as to qualifications and reliability.
      b. See governing codes, laws, ordinances, rules and regulations for additional requirements.

B. Test and inspection method standards: See technical sections and governing codes, laws, ordinances, rules and regulations.

C. Qualifications of independent testing agencies:
   1. Testing agency shall comply with governing codes, laws, ordinances, rules and regulations.
      a. Testing agency shall provide information necessary for building official to determine that testing agency meets applicable requirements.
      b. Testing agency shall be objective, competent and independent from Contractor responsibility for Work being inspected.
      c. Agency shall disclose possible conflicts of interest so that objectivity can be confirmed.
      d. Agency shall have adequate equipment to perform required tests, and equipment shall be periodically calibrated.
      e. Agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.
      f. See governing codes, laws, ordinances, rules and regulations for additional requirements.
   2. Meet American Council of Independent Laboratories, Recommended Requirements of Independent Laboratory Qualification, latest edition.
   3. Meet requirements of ASTM E329, Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction, latest edition.
   4. Meet requirements of AASHTO Materials Reference Library (AMRL) R18 Standard Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories.
   5. Meet requirements of ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories.
   6. Satisfy inspection criteria of Materials Reference Laboratory of National Institute of Standards and Technology.
   7. See technical sections for additional requirements.

D. Testing equipment calibration shall be by accredited calibration agency, at maximum 12 month intervals, by devices of accuracy traceable to either:
   1. National Institute of Standards and Technology.

E. Special Inspections:
   1. Owner will employ one or more special inspectors to perform inspections during construction on types of Work required by governing codes.
      a. These inspections are in addition to inspections by building officials having jurisdiction.
      b. See governing codes, laws, ordinances, rules and regulations for additional requirements.

F. Structural Observations:
   1. Owner will employ a registered design professional to perform structural observations as defined in the governing codes where required by provisions of governing codes.
      a. See governing codes, laws, ordinances, rules and regulations for additional requirements.

1.2 DESCRIPTION

A. Owner will arrange and pay for following testing and inspections performed by testing agency or special inspector:
   1. Site excavation and rough grading inspection: Section 31 23 00.
   2. Soil compaction inspection and testing: Section 31 23 00.
   3. Excavation inspection: Section 31 23 00.
   4. Concrete testing and evaluation of installed work: Section 03 05 05.
   5. Concrete reinforcing testing and inspection: Section 03 21 00.
   6. Concrete floor finish tolerance testing: Section 03 35 00.
   7. Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

B. Contractor arrange and bear related costs for following tests, inspections and approvals with an independent testing agency or entity acceptable to Owner:
   1. Concrete testing for qualification of proposed materials, establishment of mix design, and for Contractor's convenience: Section 03 05 05.
   2. Portland cement-lime mortars and grout testing for qualification of materials and for Contractor's convenience: Section 04 05 13.
   3. Rebar locating for drilling, core drilling or cutting of concrete.
   4. Testing and inspections of Contractor provided shoring or forming.
   5. Additional inspection and testing required by public authorities having jurisdiction.
   6. Contractor's duties for Owner provided tests, as specified.

C. Contractor shall arrange for, and bear related costs for following with Owner provided independent testing agency or entity acceptable to Owner:
   1. Re-testing due to failure of initial test or due to nonconformance with Contract Documents.
   2. Re-inspections of Work due to failure of Work to pass initial inspection or due to nonconformance with Contract Documents.

1.3 JOB CONDITIONS

A. Employment of independent testing agency does not relieve Contractor of obligation to comply with Contract Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Perform indicated inspections, sampling and testing of materials and methods of construction.

B. Use test and inspection or sampling methods or both conforming with methods indicated.

C. Report each test and inspection or sampling or both as indicated.

D. Report results called for by test method, in form specified.

E. Retest failed products and systems.

3.2 REPORTS

A. Submit reports and logs promptly to Architect/Engineer, Structural Engineer, Contractor, inspector, and public authorities having jurisdiction.

B. Include following for test or inspection reports or both:
   1. Project name and number.
   2. Project location.
   3. Product and specification section applicable.
   4. Type of test or inspection or both.
   5. Name of testing agency, if used.
   6. Name of testing or inspecting personnel, or both.
   7. Date of test or inspection or both.
   8. Record of field conditions encountered; i.e., temperature, weather.
   9. Test location.
   10. Observations regarding compliance.
   11. Test method used.
   12. Results of test.
   13. Date of report.
   14. Signature of testing or inspecting personnel or both.

C. Maintain log of tests which have failed:

1. Type of test or inspection or both.
2. Date of test or inspection or both.
3. Test or inspection number or both.
4. Reason failed.
5. Date of retest or inspection or both.
6. Results of retest.
7. Method of retest.

3.3 INDEPENDENT TESTING AGENCY DUTIES AND LIMITATIONS OF AUTHORITY

A. Cooperate with Architect/Engineer and Contractor.

B. Provide qualified personnel promptly on notice.

C. Promptly notify Architect/Engineer and Contractor of irregularities, or deficiencies of work which are observed during performance of services.

D. Testing agency is not authorized to:
   1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Approve or accept any portion of Work.
   3. Perform any duties of Contractor.

3.4 CONTRACTOR'S DUTIES

A. Cooperate with testing agency personnel, inspector and public authorities having jurisdiction and provide access to work.

B. Provide preliminary representative samples of materials to be tested, in required quantities.

C. Furnish copies of mill test reports.

D. Furnish 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. Storage and curing facilities for testing agency's exclusive use.

E. Notify building official and testing agencies when Work is ready for inspections.

F. Construction or Work for which Special Inspections are required shall remain accessible and exposed for special inspections purposes until completion of required special inspections.

G. Provide access to and means for inspections by building officials and testing agencies of such Work that are required.

H. Work shall not be done beyond point indicated in each successive inspection without first obtaining approval of building official.

I. Any portion of Work that does not comply shall be corrected and such portions shall not be covered or concealed until authorized by building official.

J. Notify appropriate testing agency, inspector or public authorities having jurisdiction sufficiently in advance of operations.

END OF SECTION

SECTION 01 61 03
EQUIPMENT - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements of this Specification Section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Specification Sections.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 81 10 - Wind and Seismic Design Criteria
   4. Section 03 15 19 - Anchorage to Concrete
   5. Section 03 31 30 - Concrete, Materials and Proportioning.
   6. Section 05 50 00 - Metal Fabrications.
   7. Section 09 96 00 - High Performance Industrial Coatings.
   8. Section 26 29 23 - Variable Frequency Drives: Low Voltage.
   9. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. American Gear Manufacturers Association (AGMA).
   3. ASTM International (ASTM):
      a. E1934, Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography.
      b. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   4. Hydraulic Institute (HI):
      a. 9.6.4, Centrifugal and Vertical Pumps for Vibration Measurements and Allowable Valves.
   5. International Electrotechnical Commission (IEC).
   6. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
   7. International Organization for Standardization (ISO):
      a. 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.
      b. 21940-11, Mechanical Vibration - Rotor Balancing - Part 11: Procedures and Tolerances for Rotors with Rigid Behavior.
   8. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 6, Enclosures for Industrial Control and System.
      c. MG 1, Motors and Generators.
   9. International Electrical Testing Association (NETA):
      a. ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.
   10. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
   11. National Institute for Certification in Engineering Technologies (NICET).
   12. National Institute of Standards and Technology (NIST).
   13. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

14. Underwriters Laboratories, Inc. (UL).
    a. 508, Standard for Safety Industrial Control Equipment.
    b. 508A, Standard for Safety Industrial Control Panels.
    c. 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.

B. Miscellaneous:
1. A single manufacturer of a "product" shall be selected and utilized uniformly throughout Project even if:
    a. More than one (1) manufacturer is listed for a given "product" in Specifications.
    b. No manufacturer is listed.
2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations.
3. Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and verify their compatibility.

1.3 DEFINITIONS

A. Product: Manufactured materials and equipment.

B. Major Equipment Supports - Supports for Equipment:
1. Located on or suspended from elevated slabs with supported equipment weighing 2000 LBS or greater, or;
2. Located on or suspended from roofs with supported equipment weighing 500 LBS or greater, or;
3. Located on slab-on-grade or earth with supported equipment weighing 5000 LBS or more.

C. Equipment:
1. One (1) or more assemblies capable of performing a complete function.
2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

D. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
1. General for all equipment:
    a. See Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
    b. Data sheets that include manufacturer's name and complete product model number.
        1) Clearly identify all optional accessories that are included.
    c. Acknowledgement that products submitted comply with the requirements of the standards referenced.
    d. Manufacturer's delivery, storage, handling, and installation instructions.
    e. Equipment identification utilizing numbering system and name utilized in Drawings.
    f. Equipment installation details:
        1) Location of anchorage.
        2) Type, size, and materials of construction of anchorage.
        3) Anchorage setting templates.
        4) Manufacturer's installation instructions.
    g. Equipment area classification rating.

h. Shipping and operating weight.
i. Equipment physical characteristics:
    1) Dimensions (both horizontal and vertical).
    2) Materials of construction and construction details.
j. Equipment factory primer and paint data.
k. Manufacturer's recommended spare parts list.
l. Equipment lining and coatings.
m. Equipment utility requirements include air, natural gas, electricity, and water.
n. Ladders and platforms provided with equipment:
    1) Certification that all components comply fully with OSHA requirements.
    2) Full details of construction/fabrication.
    3) Scaled plan and sections showing relationship to equipment.

2. Mechanical and process equipment:
    a. Operating characteristics:
        1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
        2) Brake horsepower requirements.
        3) Copies of equipment data plates.
    b. Piping and duct connection size, type and location.
    c. Equipment bearing life certification.
    d. Equipment foundation data:
        1) Equipment center of gravity.
        2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.
3. Electric motor:
    a. Motor manufacturer and model number.
    b. Complete motor nameplate data.
    c. Weight.
    d. NEMA design type.
    e. Enclosure type.
    f. Frame size.
    g. Winding insulation class and temperature rise.
    h. Starts per hour.
    i. Bearing data and lubrication system.
    j. Natural frequency calculations for:
        1) Completed assembly including but not limited to the equipment base, rotating piece of equipment, and the rotating piece of equipment driver.
        2) Individual piece of rotating equipment.
        3) Equipment driver and connected gear reducer, if applicable.
    k. Thermal protection system including recommended alarm and trip settings for winding and bearing RTD’s.
    l. Fabrication and/or layout drawings:
        1) Dimensioned outlined drawing.
        2) Connection diagrams including accessories (strip heaters, thermal protection, etc.).
    m. Certifications:
        1) When utilized with a reduced voltage starter, certify that motor and driven equipment are compatible.
        2) When utilized with a variable frequency controller, certify motor is inverter duty and the controller and motor are compatible.
            a) Include minimum speed at which the motor may be operated for the driven machinery.
    n. Electrical gear:
        1) Unless specified in a narrow-scope Specification Section, provide the following:
            a) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.
        2) Control panels:

a) Panel construction.
b) Point-to-point ladder diagrams.
c) Scaled panel face and subpanel layout.
d) Technical product data on panel components.
e) Panel and subpanel dimensions and weights.
f) Panel access openings.
g) Nameplate schedule.
h) Panel anchorage.
i) Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70. Include any required calculations.

4. Systems schematics and data:
   a. Provide system schematics where required in system specifications.
      1) Acknowledge all system components being supplied as part of the system.
      2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
      3) Provide technical data for each system component showing compliance with the Contract Document requirements.
      4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.
5. For factory painted equipment, provide paint submittals in accordance with Section 09 96 00.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Motors:
      a. Baldor.
      b. General Electric.
      c. Hyundai Heavy Industries.
      d. Marathon Electric.
      e. Rockwell - Reliance.
      f. Siemens.
      g. TECO-Westinghouse.
      h. Toshiba U.S.
      i. U.S. Motors, Nidec Motor Corporation.
      j. WEG.

B. Submit request for substitution in accordance with Section 00700, Paragraph 5.2.

2.2 MANUFACTURED UNITS

A. Electric Motors:
   1. Where used in conjunction with adjustable speed AC or DC drives, provide motors that are fully compatible with the speed controllers.
   2. Design for frequent starting duty equivalent to duty service required by driven equipment.
   3. Design for full voltage starting.
   4. Design bearing life based upon actual operating load conditions imposed by driven equipment.
   5. Size for altitude of Project.
   6. Furnish with stainless steel nameplates which include all data required by NEC Article 430.

7. Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
8. AC electric motors less than 1/3 HP:
    a. Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Permanently lubricated sealed bearings conforming to ABMA standards.
    c. Built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element with stainless steel enclosure.
9. AC electric motors 1/3 to 1 HP:
    a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Permanently lubricated sealed bearings conforming to ABMA standards.
        1) For single phase motors, provide built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element.
10. AC electric motors 1-1/2 to 10 HP:
    a. 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Permanently lubricated sealed bearings conforming to ABMA standards.
    c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
11. AC electric motors greater than 10 HP:
    a. 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Oil or grease lubricated antifriction bearings conforming to ABMA standards.
        1) Design bearing life for 90 PCT survival rating at 50,000 HRS of operation for motors up to and including 100 HP.
        2) For motors greater than 100 HP, design bearing life for 90 PCT survival rating at 100,000 HRS of operation.
    c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
12. Severe duty motor to have the following minimum features:
    a. All cast iron construction.
    b. Gasketed conduit box.
    c. Epoxy finish for corrosion protection.
    d. Hydroscopic varnish on windings for corrosion protection.
    e. Drain plug and breather.

B. NEMA Design Squirrel Cage Induction Motors:
1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
2. Motors to meet NEMA MG 1 (NEMA Premium) efficiencies.
3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard for the assigned NEMA code letter.
4. For use on variable frequency type adjustable speed drives, provide:
    a. Induction motors that are in compliance with NEMA MG 1, Part 31.
    b. Nameplate identification meeting NEMA MG 1 Part 31 requirements.
    c. Insulated drive end bearing on all motors.
    d. Insulated non-drive end bearings, at a minimum, on all motors with horizontal shaft 100 HP and larger.
    e. An insulated bearing carrier on the non-drive end for vertical shaft motors 100 HP and larger.
    f. Shaft grounding ring on all motors:
        1) Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
        2) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.
    g. Have the following minimum turndown ratio without the use of additional cooling, such as a blower, to provide continuous supply of cooling air over the motor.
        1) Variable torque: 10:1.

2) Constant torque: 6:1.

5. Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 40 DEGC ambient.
6. Design motors for continuous duty.
7. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 PCT greater than the maximum HP requirements of the driven equipment over its entire operating range.
   a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.
8. Motor enclosure and winding insulation application:
   a. The following shall apply unless modified by specific Specification Sections:

MOTOR LOCATION	MOTOR ENCLOSURE / WINDING INSULATION
Unclassified Indoor Areas	DPFG (for horizontal motors), WP-I (for vertical motors)
Wet indoor Areas	TEFC, Encapsulated Windings, and WP-II (for vertical motors)
Wet outdoor Areas	Encapsulated Windings, and WP-II (for vertical motors)
Corrosive Areas	TEFC, Severe/ Chemical Duty
Class I, Division 1 Areas	Explosion Proof, Approved for Class I Division 1 Locations
Class II, Division 1 Areas	Explosion Proof, Approved for Class II Division 1 Locations
Class I or Class II, Division 2 Areas	Explosion Proof, Approved for Division 1 Locations or TEFC with maximum external frame temperature compatible with the gas or dust in the area.

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

9. Provide oversize conduit box complete with clamp type grounding terminals inside the conduit box.
10. Balance motors to ISO G2.5 level.

C. Submersible Motors: Refer to individual narrow-scope Specification Sections for submersible motor requirements.

D. V-Belt Drive:
   1. Provide each V-belt drive with sliding base or other suitable tension adjustment.
   2. Provide V-belt drives with a service factor of at least 1.6 at maximum speed.
   3. Provide static proof belts.

E. Vibration Isolators:
   1. Provide all equipment subject to vibration with restrained spring type vibration isolators or pads according to the manufacturer's written recommendation.

F. Space Heaters:
   1. Silicone rubber strip type, 120 V rated.
   2. Provided on:
      a. All motors 10 HP and larger mounted outdoors.
      b. Indoor motors in humid environments as indicated.

2.3 COMPONENTS

A. Gear Drives and Drive Components:
   1. Size drive equipment capable of supporting full load including losses in speed reducers and power transmission.
   2. Provide nominal input horsepower rating of each gear or speed reducer at least equal to nameplate horsepower of drive motor.
   3. Design drive units for 24 HR continuous service, constructed so oil leakage around shafts is precluded.

4. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and flexible couplings meeting applicable standards of AGMA.
5. Gear reducers:
    a. Provide gear reducer totally enclosed and oil lubricated.
    b. Utilize antifriction bearings throughout.
    c. Provide worm gear reducers having a service factor of at least 1.20.
    d. Furnish other helical, spiral bevel, and combination bevel-helical gear reducers with a service factor of at least 1.50.

2.4 ACCESSORIES

A. Guards:
1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
2. Interior applications:
    a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
    b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
    c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
3. Exterior applications:
    a. Construct from 16 GA stainless steel or aluminum.
    b. Construct to preclude entrance of rain, snow, or moisture.
    c. Roll to conform to shaft or coupling surface.
    d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Anchorage:
1. Cast-in-place anchorage:
    a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
    b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
    c. Provide two (2) nuts for each bolt.
2. Drilled anchorage:
    a. Adhesive anchors per Section 05 50 00.
    b. Epoxy grout per Section 03 31 30.
    c. Threaded rods same as cast-in-place.

C. Data Plate:
1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

D. Gages:
1. Provide at the following locations:
    a. Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical and process equipment.
    b. At locations identified on Drawings.
2. Utilize tapping sleeves for mounting per Section 40 05 00.

E. Lifting Eye Bolts or Lugs:
1. Provide on all equipment 50 LBS or greater.
2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.

F. Platforms and Ladders:
1. Design and fabricate in accordance with OSHA Standards.
2. Fabricate components from galvanized steel or fiberglass-reinforced plastic.
3. Provide platform surface: Non-skid grating, unless specified in narrow-scope Specification Sections.

2.5 FABRICATION

A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.

C. Furnish like parts of duplicate units to be interchangeable.

D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.

E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
   1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.

F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
   1. Provide drain connection for 3/4 IN PVC tubing.

G. Machine the mounting feet of rotating equipment.

H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that cannot be properly prepared and painted.
   1. When such back to back fabrication cannot be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
   2. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment in accordance with joint sealant instructions.

I. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
   1. Manufacturer’s standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
   2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer’s standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
   3. Affix entire assembly with a UL 508A or UL 698A label "Listed Enclosed Industrial Control Panel" prior to delivery.
      a. Control panels without an affixed UL 508A or UL 698A label shall be rejected.
   4. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
      a. Determine the SCCR rating by one of the following methods:
         1) Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
         2) Method 2: SCCR rating meets or exceeds the source equipment’s Amp Interrupting Current (AIC) rating as indicated on the Drawings.
         3) Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
      b. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the control panel circuit originates.
      c. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

2.6 SHOP OR FACTORY PAINT FINISHES

A. Electrical Equipment:
   1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Section 09 96 00 to receive field painting.

a. Field painted equipment: See Section 09 96 00 for factory applied primer/field paint compatibility requirements.

B. Field paint other equipment in accordance with Section 09 96 00.
1. See Section 09 96 00 for factory applied primer/field paint compatibility requirements.

2.7 SOURCE QUALITY CONTROL

A. Motor Tests:
1. Test motors in accordance with NEMA and IEEE standards.
2. Provide routine test for all motors.
3. The Owner reserves the right to select and have tested, either routine or complete, any motor included in the project.
a. The Owner will pay all costs, including shipping and handling, for all motors successfully passing the tests.
b. Pay all costs, including shipping and handling, for all motors failing the tests.
c. If two (2) successive motors of the same manufacturer fail testing, the Owner has the right to reject all motors from that manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.

B. Utilize templates for anchorage placement for slab-mounted equipment.

C. For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.
1. Route clear of major traffic areas and as approved by Engineer.

D. DO NOT construct foundations until major equipment supports are approved.

E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.

F. Equipment Base:
1. Construct level in both directions.
2. Take particular care at anchor bolt locations so these areas are flat and level.

G. Machine Base:
1. Mount machine base of rotating equipment on equipment base.
a. Level in both directions, using a machinist level, according to machined surfaces on base.
2. Level machine base on equipment base and align couplings between driver and driven unit using stainless steel blocks and shims.
a. Blocks and shims milled flat and coplanar of both faces.
b. Maximum of 3 shims under each foot.
c. Size blocks and shims to provide solid support at each mounting bolt location.
1) Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
d. Provide blocks and shims at each mounting bolt.
1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
e. After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.

H. Rotating equipment Couplings:
1. Align in the annular and parallel positions.
a. For equipment rotating at 1200 RPM or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller.

b. Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling 0.004 IN tolerance.
c. For equipment rotating at speeds greater than 1200 RPM allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.

2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
3. Check surfaces for runout before attempting to trim or align units.

I. Grouting:
1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.
a. Extend dam or formwork to cover leveling shims and blocks.
b. Do not use nuts below the machine base to level the unit.
2. Saturate top of roughened concrete subbase with water before grouting.
a. Add grout until entire space under machine base is filled to the top of the base underside.
b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
b. When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
c. Recheck driver-driven unit for proper alignment.

3.2 INSTALLATION CHECKS

A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.

B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
1. Has been properly installed and lubricated.
2. Is in accurate alignment.
3. Is free from any undue stress imposed by connecting piping or anchor bolts.
4. Has been operated under full load conditions and that it operated satisfactorily.
a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.

C. No separate payment shall be made for installation checks.
1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

A. Identify equipment and install hazard warning signs as needed.

3.4 FIELD PAINTING AND PROTECTIVE COATINGS

A. For required field painting and protective coatings, comply with Section 09 96 00, High Performance Industrial Coatings.

3.5 WIRING CONNECTIONS AND TERMINATION

A. Clean wires before installing lugs and connectors.

B. Coat connection with oxidation eliminating compound for aluminum wire.

C. Terminate motor circuit conductors with copper lugs bolted to motor leads.

D. Tape stripped ends of conductors and associated connectors with electrical tape.
   1. Wrapping thickness shall be 150 PCT of the conductor insulation thickness.

E. Connections to carry full ampacity of conductors without temperature rise.

F. Terminate spare conductors with electrical tape.

3.6 FIELD QUALITY CONTROL

A. General:
   1. Furnish equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.
   2. Execute pre-demonstration requirements in accordance with Section 01 75 00.
   3. Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
   4. Provide testing of electrical equipment and connections in accordance with the Electrical specifications.
   5. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
      a. Contract Drawings and Specifications.
      b. Related construction change documentation.
      c. Approved Shop Drawings.
      d. Approved Operation and Maintenance Manuals.
      e. Other pertinent information as required.

B. Electrical Equipment and Connections Testing Program:
   1. Perform testing on Electrical equipment and connections in accordance with the Electrical specification requirements.
   2. Testing of motors:
      a. After installation and prior to energizing the motor, perform inspections and tests per NETA ATS 7.15 for all motors 20 HP or above.
      b. Ensure motor has been lubricated.
      c. Bump motor to check for correct rotation.
   3. Repair or replace equipment shown to be out of range of the acceptable tolerance until the equipment meets or exceeds acceptability standards.

C. Other Testing:
   1. Perform tests and inspections not specifically listed but required to assure equipment is safe to energize and operate.
   2. Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs, and cross members that are cast, welded, or bolted shall be tested for a natural frequency of vibration after equipment is mounted.
      a. The ratio of the natural frequency of the structure to the frequency of the disturbing force shall not be between 0.5 and 1.5.

3.7 DEMONSTRATION

A. Demonstrate equipment in accordance with Section 01 75 00.

END OF SECTION

SECTION 01 65 50
PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling of product delivery.
   2. Packaging of products for delivery.
   3. Protection of products against damage from:
      a. Handling.
      b. Exposure to elements or harsh environments.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

C. Payment:
   1. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved Shop Drawings.
      a. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

1.2 DELIVERY

A. Scheduling: Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.

B. Packaging: Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

C. Identification: Clearly and fully mark and identify as to manufacturer, item, and installation location.

D. Protection and Handling: Provide manufacturer's instructions for storage and handling.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PROTECTION, STORAGE AND HANDLING

A. Manufacturer's Instruction:
   1. Protect all products or equipment in accordance with manufacturer's written directions.
      a. Store products or equipment in location to avoid physical damage to items while in storage.
      b. Handle products or equipment in accordance with manufacturer's recommendations and instructions.
   2. Protect equipment from exposure to elements and keep thoroughly dry.
   3. When space heaters are provided in equipment, connect and operate heaters during storage until equipment is placed in service.

3.2 STORAGE FACILITIES

A. Provide temporary storage as required to store all materials per manufacturer's recommendations.
   1. Provide a weatherproof temporary storage specifically for the purpose of providing for protection of products and equipment.
      a. Size storage to accommodate anticipated storage items
   2. Equip storage with lockable doors and lighting, and provide electrical service for equipment space heaters and heating or ventilation as necessary to provide storage environments acceptable to specified manufacturers.
   3. Provide methods of storage of products and equipment off the ground.

3.3 FIELD QUALITY CONTROL

A. Inspect Deliveries:
   1. Inspect all products or equipment delivered to the site prior to unloading.
      a. Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on Project.

B. Monitor Storage Area: Monitor storage area to ensure suitable temperature and moisture conditions are maintained as required by manufacturer or as appropriate for particular items.

END OF SECTION

SECTION 01 71 14
MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project mobilization and demobilization.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 GENERAL

A. Mobilization work shall consist of preparatory work and operations necessary to be ready to perform the Work required under the Contract, and for other work and operations which must be performed, or costs incurred prior to the beginning of the Work.

B. Demobilization work shall consist of all activities and costs for transportation of personnel, equipment, and supplies necessary to demobilize the contractor from the site.

C. Mobilization and Demobilization shall not include mobilization or demobilization for specific items of work for which payment is provided elsewhere in the Contract.

D. When the Contract or proposed Schedule of Values includes a separate item for mobilization or demobilization, payment will include full compensation for the furnishings of all labor, materials, tools, equipment, administrative costs, and incidentals to mobilization or demobilization.

E. If additional mobilization and demobilization activities and costs are required during the performance of the Contract as a result of the changed, deleted, or added items of work for which the Contractor is entitled to an adjustment in Contract price, compensation for such costs shall be included in the price adjustment for the item of Work changed or added.

1.3 ITEMS INCLUDED

A. Mobilization costs shall be limited to the following items:
   1. Obtaining bonds and insurance.
   2. Obtaining required permits and licenses.
   3. Developing Project Work Schedule.
   4. Attending Preconstruction Conference.
   5. Processing Permits.
   6. Furnishing and installing signs.
   7. Any work that is necessary to provide access to the site, including, but not limited to, grading and clearing.
   8. Installing temporary construction power wiring.
   9. Necessary assembly and testing required prior to start of the Work.
   10. Establishment of all and other facilities necessary for the Work, including utilities and specified field offices.
   11. Providing for and establishing Contractor's work and storage yard.
   12. Movement of personnel, major equipment, supplies, and incidentals to the site.
   13. Cost incurred prior to the start of the Work which must be performed, such as a down payment on a long lead item.

B. Demobilization costs shall be limited to the following items:
   1. Disassembly, removal and site cleanup/repair of offices, buildings, and other facilities assembled on the site for the Contract.

2. Costs for final site cleanup, packaging of miscellaneous items for return to the yard and other project closeout related expenses.
3. Cost for final payment documents, and provision of Acknowledgement Certification Request, Bond, and Certificate of Completion.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 73 20
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Methods of installing and sealing openings and penetrations in construction.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 05 50 00 - Miscellaneous Metals.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
      d. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
      e. A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
      f. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
      g. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      h. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
      i. A995, Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 501, Class 1 Locations.
      b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
      c. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.3 DEFINITIONS

A. Corrosive Areas: For the purpose of this specification section, the following areas are defined as corrosive:
   1. Continually wet areas.

B. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.

C. Washdown Areas: Areas having floor drains or hose bibbs.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. For each structure provide dimensioned or scaled (minimum 1/8 IN = 1 FT) plan view drawings containing the following information:
      a. Vertical and horizontal location of all required openings and penetrations.

b. Size of all openings and penetrations.
c. Opening type.
d. Seal type.

3. Manufacturer's installation instructions for standard manufactured products.

1.5 PROJECT CONDITIONS

A. For purposes of this Project, water table level is elevation 629 +/- at Boring B101 only.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe Sleeves:
1. Areas listed as Corrosive Areas in PART 1:
a. Stainless steel, Type 304L
b. Penetrations 24 IN DIA or less: ASTM A269, ASTM A312 or ASTM A554, Schedule 40.
c. Penetrations larger than 24 IN DIA: Stainless steel, ASTM A666, Minimum 1/4 IN thickness.
2. All other Areas:
a. Steel, Hot-dipped galvanized after fabrication.
b. Penetrations 24 IN DIA or less: ASTM A53, Schedule 40.
c. Penetrations larger than 24 IN DIA: ASTM A36, Minimum 1/4 IN thickness.

B. Backing Rod and Sealant: Follow joint sealant instructions.

C. Modular Mechanical Seals:
1. Acceptable manufacturers:
a. Link-Seal.
2. 304 stainless steel bolts, nuts and washers.

D. Sheet Metal Sleeves:
1. Areas listed as Corrosive Areas in PART 1: Stainless steel: ASTM A240, Type 304L.
2. All other areas: Galvanized steel: ASTM A653, G90.
3. Minimum 12 GA.

E. Commercial Wall Castings:
1. Ductile iron, ASTM A536.
2. Grade equal to connecting piping system.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate pipe sleeves in accordance with Specification Section 05 50 00.

B. Fabricate sheet metal sleeves in accordance with flashing and sheet metal instructions.

C. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete.
1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
2. For commercial castings, cast water stop/anchor with wall pipe.
3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
4. For fabricated units, diameter of plate or flange to be 4 IN larger than outside diameter of sleeve, pipe or ductwork.
5. For commercial castings, waterstop/anchor size to be manufacturer standard.
6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.

D. Factory or shop-coat painted components in accordance with Specification Section 09 96 00.

3.2 INSTALLATION AND APPLICATION

A. Seal openings and penetrations in non-fire-resistance-rated construction in accordance with joint sealant instructions.

B. Obtain prior approval from Engineer when any opening larger than 100 SQIN must be made in existing or newly completed construction.

C. Perform HVAC penetrations in accordance with NFPA 90A.

D. Perform electrical penetrations in accordance with NFPA 70, Article 501.

E. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.
   1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.

F. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.
   1. In non-washdown areas, install sleeves with ends flush with finished surfaces.

G. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.

H. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.

I. Where pipes, conduits or ducts pass through grating, provide banding at the entire perimeter of the opening.
   1. Metal grating: See Specification Section 05 50 00.

J. Where pipes, conduits or ducts are removed where passing through grating:
   1. Metal grating:
      a. Provide banding at perimeter and cover opening with 1/4 IN plate of the same material of the grating.
      b. See Specification Section 05 50 00.

K. Do not cut into or core drill any beams, joists, or columns.

L. Do not install sleeves in beams, joists, or columns.

M. Do not install recesses in beams, joists, columns, or slabs.

N. Field Cutting and Coring:
   1. Saw or core drill with non-impact type equipment.
   2. Mark opening and drill small 3/4 IN or less holes through structure following opening outline.
   3. Sawcut opening outline on both surfaces.
      a. Knock out within sawcuts using impact type equipment.
      b. Do not chip or spall face of surface to remain intact.
      c. Do not allow any overcut with saw kerf.

O. Precast-Prestressed Concrete Construction:
   1. Do not cut openings or core drill vertically or horizontally through stems of members.
   2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.
   3. Cast openings and sleeves into flanges of units.
   4. Cast openings larger than 6 IN in diameter or 6 IN maximum dimension in units at time of manufacture.
   5. Cast openings smaller than 6 IN in diameter or 6 IN maximum dimensions in flanges of units at time of manufacture or field cut.

P. Where area is blocked out to receive sheet metal sleeve at later date:
   1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later.
      a. Size blockout based on sleeve size required plus 4 to 6 IN each side of sleeve for concrete encasement.
      b. Provide #4 dowels at 12 IN spacing along each side of blockout with minimum of two (2) dowels required per side.
   2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout.
      a. Size blockout based on sleeve size required plus 2 to 4 IN each side of sleeve for concrete encasement.

Q. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.

R. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

S. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.

T. Modular Mechanical Seals:
   1. Utilize one (1) seal for concrete thickness less than 8 IN and two (2) seals for concrete, 8 IN thick or greater.
   2. Utilize two (2) seals for piping 16 IN diameter and larger if concrete thickness permits.
   3. Install seals such that bolt heads are located on the most accessible side of the penetration.

U. Backer Rod and Sealant:
   1. Install in accordance with joint sealant instructions.
   2. Provide backer rod and sealant for modular mechanical seal applications.
      a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.3 SCHEDULES

A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
   1. Provide the following opening and penetration types:
      a. Type A - Block out 2 IN larger than outside dimensions of duct, pipe, or conduits.
      b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
      c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
      d. Type D - Commercial type casting or fabrication.
      e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
      f. Type F - Integrally cast pipe, duct or conduit.
      g. Type G - Saw cut or line-drill and remove area 1 IN larger than outside dimensions of duct, pipe or conduit.
      h. Type H - Core drill.
      i. Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
      j. Type J- Grating Banding for any field cut openings.
   2. Provide seals of material and method described as follows.
      a. Category 1 - Modular Mechanical Seal.
      b. Category 2 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on Drawings.
      c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.
      d. Category 4 - Backer rod and sealant.

e. Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.
f. Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN larger than opening.
g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.
h. Category 8 - Banding for all grating openings and banding and cover plate of similar materials for abandoned openings.

3. Furnish openings and sealing materials through new floors, roofs, grating, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.

SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE
FOR NEW CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors on grade above water table	C F I	4 Not Req 4	C F I (1)	7 Not Req 7	C F I (1)	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H (2) I (1)	4 3 4	F H (2) I (1)	Not Req 3 7
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I (1)	1 Not Req Not Req 1	F I (1)	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F I	7 Not Req 7	C D F H (2)	1 Not Req Not Req 1	C F H (2) I (1)	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req
Through exterior wall above grade	A B C	6 6 6	A B D H (2)	5 5 Not Req 5	C H (2)	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req
Grating openings and penetrations	J	8	J	8	J	8

END OF SECTION

SECTION 01 73 29
DEMOLITION, CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition, cutting and patching of existing construction where shown on Drawings, or as required to accommodate new work shown or specified.
   2. Removal and protection of items identified to be saved or reused.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 31 30 - Concrete, Materials and Proportioning.
   4. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
   5. Section 09 96 00 - High Performance Industrial Coatings.
   6. Section 31 23 00 - Earthwork.
   7. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Provide documentation of demolition and removal. Indicate limits and sequencing to be used. Show and identify any items to be kept for Owner reuse or retention.
   3. Provide schedule of demolition activities including overall schedule, planned utility interruptions, interruptions of Owner/Using Agency services and traffic control if required.
   4. Indicating manufacturer and type of:
      a. Proposed non-shrink grout.
      b. Epoxy bonding adhesive.
      c. Proposed materials and methods to be used for matching and repairing existing construction.

1.3 DESCRIPTION

A. This section covers cut and patch work either in remodel, add-on or new construction as necessary for execution of the Work.

B. Install Work in such a manner and sequence as to preclude or minimize cutting and patching of new Work.

C. Execute cutting, including excavation, fitting or patching of Work, required to:
   1. Make several parts fit properly.
   2. Uncover Work to provide for installation of ill-timed Work.
   3. Remove and replace defective Work.
   4. Remove and replace non-conforming Work.
   5. Remove samples of installed Work for testing.
   6. Install specified Work in existing construction.
   7. Provide rerouting penetrations of non-structural surfaces for installation of piping and electrical conduit.
   8. Patch and repair fireproofing damaged after installation of other Work or demolition activities.
   9. Remove and finish construction at connections to other structures.
   10. Remove existing roofing where required by new Work, and patch to match existing roofing.

D. Do not endanger any Work or Work of other Contractors, by cutting, excavating, or otherwise altering Work except with written consent of Contractor subject to review by Architect.

E. Do not cut into or cut away structural concrete, other concrete or other structural members nor dig under foundations or into structural walls or other parts, or in any case allow same to be done without full knowledge and written consent of Architect.

F. Repair or replace damaged work resulting from violation of these provisions.

G. Use only firms or individual trades qualified to perform Work required under this Section.

1.4 QUALITY ASSURANCE

A. Employ skilled persons experienced with material requiring cutting and patching.
   1. To the greatest extent practicable, employ original installer to perform cutting and patching for weather-exposed and moisture-resistant components, and sight-exposed surfaces.

B. Written Requests:
   1. Submit requests in advance of cutting or alteration which affects:
      a. Structural integrity of any component of Project.
      b. Integrity of weather-exposed or moisture-resistant component.
      c. Efficiency, maintenance, or safety of an operational component.
      d. Visual qualities of sight-exposed components.
      e. Work of Owner or separate contractor.
   2. Include in Request:
      a. Location and description of affected work.
      b. Necessity for cutting or alteration.
      c. Description of proposed work, and products to be used.
      d. Alternatives to cutting and patching.
      e. Effect on work of Owner or separate contractor.
      f. Written permission of affected separate contractor.
      g. Date and time work will be executed.

C. Proceed with cutting and patching at the earliest feasible time and complete without delay.

D. Operational Limitations:
   1. Cut and patch operating elements or related components in a manner that results in maintaining their capacity to perform as intended.
   2. Cut and patch operating elements or related components in a manner that does not result in increased maintenance or decreased operational life or safety.

E. Structural Work:
   1. Cut and patch structural elements in a manner that maintains their load-carrying capacity or load-deflection ratio.
   2. Follow applicable NFPA Standards when torch cutting is required.

F. Visual Requirements:
   1. Cut and patch construction exposed on exterior or in occupied spaces in a manner to, in Architect’s opinion, retain the building’s aesthetic or visual qualities.
   2. Cut and patch construction in a manner to avoid visual evidence of cutting and patching.
   3. Remove and replace construction which was cut and patched in a visually unsatisfactory manner.

G. Warranties and Existing Warranties:
   1. Replace, patch, and repair material and surfaces cut or damaged by methods and with materials and in such manner to maintain warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General:
   1. Salvage items, designated for Owner's salvage, as a functional unit.
   2. Clean, list and tag for storage.

3. Protect from damage and deliver to location designated.
4. Salvage each item with auxiliary or associated equipment required for operation.

1.6 PROJECT CONDITIONS

A. Perform preliminary investigations as required to ascertain extent of work.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate and reschedule work as required to preclude interference with other operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
   1. Epoxy bonding adhesive:
      a. Euco No.452 MV by Euclid Chemical Co.
      b. Sikadur 32, Hi-Mod by Sika Corporation.
   2. Epoxy patch:
      a. Depth of patch:
         1) Greater than 3/4 IN: Five Star MP Epoxy Patch.
         2) Between 1/8 IN and 3/4 IN: Five Star Fluid Epoxy.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2

2.2 MATERIALS

A. Use materials identical to existing materials.

B. For exposed surfaces, use materials that visually match existing adjacent surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used.

C. Use materials whose installed performance will equal or surpass that of existing materials.

D. Where applicable, comply with specifications for type of Work to be performed.

E. Temporary Partitions:
   1. Plywood: 1/2 IN minimum for interior or exterior use.
   2. Paneling: 1/4 IN minimum for interior use.

F. Non-shrink Grout:
   1. See Section 03 31 30.

G. Epoxy Bonding Adhesive:
   1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide and maintain temporary partitions as required in public areas.
   1. Construct partitions of braced plywood in exterior areas.
   2. Adequately braced paneling may be used in interior areas.

B. Provide and maintain covered passageways where necessary to ensure safe passage of persons in or near areas of work.

C. Provide and maintain substantial barricades and safety lights as required.

D. Provide and maintain temporary dustproof partitions where indicated or necessary.
   1. Prevent infiltration of dust into occupied areas.

E. Provide and maintain temporary weather protection as necessary.

F. Provide adequate temporary bracing to maintain safety, stability and to resist all loads to which the structure may be subjected.

3.2 DEMOLITION

A. Cutting and Removal:
   1. Remove existing work indicated to be removed, or as necessary for installation of new work.
   2. Neatly cut and remove materials, and prepare all openings to receive new work.
   3. Remove masonry or concrete in small sections.

B. Modification of Existing Concrete:
   1. Where indicated, remove existing concrete and finish remaining surfaces as specified in Specification Section 03 35 00.
      a. Make openings by sawing through the existing concrete.
         1) Core drill with 6 IN DIA core at the corners of rectangular openings to avoid overcutting at corners.
      b. Break out concrete after initial saw cuts in the event concrete thickness prevents cutting through.
      c. Where saw cutting is not possible, make openings by drilling holes around perimeter of opening and then chipping out the concrete.
         1) Holes shall be sufficient in number to prevent damage to remaining concrete.
   2. Oversize required openings in existing concrete 1 IN on all sides and build back to required opening size by means of grout epoxy bonded to the existing concrete.
   3. Where oversized openings cannot be made, remove the concrete to the required opening size and cut back exposed reinforcing 1 IN from face of concrete and fill resulting holes with bonding agent and non-shrink grout.
      a. At liquid containing structures, coat entire surface with cementitious waterproofing mortar.
   4. Protect remaining concrete from damage.
      a. If existing concrete to remain becomes damaged, cease demolition and make corrections as required to avoid further damage.
      b. Notify Engineer immediately of any damage to remaining concrete.

C. Removal of Existing Anchor Bolts or Other Protruding Elements:
   1. Remove all protruding elements.
   2. Remove to a depth of 1/4 IN from finished surface.
   3. Fill void with epoxy patch.

D. Matching and Patching:
   1. Walls, ceilings, floors or partitions:
      a. Repair abutting walls, ceilings, floors or partitions disturbed by removal.
      b. Match and patch existing construction disturbed during installation of new work.
   2. Methods and materials:
      a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being repaired.
      b. Subject to review of Owner.
   3. Reinforcing steel that is cut and exposed:
      a. Remove to a depth of 1/4 IN.
      b. Fill void with epoxy patch.

E. Salvaged Items:
   1. Thoroughly dry and clean all metal surfaces.
   2. Prime all bare metal in accordance with Specification Section 09 96 00.

3. Clean and lubricate motors and other moving parts.
4. Brace motors attached to flexible mountings until reinstallation.
5. Dispose of items or materials not designated for Owner's salvage or reuse.
    a. Promptly remove from site.
6. Do not store or sell Contractor salvaged items or materials on-site.
7. Carefully remove items to be salvaged and reused or to be delivered to Owner's storage.
    a. Store and protect items indicated on Drawings or those which have been marked by Owner to be salvaged or to be reused in Work.
    b. Replace any item damaged through carelessness in removal, storage, or handling with new items of same type.
    c. Do not reuse materials or equipment not specifically indicated or specified to be reused.
8. Preparation of equipment for storage:
    a. Identify each component with markings or tags to show its position in the assembly and the assembly of which it belongs.
    b. Place small parts of wooden boxes and clearly mark contents on the outside.
    c. Remove oil from oil-lubricated bearings and gear boxes and replace with storage oil.
    d. Grease grease-lubricated bearings.
    e. Replace any breather plug with solid plug.
    f. Megger test motor windings: Attach report of the test results to the unit and furnish one (1) copy to the Engineer.
    g. Attach unit to suitable crate bottom.
    h. Enclose unit in polyethylene film and seal all seams and the film to the base of the unit with tape.
    i. Construct crate of wooden slats around top and sides of unit.
    j. Attach permanent instruction tag to outside of crate stating "This unit has been prepared for storage--replace oil, vent plugs, and lubricant in accordance with manufacturer's instructions before start-up."

F. Clean Up: Transport debris and legally dispose of off-site.

3.3 SCHEDULE

A. Items to be Salvaged to Owner: See Drawing X-1.

END OF SECTION

SECTION 01 74 23
CLEANING

PART 1 - GENERAL

1.1 FIRE PROTECTION

A. Store volatile waste in listed disposal containers.

B. Maintain site and building so no condition provides a fire hazard.

C. Remove combustible debris from building at end of each shift and from site daily.

D. Sources of ignition and smoking are prohibited in flammable and combustible storage areas.

E. Do not burn on-site.

1.2 POLLUTION CONTROL

A. Conduct cleanup and disposal operations to comply with codes, rules, regulations, ordinances, and anti-pollution laws.

B. Do not burn or dispose of combustible debris, rubbish and waste material on site.

C. Do not discharge volatile, harmful, or dangerous materials into storm or sanitary drains or sewer systems.

D. Prevent accumulation of wastes that create hazardous conditions.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Use materials recommended by manufacturers of surfaces to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

C. Use only those cleaning materials which will not create hazards to health or property and will not damage surfaces.

PART 3 - EXECUTION

3.1 GENERAL

A. Clean items installed under this Contract.
   1. Leave free of stains, dirt, dust, damage, or defects.
   2. Include washing, sweeping, polishing of wall surfaces, floors, windows, hardware, mirrors, lighting fixtures, equipment, etc.

3.2 DURING CONSTRUCTION

A. Provide on-site listed disposal containers for collection of waste materials, debris, and rubbish.
   1. Dispose of off site once a week at an approved solid waste disposal site.
   2. Cover container to prevent blowing by wind.

B. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.

C. Interior cleaning:
   1. Clean and vacuum interior space prior to start of painting, and continue cleaning as-needed until substantial completion.
   2. Schedule cleaning operations so contaminants do not fall on wet painted surfaces.

3. Clean and protect Work in progress and adjoining materials in place, during handling and installation.
4. Clean lunch/break area after each use.

D. Exterior cleaning:
1. Wet down dusty materials and rubbish to prevent blowing dust during entire construction period.
2. If use of water is prohibited by law, seek an alternate method to prevent blowing dust.
3. Perform cleaning operations as required during construction to prevent accumulations of dust, soil, and debris.
4. Keep weeds and other vegetation trimmed to 3 IN maximum height.
5. Remove snow and ice from access to buildings.

3.3 FINAL CLEANING

A. At Substantial Completion, perform final cleaning of Work and existing areas wherever any area are left less than clean by construction operations.
1. Complete cleaning operations before requesting review for Substantial Completion.

B. Use experienced professional cleaners for final cleaning.

C. Repair and touch-up marred areas.

D. Broom clean and remove stains from paved surfaces; rake clean other surfaces of grounds.

E. Ventilation systems:
1. Clean permanent filters and replace disposable filters if units were operated during construction.
2. Clean ducts, blowers, and coils in air conditioning units operated during construction.

F. Remove grease, dust, dirt, stains, labels, fingerprints, mastic, adhesive, and foreign materials from interior and exterior surfaces, and fixtures, hardware, and equipment.

G. Wash and shine glazing, mirrors, stainless steel, etc., including existing windows in area of construction.

H. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
1. Replace all burned out lamps.

I. Polish glossy surfaces to a clear shine.

J. Remove temporary protection and facilities installed for protection of the Work during construction.

3.4 FIELD QUALITY CONTROL

A. Prior to Owner occupancy, Contractor and Owner shall conduct an inspection of interior and exterior surfaces and Work areas to verify Project is clean to Owner’s satisfaction.

END OF SECTION

SECTION 01 75 00
FACILITY START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
   2. Requirements for Substantial Completion Submittals.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 61 03 - Equipment: Basic Requirements.
   4. Section 01 91 03 – Component and System Commissioning.

1.2 DEFINITIONS

A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.

B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
   1. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
   2. Equipment start-up.
   3. Personnel training.

C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the facility and starts up and operates the facility, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.

D. Substantial Completion: Section 01 77 00.

1.3 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.
   1. Master operation and maintenance training schedule:
      a. Submit 30 days (minimum) prior to first training session for Owner's personnel.
      b. Schedule to include:
         1) Target date and time for Owner witnessing of each system initial start-up.
         2) Target date and time for Operation and Maintenance training for each system, both field and classroom.
         3) Target date for initiation of Demonstration Period.
      c. Submit for review and approval by Owner.
      d. Include holidays observed by Owner.

e. Attend a schedule planning and coordination meeting 90 calendar days prior to first anticipated training session.
    1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
    2) Identify initial target dates for individual manufacturer's training sessions.
f. Owner reserves the right to insist on a minimum seven (7) days' notice of rescheduled training session not conducted on master schedule target date for any reason.
g. Schedule to be resubmitted until approved.

2. Substantial Completion Submittal:
    a. File Contractor's Notice of Substantial Completion and Request for Inspection.
    b. Approved Operation and Maintenance manuals received by Owner's Site Representative minimum 30 days prior to scheduled training.
    c. Written request for Owner to witness each system pre-demonstration start-up.
        1) Request to be received by Owner minimum one (1) week before scheduled training of Owner's personnel on that system.
    d. Equipment installation and pre-demonstration start-up certifications.
    e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

1.4 SEQUENCING AND SCHEDULING

A. Phased Construction:
    1. None.

B. Schedule of Events:
    1. None. Coordinate Facility Start-Up with the requirements set forth in Section 01 91 03 which covers aquaculture specific items.

1.5 COST OF START-UP

A. Contractor to pay all costs associated with Facility start-up.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 GENERAL

A. Facility Start-up Divided into Two Periods:
    1. Pre-Demonstration Period including:
        a. Completion of construction work to bring Project to a state of Substantial Completion.
        b. Start-up of Equipment.
        c. Training of Personnel.
        d. Completion of the filing of all required submittals.
        e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.
    2. Demonstration Period including:
        a. Demonstration of functional integrity of facility or PCS.

3.2 PRE-DEMONSTRATION PERIOD

A. Completion of Construction Work:
    1. Complete the work to bring the Project to a state of substantial completion.

B. Equipment Start-up:
    1. Requirements for individual items of equipment are included in the Technical Specification Sections.
    2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.

3. Perform Equipment Start-up to extent possible without introducing product flow.
4. Introduce product flow to complete Equipment Start-up for the following equipment:
    a. See Section 01 91 03
5. Procedures include but are not necessarily limited to the following:
    a. Test or check and correct deficiencies of:
        1) Power, control, and monitoring circuits for continuity prior to connection to power source.
        2) Voltage of all circuits.
        3) Phase sequence.
        4) Cleanliness of connecting piping systems.
        5) Alignment of connected machinery.
        6) Vacuum and pressure of all closed systems.
        7) Lubrication.
        8) Valve orientation and position status for manual operating mode.
        9) Tankage for integrity using project flow.
        10) Pumping equipment using product flow.
        11) Instrumentation and control signal generation, transmission, reception, and response.
        12) Tagging and identification systems.
        13) All equipment: Proper connections, alignment, calibration and adjustment.
    b. Calibrate all safety equipment.
    c. Manually rotate or move moving parts to assure freedom of movement.
    d. "Bump" start electric motors to verify proper rotation.
    e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.
    f. Documentation:
        1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Start-up.
        2) Provide a place for the Contractor to record date and person accomplishing required work.
        3) Submit completed document before requesting inspection for Substantial Completion certification.
6. Obtain certifications, without restrictions or qualifications, and deliver to Owner’s Site Representative:
    a. Manufacturer's equipment installation check letters (sometimes referred to as Manufacturer’s Field Services report).
    b. Instrumentation Supplier's Instrumentation Installation Certificate.

C. Personnel Training:
1. See individual equipment specification sections.
2. Conduct all personnel training after completion of Equipment Start-up for the equipment for which training is being conducted.
    a. Personnel training on individual equipment or systems will not be considered completed unless:
        1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
        2) No system malfunctions occur during training.
        3) All provisions of field and classroom training specifications are met.
    b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.
3. Field and classroom training requirements:
    a. Hold classroom training on-site.
    b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions.
        1) Organize each training session in a format compatible with video recording.

c. Training instructor qualification: Factory trained and familiar with giving both classroom and "hands-on" instructions.
d. Training instructors:
    1) Be at classes on time.
    2) Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule.
    3) Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.
e. Organize training sessions into maintenance verses operation topics and identify on schedule.
f. Plan for minimum class attendance of 5 people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
g. Instructors to have a typed agenda and well prepared instructional material.
    1) The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs.
    2) Deliver agendas to the Owner's Site Representative a minimum of seven (7) days prior to the classroom training.
    3) Provide equipment required for presentation of films, slides, and other visual aids.
h. In the on-site training sessions, cover the information required in the Operation and Maintenance Manuals submitted according to Specification Section 01 33 04 and the following areas as applicable to PCS's.
    1) Operation of equipment.
    2) Lubrication of equipment.
    3) Maintenance and repair of equipment.
    4) Troubleshooting of equipment.
    5) Preventive maintenance procedures.
    6) Adjustments to equipment.
    7) Inventory of spare parts.
    8) Optimizing equipment performance.
    9) Capabilities.
    10) Operational safety.
    11) Emergency situation response.
    12) Takedown procedures (disassembly and assembly).
i. Address above Paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address above Paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.
j. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.

D. Complete the filing of all required submittals:
    1. Shop Drawings.
    2. Operation and Maintenance Manuals.
    3. Training material.

E. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project or PCS:
    1. File the notice when the following have been completed:
        a. Construction work (brought to state of Substantial Completion).
        b. Equipment Start-up.
        c. Personnel Training.
        d. Submittal of required documents.
    2. Owner's Site Representative will review required submittals for completeness within 5 calendar days of Contractor's notice. If complete, Owner's Site Representative will complete inspection of the Work, within 10 calendar days of Contractor's notice.

3. Owner’s Site Representative will inform Contractor in writing of the status of the Work reviewed, within 14 calendar days of Contractor's notice.
    a. Work determined not meeting state of Substantial Completion:
        1) Contractor: Correct deficiencies noted or submit plan of action for correction within 5 days of Owner’s Site Representative's determination.
        2) Owner’s Site Representative: Reinspect work within 14 days of Contractor's notice of correction of deficiencies.
        3) Reinspection costs incurred by Owner’s Site Representative will be billed to Owner who will deduct them from final payment due Contractor.
    b. Work determined to be in state of tentative Substantial Completion: Owner’s Site Representative to prepare tentative "Owner’s Site Representative's Certificate of Substantial Completion."
    c. Owner’s Site Representative's Certificate of Substantial Completion:
        1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
        2) Issued for Project as a whole or for one or more PCS.
        3) Issued subject to completion or correction of items cited in the certificate (punch list).
        4) Issued with responsibilities of Owner and Contractor cited.
        5) Executed by Owner’s Site Representative.
        6) Accepted by Owner.
        7) Accepted by Contractor.
    d. Upon successful completion of Demonstration Period, Owner’s Site Representative will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

A. General:
1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.
2. Duration of Demonstration Period: 120 consecutive hours.
3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed.
    a. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure.
    b. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
4. Conduct the demonstration of functional integrity under full operational conditions.
5. Owner will provide operational personnel to provide process decisions affecting plant performance.
    a. Owner's assistance will be available only for process decisions.
    b. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
7. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Owner’s Site Representative in advance of initiating Demonstration Period.

8. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
   a. Provide final field instruction.
9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION

SECTION 01 77 00
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Specific requirements for the closeout procedures for the project.

1.2 SUBMITTALS

A. Contract Closeout Information:
   1. For substantial completion:
      a. Comprehensive list of all items to be completed or corrected.
      b. Contractor's Notice of Substantial Completion.
      c. Certificates of governing authorities.
      d. Submittals required by other Sections.
   2. For final completion:
      a. Contractor's Certificate of Completion.
      b. Evidence of payments and release or waiver of liens in triplicate.
         1) Contractor's Affidavit of Payments of Debts and Claims.
         2) Contractor's Affidavit of Release of Liens.
         3) Contractor's release or waiver of liens.
         4) Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against Owner, together with list of all such parties.
         5) If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
      c. Consent of Surety (if any) to Final Payment.
      d. Certificates evidencing that insurance to remain enforce.
      e. Final application for payment.
      f. Initialed list(s) of items to be completed or corrected verifying completion of each items.
      g. List of Subcontractors and equipment suppliers. Include:
         1) Name.
         2) Address.
         3) Telephone number.
         4) Representative.
      h. Letter of site conformance.
      i. Closeout submittals required by other Sections.

1.3 SUBSTANTIAL COMPLETION

A. Substantial Completion is the stage in the progress of Work when the Work or designated portion thereof is sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work for its intended use.
   1. Work will not be considered for Substantial Completion until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, instruction of designated Owner's personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to Owner, and finishes are in place. In general, the only remaining Work shall be minor in nature, such that Owner may occupy or utilize Work or designated portion thereof, and completion or correction of Work by Contractor would not materially interfere or hamper Owner's intended business use or operation.
   2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date of Substantial Completion, or as agreed to in writing, and

failure to do so shall automatically reinstate provisions for damages due Owner as contained elsewhere in Contract Document or as provided by law for such period of time as may be required by Contractor to fully complete Work whether Owner has occupied Work or not.

B. Obtain evidence of compliance with requirements of governing authorities:
   1. Certificates of inspection of:
      a. Mechanical.
      b. Electrical.
      c. Plumbing.
      d. Fire protection and life safety systems.
      e. Elevators.
      f. Etc.
   2. Health Department and other governing authorities as required.
   3. Certificate of Occupancy.

C. When Contractor considers that Work, or a portion thereof which Owner agrees to accept separately, is substantially complete, Contractor shall thoroughly inspect Work, and prepare and submit to Architect/Engineer a comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion (utilize form at end of this Section).

D. Contractor certify that:
   1. Work performed under this Contract has been thoroughly inspected and considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work for its intended use.

E. Failure of Contractor to include an item on such list(s) does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

F. Contractor shall proceed promptly to complete and correct the items on list.

G. After receipt of Contractor's comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion, Architect/Engineer and Owner will, within reasonable period after notification, review list of items to be completed or corrected, or inspect Work, or designated portion thereof, to determine whether Work is Substantially Complete.

H. If Architect/Engineer's or Owner's review or inspection discloses any item, whether or not included on Contractor's list, which is not sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work or designated portion thereof for its intended use:
   1. Contractor will be notified stating reasons.
   2. Contractor shall substantially complete or correct Work.
   3. Contractor shall thoroughly re-inspect Work.
   4. Contractor shall submit another Contractor's Notice of Substantial Completion, a revised list of items to be completed or corrected, and a request for another review.
   5. Architect/Engineer and Owner will again review list of items to be completed or corrected and Work.

I. If Contractor prematurely submits a Contractor's Notice of Substantial Completion or requests Architect/Engineer's review of Work, and Architect/Engineer determines that Project or designated portion thereof is not Substantially Complete, Architect/Engineer may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.

J. Architect/Engineer will not perform more reviews of sub-projects or phases than number indicated in Contract Documents or Owner – Architect/Engineer Agreement, unless otherwise mutually agreed to by Architect/Engineer and Owner.

K. When Work or designated portion thereof is considered Substantially Complete, Architect/Engineer will prepare a Certificate of Substantial Completion.
   1. The Certificate of Substantial Completion shall establish date of Substantial Completion, shall establish responsibilities of Owner and Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix time within which Contractor shall complete and correct Work.
   2. Warranties and guarantees required by Contract Documents shall commence on date of Substantial Completion of Work or designated portion thereof unless otherwise provided in Certificate of Substantial Completion.
   3. The Certificate of Substantial Completion shall be submitted to Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

L. Owner may occupy Project, or designated portion thereof, under provisions agreed to in Certificate of Substantial Completion, and if required, a certificate of occupancy has been issued by governing authorities.
   1. If Owner is going to occupy Project, or designated portion thereof, Contractor shall perform final cleaning immediately.
   2. If Owner or Architect/Engineer discovers any Work which is not complete and/or is not in conformance with Contract Documents, during or after occupying or utilizes Work, whether included on a list or not, Owner shall notify Contractor to complete or correct item(s) identified.

M. Contractor shall proceed expeditiously with adequate forces to complete or correct Work, and to complete all Project closeout requirements within designated time.

N. Upon completion of Work, employ Licensed Surveyor to make survey of site to assure conformance of elevations, grade and site work to contours shown. Provide letter of site conformance.

1.4 FINAL COMPLETION

A. After Contractor has completed all Work, and has thoroughly inspected Work to determine that it is sufficiently complete, is in general accordance with Contract Documents, and Contract is fully performed, Contractor shall submit Contractor's Certificate of Completion to Architect/Engineer, and the list(s) of items to be completed or corrected initialed to indicate Contractor has verified completion of each item. Utilize form at end of this section. Contractor certifies that:
   1. Work has been thoroughly inspected by Contractor for compliance with Contract Documents.
   2. Work has been completed in accordance with Contract Documents.
   3. Equipment and systems have been tested and are operating satisfactorily.
   4. Contract closeout requirements have been completed satisfactorily and submitted.
   5. Contractor knows of no reason that insurance will not be renewable to cover period required by Contract Documents.
   6. Work is ready for final inspection and acceptance.

B. Contractor submit final closeout submittals required by this and other Sections.

C. Owner and Architect/Engineer will make final walk through within a reasonable time after receipt of Contractor's Certificate of Completion and final Application for Payment.
   1. If Contractor prematurely submits a Contractor's Notice of Final Completion or requests Architect/Engineer's final review of Project, and Architect/Engineer determines that Project is not satisfactorily complete, Architect/Engineer may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.

D. Contractor shall remedy any remaining deficiencies or incomplete Work, at Contractor's expense.

E. When Owner and Architect/Engineer finds Work acceptable under Contract Documents and Contract satisfactorily performed, Architect/Engineer will promptly issue a final Certificate for Payment.

F. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to Architect/Engineer;
   1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with Work for which Owner or Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied,
   2. a certificate evidencing that insurance required by Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to Owner,
   3. a written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,
   4. consent of surety, if any, to final payment,
   5. Contractor's and Subcontractor's final release or waiver of liens,
   6. if required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of Contract, to extent and in such form as may be designated by Owner, for Owner's review, and
   7. if a Subcontractor refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owner to indemnify Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to Owner all money that Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

G. If Substantial Completion or Final Completion is delayed through no fault of Owner or Architect/Engineer, Architect/Engineer may invoice Owner as a change in services for such costs, and associated travel costs. Contractor shall reimburse the Owner for such costs.

END OF SECTION

CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

PROJECT: _____

_____

ARCH PROJ. NO.: _____ CONTRACT DATE:

CONTRACT FOR: _____

WORK OR DESIGNATED PORTION SHALL INCLUDE: _____

_____

Work performed under this Contract has been thoroughly inspected and is considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work or designated portion thereof for its intended use.

- ❑ Certificates of inspections indicating compliance with requirements of governing authorities, are attached hereto.
- ❑ Certificate of Occupancy have been obtained from governing authorities, are attached hereto.
- ❑ A comprehensive list of items to be completed or corrected, prepared by Contractor is attached, hereto. Failure to include any items on such list does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

Contractor will complete or correct Work by: _____

CONTRACTOR: _____

BY: _____ DATE: _____

OWNER (agrees) (does not agree) to accept portion designated above separately from rest of Project.

Owner intends to utilize, occupy or take use on: _____

OWNER: _____

BY: _____ DATE: _____

The Work designated above, has been determined to be:

- ❑ Substantially Complete and a Certificate of Substantial Completion will be issued.
- ❑ Not substantially complete for following reasons: _____

_____

_____

_____

_____

ARCHITECT: HDR Engineering, Inc.

BY: _____ DATE: _____

DISTRIBUTION: ❑ OWNER ❑ ARCHITECT/ENGINEER ❑ CONTRACTOR

END OF CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

CONTRACTOR'S CERTIFICATE OF COMPLETION

PROJECT: _____
ARCH. PROJECT NUMBER: _____
CONTRACT FOR: _____
CONTRACT DATE: _____

This is to certify that I am an authorized official of, and have been properly authorized by said firm or corporation to certify following:
I know of my own personal knowledge, and do hereby certify on behalf of Contractor,
that Work has been reviewed and thoroughly inspected for compliance with Contract Documents,
that Work has been completed, in accordance with Contract Documents and Contract is fully performed,
that all equipment and systems have been tested and are operating satisfactorily,
that all Contract closeout requirements have been completed satisfactorily and submitted,
know of no substantial reason that insurance will not be renewable to cover period required by Contract Documents, and Work is ready for final inspection and acceptance.

Attached are three (3) copies of following documents, which are required prior to final payment:

- ❑ Final Application for Payment.
- ❑ Contractor's Affidavit of Payments of Debts and Claims
- ❑ Contractor's Affidavit of Release of Liens:
- ❑ Contractor's Final Release or Waiver of Liens.
- ❑ Consent of Surety (if any) to Final Payment:
- ❑ Certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to Owner.
- ❑ The list(s) of if items which were to be completed and corrected, with each item initialed to indicate Contractor has verified completion or correction of each.
- ❑ List of subcontractors and equipment suppliers.
- ❑ Certified list of all sales and service taxes paid.
- ❑ Letter of site conformance by licensed surveyor.
- ❑ If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
- ❑ Bond satisfactory to Owner to indemnify Owner against liens from Subcontractors.
- ❑ Transmittal indicating Owner has received Project Record Documents.

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

CONTRACTOR: _____ BY: _____

TITLE: _____ DATE: _____

Subscribed and sworn to me this _____ day of _____ _____

NOTARY PUBLIC: _____

My commission expires: _____

DISTRIBUTION: ❑ OWNER ❑ ARCHITECT/ENGR

END OF CONTRACTOR'S CERTIFICATE OF COMPLETION

SECTION 01 78 43
SPARE PARTS, TOOLS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Contract Closeout Information:
   1. Submit spare parts, tools and materials directly to Owner.
   2. Submittal to Architect/Engineer is not required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Spare Parts and Tools:
   1. Package in clearly identified boxes.
   2. Indicate manufacturer's name, part name and stock number.
   3. Indicate piece of equipment part or tool is for.
   4. Indicate name, address and phone number of closest supplier.

B. Maintenance Materials:
   1. Package in clearly identified boxes.
   2. Indicate trade name and stock number.
   3. Indicate which item material is to be used with.
   4. Indicate name, address and phone number of closest supplier.

C. Extra Materials:
   1. Package in clearly identified containers, or install where indicated.
   2. Indicate trade name, stock number, size, color, etc.
   3. Indicate where product is to be used.
   4. Indicate name, address and phone number of closest supplier.

PART 3 - EXECUTION

3.1 DELIVERY

A. Deliver to Owner prior to substantial completion unless Owner requests earlier delivery.

B. Deliver to location directed by Owner.

C. Complete Maintenance Material Transmittal form at end of this Section.
   1. Acquire Owner's acceptance of items listed on transmittal.
   2. Transmittal to indicate Owner's acceptance.
   3. Forward copy of transmittal forms with Owner's acceptance to Architect/Engineer.

END OF SECTION

SPARE PARTS, TOOLS AND MAINTENANCE MATERIAL TRANSMITTAL

Project:

To Owner: Date:

From C.M./Contractor:

Package extra material, maintenance materials, spare parts, and tools in clearly identified boxes; indicate manufacturer's name, trade name, part name, stock number, size, color, etc. Indicate which item maintenance material is to be used with, piece of equipment part or tool is for, or where extra material is to be used. Indicate name, address, and phone of closest supplier.

Section	Description	Quantity

Owner's Verification and Acceptance

Accepted by: _____ Date: _____

Forward copy of this transmittal to the Architect/Engineer.

DISTRIBUTION: ☐ OWNER ☐ CONTRACTOR ☐ C. M. ☐ ARCHITECT/ENGINEER

END OF TRANSMITTAL

SECTION 01 79 23
INSTRUCTION OF OPERATIONS AND MAINTENANCE PERSONNEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Administrative and procedural requirements for instruction of operations and maintenance personnel.
2. Qualifications requirements for Suppliers' training personnel.
3. General requirements for training.
4. Schedule of required training sessions.

B. Scope:
1. Contractor shall furnish services of Suppliers' operation and maintenance training specialists to instruct Owner's [and facility manager's] personnel in recommended operating and maintenance procedures for materials and equipment furnished, in accordance with the Contract Documents.
2. Each Supplier shall provide a combination of classroom and field training at the Site, unless otherwise required elsewhere in the Contract Documents.
Owner reserves the right to record training sessions on video for Owner's later use in instructing Owner's personnel.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling of Training Sessions:
1. General:
a. Contractor shall coordinate training services with checkout, startup, and initial operation of materials and equipment on days and times, and in manner, acceptable to Owner, in accordance with the Contract Documents.
b. Training may be required outside of normal business hours to accommodate schedules of operations and maintenance personnel. Provide training services at the required days and times at no additional cost to Owner.
2. Prerequisites to Training:
a. Training of facility operations and maintenance personnel shall commence after preliminary operation and maintenance data has been submitted and accepted by Engineer, and the Work required in Section 01 75 00, Checkout and Startup Procedures, is complete.
b. At option of Owner or Engineer, training may be allowed to take place before, during, or after checkout and startup of materials and equipment.
3. Training Schedule Submittal:
a. Training Schedule Required: Contractor shall prepare and submit proposed training schedule for review and acceptance by Engineer and Owner. Proposed training schedule shall show and indicate all training required in the Contract Documents, and shall demonstrate compliance with specified training requirements relative to number of hours of training for various elements of the Work, number of training sessions, and scheduling.
b. Training Schedule Coordination: When Project has multiple prime contracts, prime Contractors shall comply with this Specifications section. All prime Contractors shall coordinate with the General Contractor in developing a single training schedule Submittal for the entire Project, to be submitted by General Contractor. All prime Contractors shall implement training in accordance with the approved training schedule.
c. Timing of Training Schedule Submittal: Submit initial training schedule not less than 60 days before scheduled start of first training session. Submit final training schedule,

incorporating revisions in accordance with Engineer's comments, not later than 30 days prior to starting the first training session.

d. Owner [or facility manager] reserves the right to modify personnel availability for training in accordance with process or emergency needs at the facility.

B. Training Scheduling Conference:

1. Prior to preparing initial training schedule Submittal, schedule and hold training scheduling conference at the location where progress meetings are held, to review:
   a. Training requirements indicated in the Contract Documents.
   b. Work to be completed prior to commencing training.
   c. Work progress and Progress Schedule relative to startup and training.
   d. Scheduling constraints for Owner's personnel, relative to days and times of training sessions.
   e. Preferred days for training.
   f. Location where training will be performed and facilities available.
   g. Required Submittals relative to training.
   h. Other issues relative to training of operations and maintenance personnel.
2. Attendance is mandatory for the following:
   a. Contractor's project manager.
   b. Contractor's Site superintendent.
   c. Project manager of Subcontractors responsible for furnishing materials and equipment for which training of operations and maintenance personnel is required.
   d. Suppliers invited by Contractor.
   e. Engineer.
   f. Resident Project Representative (RPR).
   g. Owner's Site Representative (OSR).
   h. Facility manager's staff responsible for training coordination, and staff responsible for scheduling operations and maintenance personnel.
3. If additional information must be developed to adequately cover agenda items, reconvene conference as soon as possible.
4. Contractor shall prepare minutes summarizing the discussions of conference, decisions made, and agreements and disagreements, and distribute the minutes to each conference attendee and others as appropriate.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Supplier's Instructors:
   a. Shall be factory-trained by manufacturer of material or equipment.
   b. Supplier's instructors shall be proficient and experienced in performing training of the types required.
   c. Instructors shall be proficient, clear, and easily understandable in spoken and written English language.
   d. Qualifications of instructors are subject to acceptance by Engineer. If Engineer does not accept qualifications of proposed instructor, provide services of replacement instructor with acceptable qualifications.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Training Schedule: Detailed schedule of training sessions, demonstrating compliance with number of training sessions, hours required in the Contract Documents, and complying with the Contract Times. Submit training schedule Submittals in accordance with time frames specified in this Specifications section.

B. Informational Submittals: Submit the following:

1. Lesson Plan: Acceptable lesson plan for training on each material or equipment item, in accordance with Table 01 79 23-A and the Contract Documents. Lesson plan shall comply

with requirements of this Specifications section as may be supplemented by Specifications sections where materials and equipment are specified. Include with lesson plan copy of handouts that will be used during training sessions. Submit lesson plan Submittals in accordance with time frames specified in this Specifications section.

2. Qualifications:
   a. Credentials of Supplier's proposed operations and maintenance instructor(s). Credentials shall demonstrate compliance with requirements of this Specifications section and shall include brief resume' and specific details of instructor's operating, maintenance, and training experience relative to the specific material and equipment for which instructor will provide training.
3. Minutes of training scheduling conference.

C. Closeout Submittals: Submit the following:
   1. Trainee sign-in sheets for each training session. Submit to [Owner's] [facility manager's] training coordinator with copy to Engineer.

1.5 LESSON PLAN

A. Supplier's lesson plan shall describe specific instruction topics, system components for which training will be provided, and training procedures. Handouts, if any, to be used in training shall be included with the lesson plan. Describe in lesson plan "hands-on" demonstrations planned for training sessions.

B. Submit acceptable lesson plan not less than 21 days prior to starting associated training.

C. Indicate in lesson plan estimated duration of each training segment.

D. Lesson plan shall include the following:
   1. Material and Equipment Overview (required for all types of operations and maintenance training):
      a. Describe material and equipment's operating (process) function and performance objectives.
      b. Describe material and equipment's fundamental operating principles and dynamics.
      c. Identify equipment's mechanical, electrical, and electronic components and features. Group related components into subsystems and describe function of subsystem and subsystem's interaction with other subsystems.
      d. Identify all support materials and equipment associated with operation of subject equipment, such as air intake filters, valve actuators, motors, and other appurtenant items and equipment.
      e. Identify and describe safety precautions and potential hazards related to operation.
      f. Identify and describe in detail safety and control interlocks.
   2. Operations Personnel Training:
      a. Material and Equipment Overview: As described in Paragraph 1.5.D.1 of this Specifications section.
      b. Operation:
         1) Describe operating principles and practices.
         2) Describe routine operating, startup, and shutdown procedures.
         3) Describe abnormal or emergency startup, operating, and shutdown procedures that may apply.
         4) Describe alarm conditions and responses to alarms.
         5) Describe routine monitoring and recordkeeping procedures.
         6) Describe recommended housekeeping procedures.
      c. Troubleshooting:
         1) Describe how to determine if corrective maintenance or an operating parameter adjustment is required.
   3. Mechanical Maintenance Training:
      a. Material and Equipment Overview: As described in Paragraph 1.5.D.1 of this Specifications section.

b. Material and Equipment Preventive Maintenance:
    1) Describe preventative maintenance inspection procedures required to:
        a) Inspect materials and equipment in operation.
        b) Identify potential trouble symptoms and anticipate breakdowns.
        c) Forecast maintenance requirements (predictive maintenance).
    2) Define recommended preventative maintenance intervals for each component.
    3) Describe lubricant and replacement part recommendations and limitations.
    4) Describe appropriate cleaning practices and recommend intervals.
    5) Identify and describe use of special tools required for maintenance of materials and equipment.
    6) Describe component removal, installation, and disassembly and assembly procedures.
    7) Perform "hands-on" demonstrations of preventive maintenance procedures.
    8) Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
    9) Define recommended torqueing, mounting, calibrating, and aligning procedures, tolerances, and settings, as appropriate.
    10) Describe recommended procedures to check and test equipment following corrective maintenance.
c. Troubleshooting:
    1) Define recommended systematic troubleshooting procedures.
    2) Provide component-specific troubleshooting checklists.
    3) Describe applicable materials and equipment testing and diagnostic procedures to facilitate troubleshooting.
    4) Describe common corrective maintenance procedures with "hands-on" demonstrations.

4. Instrumentation/Controls and Electrical Maintenance Training:
    a. Materials and Equipment Overview: As described in Paragraph 1.5.D.1 of this Specifications section.
    b. Preventative Maintenance and Troubleshooting of Instrumentation and Control Systems: Engineer may grant waiver(s) to allow all training for a given system to be at the location of Owner's training facility.
    c. Preventative Maintenance and Troubleshooting of Other Electrical Systems: In accordance with requirements for Paragraph 1.5.D.3 of this Specifications section.

1.6 TRAINING AIDS

A. Supplier's instructor(s) shall incorporate training aids as appropriate to assist in the instruction. Provide handouts of text, tables, graphs, and illustrations as required. Other appropriate training aids include:
    1. Audio-visual aids, such as videos, Microsoft PowerPoint presentations, overhead transparencies, posters, drawings, diagrams, catalog sheets, or other items.
    2. Equipment cutaways and samples, such as spare parts and damaged equipment.
    3. Tools, such as repair tools, customized tools, and measuring and calibrating instruments.

B. Handouts:
    1. Supplier's instructor(s) shall distribute and use descriptive handouts during training. Customized handouts developed especially for training for the Project are encouraged.
    2. Photocopied handouts shall be good quality and completely legible.
    3. Handouts shall be coordinated with the instruction, with frequent references made to the handouts.
    4. Provide not less than [15] paper copies of each handout for each training session.

C. Audio-Visual Equipment: Training provider shall provide audio-visual equipment required for training sessions. If suitable equipment is available at the Site, [Owner] [facility manager] may make available facility's expiring audio-visual equipment; however, do not count on facility's

expiring audio-visual equipment, if any, being available. Audio-visual equipment that training provider shall provide, as required, includes:

1. Laptop computer, presentation software, and suitable projector.
2. Power cords, power strips/surge protectors.
3. As required, extension cords, HDMI cables and other video cabling, and spare bulb for projector.
4. Laser pointer/slideshow remote controller with extra batteries.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 TRAINING DELIVERY

A. Training Delivery – General:
   1. Instructors shall be fully prepared for the training sessions. Training delivery shall be communicative, clear, and proceed according to lesson plan accepted by Engineer, with lesson content appropriate for trainees. If Owner [, facility manager,] or Engineer deems that training delivery does not comply with the Contract Documents, training shall be postponed, rescheduled, and re-performed in acceptable manner at no additional cost to Owner [and facility manager].
   2. Trainee Sign-in Sheets: In format acceptable to [Owner] [facility manager], furnish sign-in sheet for trainees for each session. Sign-in sheets shall include the Project name; materials, equipment, or system for which training was provided; and type of training (e.g., operations, mechanical maintenance, instrumentation/controls and electrical maintenance, or other), and full name and operator license number (when applicable) of each trainee. Upon completion of training, submit copy of each sign-in sheet as indicated in Article 1.4 of this Specifications section.

B. "Hands-on" Demonstrations:
   1. Supplier's instructor(s) shall present "hands-on" demonstrations of operations and maintenance of materials and equipment for each training session, in accordance with lesson plan accepted by Engineer.
   2. Contractor and manufacturer shall furnish tools necessary for demonstrations.

3.2 SCHEDULE OF REQUIRED TRAINING

A. Supplier shall provide not less than the hours of training and number of sessions indicated in Table 01 79 23-A of this Specifications Section. Travel time and expenses are responsibility of Supplier and are excluded from required training time indicated in the Contract Documents.

B. Shifts and Training Sessions Required:
   1. Operations at the Site take place 24 HRS per day, divided into three shifts as follows: day, evening, and night shift.
   2. Training Sessions per Shift:
      a. Operators: Maximum training per day is four hours; sessions longer than four hours shall be spread over multiple, preferably consecutive, days. Provide identical training sessions as follows:
         1) Two identical sessions during day shift, each session in a different week.
         2) One session during evening shift.
         3) One session during night shift.
      b. Mechanical Maintenance: Provide two identical training sessions during day shift, each session in a separate week, for indicated materials and equipment. Maximum training per day is four hours; sessions longer than four hours shall be spread over multiple, preferably consecutive, days.
      c. Instrument/Controls and Electrical Maintenance: Provide two identical training sessions during day shift, each session in a separate week, for indicated equipment.

Maximum training per day is four hours; sessions longer than four hours will be spread over multiple, preferably consecutive, days.

TABLE 01 79 23-A, TRAINING SUMMARY TABLE

Material or Equipment	Specification Section	Total Training (HRS	Training Sessions Required		
			Operations	Mechanic Maint.	Instrument/ Controls & Electrical Maint.

END OF SECTION

SECTION 01 91 03
COMPONENT AND SYSTEM COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes specifications for the Component and System Commissioning process to verify the proper installation and operation of the aquaculture systems

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL

A. Component Commissioning is not to be scheduled until the items outlined in 3.2 below have either been completed or scheduled for completion. Should the contractor request the Component Commissioning to be undertaken, if the ENGINEER's staff travels to the site and they find the project is not ready for the Component Commissioning, the Contractor shall pay the ENGINEER for all the ENGINEER's costs associated with the trip.

B. Similarly, should System Commissioning be requested before the system is ready to operate and before all deficiencies discovered during the Component Commissioning have been addressed, the Contractor shall reimburse the ENGINEER for the costs associated with the trip.

C. This Section covers aquaculture specific equipment commissioning. Coordinate efforts outlined in this specification with Section 01 75 00 which covers overall facility start-up.

3.2 PRIOR TO COMMISSIONING VISIT

A. The Contractor will complete installation and Field Quality Control of all components outlined herein.

B. FIELD QUALITY CONTROL
   1. Specific Field Quality Control, equipment startup and calibration requirements are outlined in individual specifications.
   2. Contractor will bring manufacturer's representatives or factory authorized technician to the project site to check the installation of all aquaculture-related components provided by Contractor in the project.
   3. Note that this trip is separate from the trip needed for Owner Demonstration and Training.
   4. Confirm all water control/transmission facilities and structures are cleaned of debris and ready to use.
   5. Provide training to contractor's personnel on the proper operation of the equipment.

C. Draft Operation and Maintenance Manuals (O&M)
   1. Contractor is also expected to have submitted draft copies of all Operation and Maintenance (O&M) Manuals to ENGINEER for review a minimum of 2 weeks prior to the scheduled Component Commissioning dates.
   2. Contractor will also have available on site copies of these draft O&M Manuals for reference if required during Component Commissioning.

3.3 COMPONENT COMMISSIONING

A. Duration: **Up to 1.5 days.**

B. After written notification from the Contractor that all subsystem components have been installed, operated and calibrated and all criteria outlined in 3.2 above have been met, the Contractor shall spend up to one day demonstrating component operation to the ENGINEER. This shall be called the Component Commissioning.

C. The Contractor shall make adjustments where required and operate components within their normal anticipated range of operation. Contractor will be responsible for documenting the adjustments made during the demonstration. Similarly, the Contractor will develop a written list of operational deficiencies and corrective adjustments needed. The Contractor shall add to the list any deficiencies that the Owner's Representative or Owner detects.

D. The Component Commissioning shall be conducted a minimum of 4 weeks prior to the System Commissioning and "Substantial Completion" stage of the project. All operational deficiencies discovered during the Component Commissioning shall be corrected.

E. The following components shall be operated:
   1. Water supply system including pumps, treatment equipment and all related electrical controls.
   2. Jar incubation systems
   3. Process instrumentation and alarm system.

F. At a minimum, sequence of operation as outlined in individual specification sections for each major component will be verified.

G. Other minor components such as valves and standpipes will be operated as time permits.

H. The ENGINEER will furnish a more detailed written agenda after the Contractor gives written notice of when the Contractor will be ready to perform the Component Commissioning and that the Equipment Startup and Calibration has been completed.

I. The Contractor shall have qualified technicians on site at all times during the Component Commissioning who are completely familiar with the installed project components and are capable of starting/stopping equipment components and making corrective adjustments where required. Alternately, the Contractor shall be adequately trained to demonstrate equipment operation and make adjustments (unless noted otherwise in the individual specifications).

J. ENGINEER and/or the Owner/User personnel will not operate any equipment unless give specific permission by the Contractor. Equipment will not be operated overnight or at other times when the equipment is not manned by Contractor's personnel.

3.3 SYSTEM DEMONSTRATION

A. Duration: **Up to 2 days.**

B. Systems are to be operated attended during the day and unattended, over-night in so far as the Owner concurs. All component and system alarms will be enabled and operational to protect the equipment from damage.

C. The Contractor is expected to complete all other construction requirements to the point where the project is considered Substantially Complete. Then, the Substantial Completion inspection can be held concurrently with the System Commissioning visit.

D. After written notification from the Contractor(s) that all corrective adjustments revealed during the Component Commissioning have been completed, the aquaculture systems will be operated continuously through a full range of normal hatchery operational requirements for a period of 2-3 days. The facility will be operated in a manner to mimic the actual production cycle for fish

rearing and be operated overnight to confirm stable continuous operation. This shall be called the System Commissioning.

E. The purpose of the System Commissioning is to operate all new hatchery systems through their normal, anticipated range of operation, to make adjustments where required, and to verify that all components work together properly.

F. At a minimum, sequence of operation as outlined in individual specification sections for each major component will be verified.

G. The ENGINEER will furnish a more detailed written agenda after the Contractor gives written notice of when the Contractor will be ready to perform the System Commissioning and that all component Commissioning deficiencies have been corrected.

H. The Contractor shall have qualified technicians on site at all times during the System Commissioning who are completely familiar with the installed project components and are capable of starting/stopping equipment components and making corrective adjustments where required. Alternately, the Contractor shall be adequately trained to demonstrate equipment operation and make adjustments (unless noted otherwise in the individual specifications).

I. The ENGINEER and Owner shall observe system demonstration which the Contractor shall document. The Contractor will develop a written list of operational deficiencies and corrective adjustments needed. The Contractor shall add to the list any deficiencies that the ENGINEER or Owner detects.

J. All operational deficiencies discovered during the System Commissioning shall be corrected. The operational phase of the System Commissioning may be repeated (with Owner) as necessary to assure compliance with the specifications. At this time, the project can be considered Substantially Complete and further close-out activities will follow the Owner's established procedures. Any remaining deficiencies will be added to the punch list for corrective action.

K. The above operational period is intended to reveal system characteristics when operating in a series of different design conditions as well as to reveal operational deficiencies. It is not intended as a substitute for the individual requirements for items defined in the detailed sections of these specifications.

3.4 DEMONSTRATION AND TRAINING

A. Owner Training is to occur after System Commissioning has been completed.

B. Specific Owner Training requirements are also outlined in individual specifications.

END OF SECTION

DIVISION 02

EXISTING CONDITIONS

SECTION 02 00 10
EXISTING CONDITIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.

2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Where equipment, accessories, or materials are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated in the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

1.3 CONTINUITY OF EXISTING TRAFFIC, PARKING, DRAINAGE, OPERATIONS AND UTILITIES

A. The hatchery will continue operation during this construction to the extent possible. Hatchery business traffic will continue to utilize the existing entrance roads and parking lots. Work efforts / schedules shall be coordinated with the hatchery staff.

1. Spring months are typically the most critical months in terms of hatchery operations and any interruption of services during this time period would be deemed to be potentially critical and needs to be coordinated and scheduled with Hatchery Staff.

B. Do not interrupt or change existing traffic, delivery, parking, or utility services without prior written approval from the Hatchery Staff. When an interruption is required, the Contractor shall coordinate the schedule with the Hatchery Staff to minimize disruptions. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

C. Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone, fuel, or other utilities and site features which may be encountered in any excavations or other sitework.

1.4. PROTECTION OF EXISTING WORK AND FACILITIES

A. Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. Take all measures necessary to safeguard all existing work and facilities which are outside the limits of the work or items which are within the construction limits but are intended to remain.

B. Protect all paved, turf, and landscaped surfaces to remain. Protect all areas outside of the construction limits from the effects of erosion

1.5 CONSTRUCTION LIMITS

A. Confine work to the minimum area reasonably necessary to undertake the work as determined by the Architect/Engineer. All area disturbed by excavation and grading, plus such additional areas as are disturbed by construction related activities including construction access and storage and installation of materials shall be considered the "Construction Area." The Contractor shall coordinate his proposed “Laydown Area” with the Architect/Engineer, Owner and Hatchery Staff and secure their approval on this proposed location.

PART 2 – PRODUCTS

2.1. WARNING SIGNS

A. Provide all necessary warning signing as required by OSHA, these specifications, or as shown on the Drawings.

PART 3 – EXECUTION

3.1 GENERAL

A. Perform all work in accordance with applicable manufacturer's instructions.

B. Do not interrupt or change existing services without prior written approval from the Owner. When interruption is required, the Contractor shall coordinate the schedule with the Hatchery Staff to minimize disruptions. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

3.2 CONSTRUCTION LIMITS

A. Acceptable staging areas are indicated on the Contract Drawings. Confine work to the minimum area required to execute the work as indicated on the Contract Drawings.

3.3 PROJECT SITE CONDITIONS

A. Maintain a clean, safe and orderly site.

B. Provide adequate barricades, guards, warning lights, other protection required at excavation and hazards created by work.

C. Control access to the site by only authorized personnel and vehicles.

D. Maintain site housekeeping to provide for a safe and orderly project site. Collect and dispose of debris as they accumulate daily.

E. Provide shoring, bracing, sheet piling, planking and forming required by the work.

D. Locate and protect overhead and underground utilities, sidewalks, drains, curbs, trees (including roots) shrubs, ground cover, bench marks, monuments, other reference points, adjacent building, materials, and property owned by others that are to remain.

E. Protect items and existing ponds and structures. If disturbed or destroyed, replace as directed, bearing responsibility for and replacement cost of damage arising from all operations connected with work. Video road and pond levees prior to construction and submit video to Owner.

J. Be responsible for control measures to prevent damage from flooding, erosion, sedimentation to on-site and off-site areas.

K. Minimize impact to existing pond operations to the extent possible and prevent debris from entering these ponds by the use of sediment control wattles or other appropriate measures.

3.4 SITE RESTORATION

A. Unless otherwise specified or noted on the Drawings, fully and completely restore the site to a condition present prior to the work. Restore the surface of all disturbed areas to a like condition of the surface prior to the work.

B. Topsoil, fertilize, seed, and mulch (or sod) all disturbed landscaped areas with a minimum of four (4) inches of topsoil, fertilizer, seed, and mulch (or sod), or provide for the restoration of other landscaping materials as necessary. See also Section 32 92 00- Seeding.

3.5 CLEAN UP

A. Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

B. Thoroughly clean all sewers and structures and remove and dispose of all debris and mud.

END OF SECTION

DIVISION 03

CONCRETE

SECTION 03 05 05
CONCRETE TESTING AND INSPECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor requirements for testing of concrete and grout.
   2. Definition of Owner provided testing.
   3. Acceptance criteria for concrete.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 21 00 - Reinforcement.
   4. Section 03 31 30 - Concrete, Materials and Proportioning.
   5. Section 03 31 31 - Concrete Mixing, Placing, Jointing and Curing.

1.2 RESPONSIBILITY AND PAYMENT

A. Owner will hire an independent Testing Agency/Service Provider to perform the following testing and inspection and provide test results to the Engineer and Contractor.
   1. Testing and inspection of concrete and grout produced for incorporation into the work during the construction of the Project for compliance with the Contract Documents.
   2. Additional testing or retesting of materials occasioned by their failure, by test or inspection, to meet requirements of the Contract Documents.
   3. Strength testing on concrete required by the Engineer or Special Inspector when the water-cement ratio exceeds the water-cement ratio of the typical test cylinders.
   4. In-place testing of concrete as may be required by Engineer when strength of structure is considered potentially deficient.
   5. Other testing services needed or required by Contractor such as field curing of test specimens and testing of additional specimens for determining when forms, form shoring or reshoring may be removed.
   6. Owner will pay for services defined in Paragraph 1.2A.1.
   7. See Specification Section 01 30 00.

B. Hire a qualified testing agency to perform the following testing and provide test results to the Engineer.
   1. Testing of materials and mixes proposed by the Contractor for compliance with the Contract Documents and retesting in the event of changes.
   2. Additional testing and inspection required because of changes in materials or proportions requested by Contractor.
   3. Pay for services defined in Paragraphs 1.2B.1. and 1.2B.2.
   4. Reimburse Owner for testing services defined in Paragraphs 1.2A.2., 1.2A.3., 1.2A.4. and 1.2A.5.
   5. See Specification Section 01 30 00.

C. Duties and Authorities of Testing Agency/Service Provider:
   1. Any Testing Agency/Service Provider or agencies and their representatives retained by Contractor or Owner for any reason are not authorized to revoke, alter, relax, enlarge, or release any requirement of Contract Documents, nor to reject, approve or accept any portion of the Work.
   2. Testing Agency/Service Provider shall inform the Contractor and Engineer regarding acceptability of or deficiencies in the work including materials furnished and work performed by Contractor that fails to fulfill requirements of the Contract Documents.

3. Testing Agency to submit test reports and inspection reports to Engineer and Contractor immediately after they are performed.
    a. All test reports to include exact location in the work at which batch represented by a test was deposited.
    b. Reports of strength tests to include detailed information on storage and curing of specimens prior to testing.
4. Owner retains the responsibility for ultimate rejection or approval of any portion of the Work.

1.3 QUALITY ASSURANCE

A. Referenced Standards:
    1. American Concrete Institute (ACI):
        a. 318, Building Code Requirements for Structural Concrete.
        b. 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
    2. ASTM International (ASTM):
        a. ASTM Cement and Concrete Reference Laboratory (CCRL).
        b. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
        c. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
        d. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
        e. C94, Standard Specification for Ready-Mixed Concrete.
        f. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
        g. C172, Standard Practice for Sampling Freshly Mixed Concrete.
        h. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
        i. C1019, Standard Test Method for Sampling and Testing Grout.
        j. C1218, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
        k. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

B. Qualifications:
    1. Contractor's Testing Agency:
        a. Meeting requirements of ASTM E329 and ASTM C94.
        b. Provide evidence of recent inspection by CCRL of NBS, and correction of deficiencies noted.

C. Use of Testing Agency and approval by Engineer of proposed concrete mix design shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.

1.4 DEFINITIONS

A. Testing Agency/Service Provider: An independent professional testing/inspection firm or service hired by Contractor or by Owner to perform testing, inspection or analysis services as directed, and as provided in the Contract Documents.

1.5 SUBMITTALS

A. Shop Drawings:
    1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
    2. Product technical data including:
        a. Concrete materials and concrete mix designs proposed for use.
            1) Include results of all testing performed to qualify materials and to establish mix designs.
            2) Place no concrete until approval of mix designs has been received in writing.

3) Submittal for each concrete mix design to include:
   a) Sieve analysis and source of fine and coarse aggregates.
   b) Test for aggregate organic impurities.
   c) Proportioning of all materials.
   d) Type of cement with mill certificate for the cement.
   e) Brand, quantity and class of fly ash proposed for use along with other submittal data as required for fly ash by Specification Section 03 31 30.
   f) Slump.
   g) Brand, type and quantity of air entrainment and any other proposed admixtures.
   h) Shrinkage test results.
   i) Total water soluble chloride ion concentration in hardened concrete from all ingredients determined per ASTM C1218.
   j) 28-day compression test results and any other data required by Specification Section 03 31 30 to establish concrete mix design.

3. Certifications:
   a. Testing Agency qualifications.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 TESTING SERVICES TO BE PERFORMED SERVICE PROVIDER/TESTING AGENCY

A. The following concrete testing will be performed by the Service Provider/Testing Agency:
   1. Concrete strength testing:
      a. Secure concrete samples in accordance with ASTM C172.
         1) Obtain each sample from a different batch of concrete on a random basis, avoiding selection of test batch other than by a number selected at random before commencement of concrete placement.
      b. For each strength test, mold and cure cylinders from each sample in accordance with ASTM C31.
         1) Record any deviations from requirements on test report.
         2) Cylinder size: Per ASTM C31.
            a) 4 IN cylinders shall not be used for concrete mixes with maximum aggregate size larger than 1 IN.
            b) Use the same size cylinder for all tests for each concrete mix.
         3) Quantity:
            a) 6 IN DIA by 12 IN high: Five (5) cylinders.
            b) 4 IN DIA by 8 IN high: Six (6) cylinders.
      c. Field cure one (1) cylinder for the seven (7) day test.
         1) Laboratory cure the remaining.
      d. Test cylinders in accordance with ASTM C39.
         1) 6 IN DIA cylinders:
            a) Test two (2) cylinders at 28 days for strength test result and the one (1) field cured sample at seven (7) days for information.
            b) Hold remaining cylinder in reserve.
         2) 4 IN DIA cylinders:
            a) Test three (3) cylinders at 28 days for strength test result and the one (1) field cured cylinder at seven (7) days for information.
            b) Hold remaining cylinders in reserve.
      e. Strength test result:
         1) Average of strengths of two (2) 6 IN DIA cylinders or three (3) 4 IN DIA cylinders from the same sample tested at 28 days.

2) If one (1) cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder(s); average strength of remaining cylinders shall be considered strength test result.
3) Should all cylinders in any test show any of above defects, discard entire test.

f. Frequency of tests:
1) All concrete:
a) One (1) strength test to be taken not less than once a day, nor less than once for each 60 CY or fraction thereof placed in any one (1) day.
b) Once for each 5000 SQ FT of slab or wall surface area placed each day
c) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five (5) strength tests for each concrete mix, tests shall then be made from at least five (5) randomly selected batches or from each batch if fewer than five (5) batches are provided.

2. Slump testing:
a. Determine slump of concrete sample for each strength test.
1) Determine slump in accordance with ASTM C143.
b. If consistency of concrete appears to vary, the Engineer or Owner's Representative shall be authorized to require a slump test for each concrete truck.
1) This practice shall continue until three consecutive batches are determined to be consistent and meet the slump requirements specified.
3. Air content testing: Determine air content of concrete sample for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.
4. Temperature testing: Determine temperature of concrete sample for each strength test.
5. In-place concrete testing (if required).

3.2 SPECIAL INSPECTIONS

A. See Section 01 45 33.
1. Special Inspections listed are for the Contractor reference only and is not part of the Contract Documents.
2. It is included to assist the Contractor in understanding the Owner-provided Services so that those services may be factored into the Contractor's pricing and schedule.

B. Formwork Special Inspections:
1. Shape, location, and dimensions.
a. Inspect in accordance with dimensions and details on Drawings.
b. Frequency: Inspect prior to each concrete pour.

C. Reinforcing Special Inspections:
1. Reinforcing size, spacing, lap length and concrete cover.
a. Inspect in accordance with Drawings and Specification.
b. Frequency: Inspect prior to each concrete pour.
2. Reinforcing adhesive anchoring system:
a. Inspect in accordance with ICC-ES report.
b. Frequency:
1) Inspect all adhesive anchors for the first 4 HRS of installation.
2) Inspect approximately 25 percent of adhesive anchors thereafter.
3) Additional inspection will be required for different installer or if the quality of installation appears to vary.
3. Mechanical splices:
a. Inspect in accordance with ICC-ES report.
b. Frequency:
1) Inspect all mechanical splices prior to placing concrete of installation.
2) Additional inspection will be required for different installer or if the quality of installation appears to vary.

D. Mixing, Placing, Jointing, and Curing Special Inspections:
1. Perform concrete tests per the requirements of this Specification Section.

2. Verification of proper mix design.
    a. Frequency: Periodically, prior to each concrete pour.
3. Proper concrete placement techniques.
    a. Inspect per requirements of Section 03 31 31.
    b. Frequency: During each concrete pour.
4. Proper curing temperature and techniques.
    a. Inspect per requirements of Section 03 31 31.
    b. Frequency: Periodically, but not less than every third day.
5. Joints:
    a. Inspect joints for proper joint type, dimensions, reinforcing, dowel alignment, surface preparation and location.
    b. Frequency: Prior to each concrete pour.
6. Waterstops:
    a. Visually inspect waterstops for proper location, continuity, installation to prevent displacement, cleanliness and damage to waterstop.
    b. Frequency:
        1) Prior to each concrete pour.

E. Anchorage to Concrete Special Inspection:
1. Post installed anchors as required by the Building Code, ICC-ES Evaluation Reports, and as specified by the Engineer.
    a. Frequency: Per ICC-ES Report.
2. Cast-in-place concrete anchors, including anchor size, embedment, material and location.
    a. Frequency: Prior to each concrete pour.

3.3 SAMPLING ASSISTANCE AND NOTIFICATION FOR OWNER

A. To facilitate testing and inspection, perform the following:
1. Furnish any necessary labor to assist Testing Agency in obtaining and handling samples at site.
2. Provide and maintain for sole use of Testing Agency adequate facilities for safe storage and proper curing of test specimens on site for first 24 HRS as required by ASTM C31.
3. Take samples at point of placement into concrete member.

B. Notify Engineer and Owner's Testing Agency sufficiently in advance of operations (minimum of 24 HRS) to allow for assignment of personnel and for scheduled completion of quality tests.

3.4 ACCEPTANCE

A. Completed concrete work which meets applicable requirements will be accepted without qualification.

B. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.

C. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Contract Documents.
1. In this event, modifications may be required to assure that concrete work complies with requirements.
2. Modifications, as directed by Engineer, to be made at no additional cost to Owner.

D. Dimensional Tolerances:
1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to modifications required by Engineer.
2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal.
    a. If removal of excess material is permitted, accomplish in such a manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.

3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or misplaced items interfere with other construction.
4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view, may be rejected.
    a. Repair or remove and replace if required.
5. Finished slabs exceeding tolerances may be required to be repaired provided that strength or appearance is not adversely affected.
    a. High spots may be removed with a grinder, low spots filled with a patching compound, or other remedial measures performed as permitted or required.

E. Appearance:
1. Concrete surfaces exposed to view with defects which, in opinion of Engineer, adversely affect appearance as required by specified finish shall be repaired by approved methods.
2. Concrete not exposed to view is not subject to rejection for defective appearance unless, in the opinion of the Engineer, the defects impair the long-term strength or function of the member.

F. High Water-Cement Ratio:
1. Concrete with water in excess of the specified maximum water-cement ratio will be rejected.
2. Remove and replace concrete with high water-cement ratio or make other corrections as directed by Engineer.

G. Strength of Structure:
1. Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to following:
    a. Low concrete strength:
        1) Test results for standard molded and cured test cylinders to be evaluated separately for each mix design.
            a) Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards.
            b) For evaluation of potential strength and uniformity, each mix design shall be represented by at least three (3) strength tests.
            c) A strength test shall be the average of two (2) 6 IN diameter cylinders or three (3) 4 IN diameter cylinders from the same sample tested at 28 days.
        2) Acceptance:
            a) Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:
                (1) Average of all sets of three (3) consecutive strength tests equal or exceed the required specified 28 day compressive strength.
                (2) No individual strength test falls below the required specified 28 day compressive strength by more than 500 PSI.
    b. Reinforcing steel size, configuration, quantity, strength, position, or arrangement at variance with requirements in Specification Section 03 21 00 or requirements of the Contract Drawings or approved Shop Drawings.
    c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
    d. Curing time and procedure not meeting requirements of this Specification Section.
    e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
    f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
    g. Concrete defects such as voids, honeycomb, cold joints, spalling, cracking, etc., likely to result in deficient strength or durability.

2. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.
3. In-place testing of concrete may be required when strength of concrete in place is considered potentially deficient.
    a. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer to determine relative strengths at various locations in the structure or for selecting areas to be cored.
        1) Such tests shall not be used as a basis for acceptance or rejection.
    b. Core tests:
        1) Where required, test cores will be obtained in accordance with ASTM C42.
            a) If concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 DEGF, relative humidity less than 60 PCT) for seven (7) days before test then test dry.
            b) If concrete in structure will be wet or subjected to high moisture atmosphere under service conditions, test cores after immersion in water for at least 40 HRS and test wet.
            c) Testing wet or dry to be determined by Engineer.
        2) Three (3) representative cores may be taken from each member or area of concrete in place that is considered potentially deficient.
            a) Location of cores shall be determined by Engineer so as least to impair strength of structure.
            b) If, before testing, one (1) or more of cores shows evidence of having been damaged subsequent to or during removal from structure, damaged core shall be replaced.
        3) Concrete in area represented by a core test will be considered adequate if average strength of three (3) cores is equal to at least 85 PCT of specified strength and no single core is less than 75 PCT of specified strength.
        4) Fill core holes with non-shrink grout and finish to match surrounding surface when exposed in a finished area.
4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accordance with ACI 318, Chapter 20.
5. Correct or replace concrete work judged inadequate by structural analysis or by results of core tests or load tests with additional construction, as directed by Engineer, at Contractor's expense.
6. Contractor to pay all costs incurred in providing additional testing and/or structural analysis required.

END OF SECTION

SECTION 03 11 13
FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formwork requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 05 05 - Concrete Testing and Inspection.
   4. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
   5. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. CT-13, Concrete Terminology.
      b. 117, Specification for Tolerances for Concrete Construction and Materials.
      c. 347R, Guide to Formwork for Concrete.
   2. Building code:
      a. International Code Council (ICC):
         1) International Building Code and associated standards, 2015 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:
   1. Formwork, shoring and reshoring to be designed by a licensed professional engineer currently registered or having a minimum of three (3) years' experience in this type of design work.
      a. Above qualifications apply to slabs and beams not cast on the ground.

C. Miscellaneous:
   1. Design and engineering of formwork and shoring as well as its construction is the responsibility of the Contractor.
   2. Design requirements:
      a. Design formwork for loads, lateral pressures and allowable stresses outlined in ACI 347R and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local Building Code.
         1) Where conflicts occur between the above two (2) standards, the more stringent requirements shall govern.
      b. Design formwork to limit maximum deflection of form facing materials reflected in concrete surfaces exposed to view to 1/240 of span between structural members.
   3. For slabs and beams not cast on the ground, develop a procedure and schedule for removal of shores and for calculating the loads transferred to the structure during this process in accordance with ACI 347R.
      a. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon. Calculations shall be performed by a licensed professional engineer.
      b. When developing procedure, schedule and structural calculations, consider the following at each stage of construction:
         1) The structural system that exists.
         2) Effects of all loads during construction.

3) Strength of concrete.
4) The influence of deformations of the structure and shoring system on the distribution of dead loads and construction loads.
5) The strength and spacing of shore used, as well as the method of shoring, bracing, and shore removal including the minimum time intervals between the various operations.
6) Any other loading or condition that affects the safety or serviceability of the structure during construction.

1.3 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI CT-13.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for the requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Manufacturer and type of proposed form ties.

B. Samples:
   1. A 12 IN SQ sample of each of the following form finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms for Surfaces Exposed to View:
   1. Wood forms:
      a. 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
      b. Built-in-place or prefabricated type panel.
   2. Metal forms:
      a. Metal forms may be used except for aluminum in contact with concrete.
      b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.

B. Forms for Surfaces Not Exposed to View:
   1. Wood or metal sufficiently tight to prevent leakage.
   2. Do not use aluminum forms.

2.2 ACCESSORIES

A. Form Ties:
   1. Commercially fabricated for use in form construction.
      a. Field fabricated ties are unacceptable.
   2. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete.
   3. Embedded portion of ties to be not less than 1-1/2 IN from face of concrete after ends have been removed.
   4. Cone size:
      a. 3/4 IN minimum diameter cones on both ends.
      b. Depth of cone not to exceed the concrete reinforcing cover.
   5. Provide ties with built-in waterstops in all walls that will be in contact with water during hatchery operation.
   6. Through-wall ties that are designed to be entirely removed are not allowed in all walls that will be in contact with water during hatchery operation.

B. Void Forms:
   1. Constructed from double faced corrugated cardboard or fiberboard which is wax impregnated and laminated with moisture-resistant adhesive.
   2. Capable of resisting moisture with no loss of load carrying strength or change in depth or configuration.

PART 3 - EXECUTION

3.1 PREPARATION

A. Form Surface Treatment:
   1. Before placing of reinforcing steel or concrete, cover surfaces of forms with an approved release material that will effectively prevent absorption of moisture and prevent bond with concrete, will not stain concrete or prevent bonding of future finishes.
      a. A field applied form release agent or sealer of approved type or a factory applied nonabsorptive liner may be used.
   2. Provide form oil that conforms to NSF/ANSI Standard 61.
   3. Do not allow excess form release material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.

B. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed, and to limit height of free fall of concrete to prevent aggregate segregation.
   1. Temporary openings to limit height of free fall of concrete shall be spaced no more than 8 FT apart.

C. Clean surfaces of forms, reinforcing steel and other embedded materials of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

3.2 ERECTION

A. Install products in accordance with manufacturer's instructions.

B. Tolerances:
   1. Conform to ACI 117.
   2. Variation from plumb:
      a. In lines and surfaces of columns, piers, walls, and in risers.
         1) Maximum in any 10 FT of height: 1/4 IN.
         2) Maximum for entire height: 1/2 IN.
      b. For exposed corner columns, control-joint grooves, and other exposed to view lines:
         1) Maximum in any 20 FT length: 1/4 IN.
         2) Maximum for entire length: 1/2 IN.
   3. Variation from level or from grades specified:
      a. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores.
         1) Maximum in any 10 FT of length: 1/4 IN.
         2) Maximum in any bay or in any 20 FT length: 3/8 IN.
         3) Maximum for entire length: 3/4 IN.
      b. In exposed lintels, sills, parapets, horizontal grooves, and other exposed to view lines:
         1) Maximum in any bay or in 20 FT length: 1/4 IN.
         2) Maximum for entire length: 1/2 IN.
   4. Variation of linear structure lines from established position in plan and related position of columns, walls, and partitions:
      a. Maximum in any bay: 1/2 IN.
      b. Maximum in any 20 FT of length: 1/2 IN.
      c. Maximum for entire length: 1 IN.

5. Variation in sizes and location of sleeves, floor openings, and wall openings: Maximum of +1/2 IN.
6. Variation in horizontal plan location of beam, column and wall centerlines from required location: Maximum of +1/2 IN.
7. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls: Maximum of -1/4 IN, +1/2 IN.
8. Footings and foundations:
    a. Variations in concrete dimensions in plan: -1/2 IN, +2 IN.
    b. Misplacement or eccentricity:
        1) 2 PCT of footing width in direction of misplacement but not more than 2 IN.
    c. Thickness:
        1) Decrease in specified thickness: 5 PCT.
        2) Increase in specified thickness: No limit except that which may interfere with other construction.
9. Variation in steps:
    a. In a flight of stairs:
        1) Rise: +1/8 IN.
        2) Tread: +1/4 IN.
    b. In consecutive steps:
        1) Rise: +1/16 IN.
        2) Tread: +1/8 IN.
10. Establish and maintain in an undisturbed condition and until final completion and acceptance of Project, sufficient control points and bench marks to be used for reference purposes to check tolerances.
11. Regardless of tolerances listed allow no portion of structure to extend beyond legal boundary of Project.
12. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete.

C. Make forms sufficiently tight to prevent loss of mortar from concrete.

D. Place 3/4 IN chamfer strips in exposed to view corners of forms to produce 3/4 IN wide beveled edges.

E. At construction joints, overlap contact surface of form sheathing for flush surfaces exposed to view over hardened concrete in previous placement by at least 1 IN.
    1. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
    2. Where possible, locate juncture of built-in-place wood or metal forms at architectural lines, control joints or at construction joints.

F. Where circular walls are to be formed and forms made up of straight sections are proposed for use, provide straight lengths not exceeding 2 FT wide.
    1. Brace and tie formwork to maintain correct position and shape of members.

G. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.

H. Anchor formwork to shores or other supporting surfaces or members so that movement of any part of formwork system is prevented during concrete placement.

I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

J. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up all settlement during concrete placing operation.
    1. Securely brace forms against lateral deflection.
    2. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.

3.3 REMOVAL OF FORMS

A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads places thereon.

B. When required for concrete curing in hot weather, required for repair of surface defects or when finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.

C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging.
   1. Perform any needed repairs or treatment required on such sloping surfaces at once, followed by curing specified in Specification Section 03 31 31.

D. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.

E. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.

F. Where no reshoring is planned, leave forms and shoring used to support weight of concrete in place until concrete has attained its specified 28 day compressive strength.

G. When shores and other vertical supports are so arranged that non-load-carrying form facing material may be removed without loosening or disturbing shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

3.4 FIELD QUALITY CONTROL

A. Special Inspection:
   1. See Section 01 45 33.
   2. See Section 03 05 05.

END OF SECTION

SECTION 03 15 19
ANCHORAGE TO CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for all cast-in-place anchor bolts, anchor rods, reinforcing adhesive anchorage, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.
   2. Design of all concrete anchors not indicated on the Drawings including, but not limited to, installation of anchors into concrete for the following structural and nonstructural components:
      a. Structural members and accessories.
      b. Metal, wood, and plastic fabrications.
      c. Architectural components.
      d. Mechanical and electrical equipment and components.
      e. Plumbing, piping, and HVAC work.
      f. All other components requiring attachment to concrete.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 05 05 - Concrete Testing and Inspection.
   4. Section 09 96 00 – High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 318, Building Code Requirements for Structural Concrete and Commentary.
      b. 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
   2. American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):
      a. Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.
   3. American Institute of Steel Construction (AISC):
      a. 303, Code of Standard Practice for Steel Buildings and Bridges.
   4. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
      c. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      d. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
      f. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
      g. A563, Standard Specification for Carbon and Alloy Steel Nuts.
      h. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
      i. F436, Standard Specification for Hardened Steel Washers.
      j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
      k. F594, Standard Specification for Stainless Steel Nuts.
      l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

m. F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

5. ICC Evaluation Service (ICC-ES):
   a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
6. Building code:
   a. International Code Council (ICC):
      1) International Building Code and associated standards, 2015 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:
   1. Anchor designer for Contractor-designed post-installed anchors shall be a professional structural engineer licensed in the State that the Project is located in.
   2. Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.

C. Post-installed anchors and related materials shall be listed by the following agencies:
   1. ICC-ES.
   2. Engineer approved equivalent.

1.3 DEFINITIONS

A. Adhesive Anchors:
   1. Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.
   2. Includes anchors using acrylics, epoxy and other similar adhesives.

B. Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.

C. Anchor Rod: Any cast-in-place or post-installed anchorage made from unheaded, threaded, rod or deformed bar material.

D. Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.

E. Galvanizing: Hot-dip galvanizing per ASTM A123, ASTM A153 or ASTM F2329 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

F. Hardware: As defined in ASTM A153.

G. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

H. MPII: Manufacturer’s printed installation instructions.

I. Mechanical Anchors:
   1. Post-installed anchors developing their strength from attachment other than thru adhesives or chemical bond to concrete.
   2. Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.
   3. Drop-in anchors and other similar anchors are not allowed.

J. Post-Installed Anchor: Any adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that submitted products meet requirements of referenced standards.
      b. Manufacturer material data sheet for each anchor.
         1) Clearly indicate which products on the data sheet are proposed for use on the Project.
      c. Manufacturer's printed installation instructions.
      d. Current ICC-ES report for each post-installed anchor system indicating the following:
         1) Certification that anchors meet all requirements indicated in this Specification.
         2) Performance data showing that anchor is approved for use in cracked concrete.
         3) Seismic design categories for which anchor system has been approved.
         4) Required installation procedures.
         5) Special inspection requirements for installation.
      e. Anchorage layout drawings and details:
         1) Indicate anchor diameter, embedment, length, anchor type, material and finish.
         2) Drawings showing location, configuration, spacing and edge distance.
      f. Contractor Designed Post-Installed Anchors:
         1) Show diameter and embedment depth of each anchor.
         2) Indicate compliance with ACI 318, Appendix D, ACI 350 Appendix D.
         3) Design tension and shear loads used for anchor design.
         4) Engineering design calculations:
            a) Indicate design load to each anchor.
            b) When the design load is not indicated on Drawings, include calculations to develop anchor forces based on Design Criteria listed herein.
            c) Sealed and signed by contractor’s professional structural engineer.
            d) Calculations will be submitted for information purposes only.
         5) Type of post-installed anchor system used.
            a) Provide manufacturer's ICC-ES report for the following:
               (1) Mechanical anchorage per ICC-ES AC193.
               (2) Adhesive anchorage per ICC-ES AC308.

B. Samples:
   1. Representative samples of concrete anchors may be requested by Engineer. Review will be for type and finish only. Compliance with all other requirements is exclusively the responsibility of the Contractor.

C. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Certification of qualifications for each installer of post-installed anchors.
      a. Indicate successful completion or certification for each type of approved post-installed anchor as required by the Contract Documents.
      b. Provide one of the following for each type of anchor, as required by this specification section:
         1) Letter from manufacturer documenting successful training completion.
         2) Certification of completion for Engineer approved program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to job site in manufacturer’s or distributor’s packaging undamaged and complete with installation instructions.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

C. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cast-in-place Concrete Anchors:
   1. Building, nonbuilding structures, and equipment:
      a. ASTM F1554, Grade 36 or Grade 55 with weldability supplement S1 for galvanized threaded rods.
      b. ASTM A307, Grade A for galvanized headed bolts.
   2. All other cast-in-place concrete anchors:
      a. Stainless steel with matching nut and washer.
      b. Submerged application: ASTM F593, Type 316.
      c. Non-submerged application: ASTM F593, Type 304 or Type 316.

B. Post-Installed Mechanical and Adhesive Concrete Anchors:
   1. Stainless steel with matching nut and washer.
   2. Submerged application: ASTM F593, Type 316.
   3. Non-submerged application: ASTM F593, Type 304 or Type 316.

C. Reinforcement: See Section 03 21 00.

D. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 PSI and a minimum tensile strength of 60,000 PSI.

E. Deformed Bar Anchors: ASTM A496 with minimum yield strength of 70,000 PSI and a minimum tensile strength of 80,000 PSI.

F. Washers:
   1. ASTM F436 unless noted otherwise.
   2. If stainless steel anchorage is being used for cast-in-place anchorage, furnish washers of the same material and alloy as in the accompanying anchorage.
   3. Plate washers: Minimum 1/2 IN thick fabricated ASTM A36 square plates as required.
   4. Follow manufacturer's requirements for all post-installed anchorage.

G. Nuts:
   1. ASTM A563 for all cast-in-place anchorage.
   2. If stainless steel anchorage is being used for cast-in-place anchorage, nuts shall meet ASTM F594 and be the matching material and alloy as in the accompanying anchorage.
   3. Follow manufacturer's requirements if using post-installed anchorage.

H. Galvanizing Repair Paint:
   1. High zinc dust content paint for regalvanizing welds and abrasions.
   2. ASTM A780.
   3. Zinc content: Minimum 92 PCT in dry film.
   4. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."

I. Dissimilar Materials Protection: See Specification Section 09 96 00.

2.2 CONTRACTOR DESIGNED ANCHORAGE

A. Acceptable Manufacturers:
   1. Post-installed anchor systems for the listed manufacturers will be considered only if a current ICC-ES evaluation report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section and if the anchor system is approved by the Engineer.
      a. Hilti.
      b. Dewalt.
      c. Simpson Strong-Tie.

2. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

B. Design the anchorage when any of the following occur:
   1. Design load for concrete anchorage is shown on the Drawings.
   2. When specifically required by the Contract Documents.
   3. When an anchorage is required but not specified in the Drawings.
   4. When anchorage is shown on Drawings other than Structural Drawings.

C. Anchorage Design Loads:
   1. Determine all of the design loads, including wind and seismic loads, per the Building Code.
      a. Anchorage of equipment and non-structural components: Use the actual dead and operating loads provided by the manufacturer.

D. When Contract Drawings, other than the Structural Drawings, indicate an anchor diameter or length, the Contractor design shall incorporate these as "minimums."

E. Cast-in-Place Concrete Anchors:
   1. Provide the material, nominal diameter, embedment length, spacing, edge distance and design capacity to resist the calculated load based on the requirements given in the Building Code including ACI 318, Appendix D, ACI 350, Appendix D.
   2. Design assuming cracked concrete.

F. Post-installed Concrete Anchors:
   1. Provide the manufacturer's system name/type, nominal diameter, embedment depth, spacing, minimum edge distance, cover, and design capacity to resist the specified or calculated load based on requirements given in the Building Code, ACI 318, Appendix D, ACI 350, Appendix D and current ICC-ES report, for the anchor to be used.
   2. Design assuming cracked concrete.

2.3 ENGINEER DESIGNED ANCHORAGE

A. When the size, length and details of anchorages are shown on Contract Structural Drawings, Contractor design of anchorage is not required.

B. Acceptable Manufacturers:
   1. Additional newer post-installed anchor systems for the listed manufacturers will be considered only if a current evaluation agency report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section, the anchor system is certified by ICC-ES for cracked concrete conditions, and if approved by the Engineer.
   2. Mechanical Anchors:
      a. Hilti:
         1) Kwik Bolt TZ (ICC-ES ESR-1917).
   3. Adhesive Concrete Anchors:
      a. Hilti:
         1) HIT RE 500 V3 (ICC ESR-3814).
   4. Concrete Screw Anchors:
      a. Hilti:
         1) Kwik HUS-EZ Screw (ICC-ES ESR-3027).
   5. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.
      a. Substitution request to indicate the proposed anchor has the at least the same tension and shear strength as the specified anchor installed as indicated in the Contract Drawings.
      b. Calculations to be stamped by a Professional Engineer registered in the state that the Project is located in.

PART 3 - EXECUTION

3.1 GENERAL

A. Cast-in-Place Anchorage:
   1. Use where anchor rods or bolts are indicated on the Drawings, unless another anchor type is approved by the Engineer.
   2. Provide concrete anchorage as shown on the Drawings or as required to secure components to concrete.

B. Adhesive Anchorage:
   1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
   2. May be used where subjected to vibration or where buried or submerged.
   3. Do not use in overhead applications or sustained tension loading conditions such as utility hangers.
   4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.

C. Mechanical Anchorage:
   1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
   2. Do not use where subjected to vibration.
   3. May be used in overhead applications.
   4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.

D. Do not use powder actuated fasteners and other types of bolts and fasteners not specified herein for structural applications unless approved by the Engineer or specified in Contract Documents.

3.2 PREPARATION

A. Provide adequate time to allow for proper installation and inspection prior to placing concrete for cast-in-place concrete anchorage.

B. Prior to installation, inspect and verify areas and conditions under which concrete anchorage is to be installed.
   1. Notify Engineer of conditions detrimental to proper and timely completion of work.
   2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

C. Special Inspection is required in accordance with the Building Code for all concrete anchorage.
   1. Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).
   2. See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section for additional requirements.

D. Post-installed anchor manufacturer’s representative shall demonstrate and observe the proper installation procedures for the post-installed anchors at no additional expense to the Owner.
   1. Follow such procedures to assure acceptable installation.
   2. Adhesive anchors must be installed in concrete aged a minimum of 21 days

3.3 INSTALLATION

A. Tie cast-in-place anchorage in position to embedded reinforcing steel using wire.
   1. Tack welding of anchorage is prohibited.
   2. Coat the projected portion of carbon steel anchors and nut threads with a heavy coat of clean grease after concrete has cured.
   3. Anchorage location tolerance shall be in accordance with AISC 303.

4. Provide steel or durable wood templates for all column and equipment anchorage.
    a. Templates to be placed above top of concrete and not impede proper concrete placement and consolidation.

B. Unless noted or specified otherwise:
1. Connect aluminum and steel members to concrete and masonry using stainless steel cast-in-place anchorage unless shown otherwise.
    a. Provide dissimilar materials protection per Specification Section 09 96 00.
2. Provide washers for all anchorage.
3. Where exposed, extend threaded anchorage a maximum of 3/4 IN and a minimum of 1/2 IN above the top of the fully engaged nut.
    a. If anchorage is cut off to the required maximum height, threads must be dressed to allow nuts to be removed without damage to the nuts.

C. Do the following after nuts are snug-tightened down:
1. If using post-installed anchorage, follow MPII.
2. Upset threads of anchorage to prevent nuts from backing off.
    a. Provide double nut or lock nut in lieu of upset threads for items that may require removal in the future.
3. For all other cast-in-place anchorage material, tighten nuts down an additional 1/8 turn to prevent nuts from backing off.
4. If two (2) nuts are used per concrete anchor above the base plate, tighten the top nut an additional 1/8 turn to "lock" the two (2) nuts together.
5. If using post-installed anchorage, follow manufacturer’s installation procedures.

D. Assure that embedded items are protected from damage and are not filled in with concrete.

E. Secure architectural components such that it will not be aesthetically distorted nor fasteners overstressed from expansion, contraction or installation.

F. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification Section 09 96 00.

G. Repair damaged galvanized surfaces in accordance with ASTM A780.
1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions and ASTM A780.

H. For post-installed anchors, comply with the MPII on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar.
1. Use hammer drills to create holes.
2. Properly clean out the hole per the ICC-ES reports utilizing a non-metallic fiber bristle brush and compressed air or as otherwise required to remove all loose material from the hole prior to installing the anchor in the presence of the Special Inspector.

3.4 FIELD QUALITY CONTROL

A. Special Inspection:
1. See Section 01 45 33.
2. See Section 03 05 05.

3.5 CLEANING

A. After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings when specified in Specification Section 09 96 00.

END OF SECTION

SECTION 03 21 00
REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing bar requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 05 05 - Concrete Testing and Inspection.
   4. Section 03 15 19 - Anchorage to Concrete.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. SP 66, ACI Detailing Manual.
      b. 117, Specification for Tolerances for Concrete Construction and Materials.
      c. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
      d. 318, Building Code Requirements for Structural Concrete.
      e. 350, Code Requirements for Environmental Engineering Concrete Structures.
   2. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A276, Standard Specification for Stainless Steel Bars and Shapes.
      c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      d. A706, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      e. A970, Standard Specification for Headed Steel Bars for Concrete Reinforcement.
      f. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   3. Concrete Reinforcing Steel Institute (CRSI):
      a. Manual of Standard Practice.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Mill certificates for all reinforcing.
      d. Manufacturer and type of proprietary reinforcing mechanical splices.
   3. Qualifications of welding operators, welding processes and procedures.
   4. Reinforcing number, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and reinforcing supports.
   5. Sufficient reinforcing details to permit installation of reinforcing.
   6. Reinforcing details in accordance with ACI SP 66 and ACI 315.
   7. Locations where proprietary reinforcing mechanical splices are required or proposed for use.

8. Shop Drawings shall be in sufficient detail to permit installation of reinforcing without reference to Contract Drawings.
    a. Shop Drawings shall not be prepared by reproducing the plans and details indicated on the Contract Drawings but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of all reinforcing steel.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Support and store all reinforcing above ground.

B. Ship to jobsite with attached plastic or metal tags with permanent mark numbers which match the Shop Drawing mark numbers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. Reinforcing adhesive anchors:
        a. See Specification Section 03 15 19.
    2. Reinforcing mechanical splices:
        a. Lenton Rebar Splicing by Erico, Inc.
        b. Richmond dowel bar splicer system by Richmond Screw and Anchor Co., Inc.
        c. Bar-Grip Systems by Barsplice Products, Inc.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Reinforcing Bars: ASTM A615, grade 60, deformed.

B. Reinforcing Bars to be Welded: ASTM A706.

C. Welded Wire Reinforcement: ASTM A1064.

D. Smooth Dowel Bars:
    1. Water containing structures: ASTM A276, Type 304.
    2. All other locations: ASTM A36, with metal end cap to allow longitudinal movement equal to joint width plus 1 IN.

E. Proprietary Reinforcing Mechanical Splices: To develop in tension and compression a minimum of 125 PCT of the yield strength of the reinforcing bars being spliced.

F. Headed Deformed Bars:
    1. ASTM A970, Class A.

G. Reinforcing Adhesive Anchors:
    1. See Specification 03 15 19.

2.3 ACCESSORIES

A. Chairs, Runners, Bolsters, Spacers, Hangers, and Other Reinforcing Supports:
    1. Metal fabrications with plastic-coated tips in contact with forms.
        a. Plastic coating meeting requirements of CRSI Manual of Standard Practice.
    2. All plastic construction meeting the requirements of CRSI Manual of Standard Practice.
        a. 100 PCT non-metallic, non-corrosive.
        b. Required for all walls and elevated construction exposed to liquid containing structures.

B. Protective plastic caps at mechanical splices.

2.4 FABRICATION

A. Tolerances:
   1. Conforms to ACI 117, expect as modified herein.
   2. Sheared lengths: +1 IN.
   3. Overall dimensions of stirrups, ties and spirals: +1/2 IN.
   4. All other bends: +0 IN, -1/2 IN.

B. Minimum diameter of bends measured on the inside of the reinforcing bar to be as indicated in ACI 318 Paragraph 7.2.

C. Ship reinforcing to jobsite with attached plastic or metal tags.
   1. Place on each tag the mark number of the reinforcing corresponding to the mark number indicated on the Shop Drawing.
   2. Mark numbers on tags to be so placed that the numbers cannot be removed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Tolerances:
   1. Conform to ACI 117, except as modified herein.
   2. Reinforcing placement:
      a. Clear distance to formed surfaces: +1/4 IN.
      b. Minimum spacing between bars: -1/4 IN.
      c. Top bars in slabs and beams:
         1) Members 8 IN deep or less: +1/4 IN.
         2) Members between 8 IN and 2 FT deep: -1/4 IN, +1/2 IN.
         3) Members more than 2 FT deep: -1/4 IN, +1 IN.
      d. Crosswise of members: Spaced evenly within +1 IN.
      e. Lengthwise of members: +2 IN.
   3. Minimum clear distances between reinforcing bars:
      a. Beams, walls and slabs: Distance equal to bar diameter or 1 IN, whichever is greater.
      b. Columns: Distance equal to 1-1/2 times the bar diameter or 1-1/2 IN, whichever is greater.
      c. Beam and slab reinforcing shall be threaded through the column vertical rebars without displacing the column vertical bars and still maintaining the clear distances required for the beam and slab reinforcing bars.

B. Minimum concrete protective covering for reinforcement: As shown on Drawings.

C. Unless indicated otherwise on Drawings, provide splice lengths for reinforcing as follows:
   1. For reinforcing: Class B splice meeting the requirements of ACI 350.
   2. For welded wire reinforcement:
      a. Splice lap length measured between outermost cross wires of each fabric sheet shall not be less than one (1) spacing of cross wires plus 2 IN, nor less than 1.5 x development length nor less than 6 IN.
      b. Development length shall be as required for the yield strength of the welded wire reinforcement in accordance with ACI 350.
   3. Provide splices of reinforcing not specifically indicated or specified subject to approval of Engineer.
      a. Mechanical proprietary splice connectors may only be used when approved or indicated on the Contract Drawings.

D. Welding:
   1. Welding reinforcing is not permitted.

E. Placing Reinforcing:
1. Assure that reinforcement at time concrete is placed is free of mud, oil or other materials that may affect or reduce bond.
2. Reinforcement with rust, mill scale or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights including heights of deformations on a cleaned sample is not less than required by applicable ASTM specification that governs for the reinforcing supplied.
3. Reinforcing support:
    a. Uncoated reinforcing:
        1) Support reinforcing and fasten together to prevent displacement by construction operations.
            a) Locate and support reinforcement with bar supports to maintain minimum concrete cover.
            b) Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
            c) Reinforcement shown on the Contract Documents may not be repositioned for use a support for reinforcement. Additional drop bars may be provided for support of reinforcing,
        2) Reinforcing supported on ground:
            a) Slab on grade and other members with only one mat of reinforcing:
                (1) Provide metal bar supports with bottom plate.
                (2) Do not use concrete blocks to support slab-on-grade reinforcing.
            b) All other members: Provide supporting concrete blocks or metal bar supports with bottom plate.
        3) Reinforcing supported on formwork:
            a) Concrete surfaces in contact with or over process liquid: All-Plastic chairs, runners and bar supports.
            b) All other formed surfaces:
                (1) Provide plastic-coated metal chairs, runners, bolsters, spacers, hangers and other reinforcing support.
                (2) Only tips in contact with the forms need to be plastic coated.
4. Support reinforcing over cardboard void forms by means of concrete supports which will not puncture or damage the void forms during construction nor impair the strength of the concrete members in any way.
5. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, bars in the upper layers shall be placed directly above bars in the bottom layer with clear distance between layers to be 1 IN.
    a. Place spacer bars at 3 FT maximum centers to maintain the required 1 IN clear distance between layers.
6. Extend reinforcement to within 2 IN of concrete perimeter edges.
    a. If perimeter edge is formed by earth, extend reinforcement to within 3 IN of the edge.
7. To assure proper placement, furnish templates for all column vertical bars and dowels.
8. Do not bend reinforcement after embedding in hardened concrete unless approved by Engineer.
    a. Do not bend reinforcing by means of heat.
9. Do not tack weld reinforcing.
10. Embed reinforcing into hardened concrete utilizing adhesive anchor system specifically manufactured for such installation:
    a. See Specification Section 03 15 19.

3.2 FIELD QUALITY CONTROL

A. Reinforcement Congestion and Interferences:
1. Notify Engineer whenever the specified clearances between bars cannot be met.
2. Do not place any concrete until the Engineer submits a solution to reinforcing congestion problem.

3. Reinforcing may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
4. If bars are moved more than one bar diameter, obtain Engineer's approval of resulting arrangement of reinforcing.
5. No cutting of reinforcing shall be done without written approval of Engineer.

B. Special Inspection:
1. See Section 01 45 33.
2. See Section 03 05 05.

END OF SECTION

SECTION 03 31 30
CONCRETE, MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete materials, strengths and proportioning for concrete work.
   2. Grouting:
      a. Base plates for columns and equipment.
      b. As specified and indicated in the Contract Document.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 05 05 - Concrete Testing and Inspection.
   4. Section 03 11 13 - Formwork.
   5. Section 03 15 19 - Anchorage to Concrete.
   6. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
   7. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. CT-13, Concrete Terminology.
      b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
      c. 212.3R, Chemical Admixtures for Concrete.
      d. 232.2R, Use of Fly Ash in Concrete.
      e. 350, Code Requirements for Environmental Engineering Concrete Structures.
   2. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      c. C94/C94M, Standard Specification for Ready-Mixed Concrete.
      d. C150, Standard Specification for Portland Cement.
      e. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
      f. C192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
      g. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
      h. C227, Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
      i. C494, Standard Specification for Chemical Admixtures for Concrete.
      j. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
      k. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
      l. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
      m. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.

1.3 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI CT-13.

B. Water-Bearing Concrete: Any concrete surface to be in contract with process fluids during normal operation of the facility, including, but not limited to, tank, channels, wet wells and distribution chambers.

C. Supplementary Cementitious Materials (SCM): Fly ash, silica fume and ground granulated blast furnace slag.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's instructions.
      c. Concrete mix designs as required by Specification Section 03 05 05.
      d. Manufacturer and type of proposed admixtures.
      e. Manufacturer and type of proposed non-shrink grout and grout cure/seal compound.
   3. Certifications:
      a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.
      b. Certification that the SCM meet the quality requirements stated in this Specification Section, and SCM supplier's certified test reports for each shipment of SCM delivered to concrete supplier.
      c. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for type and location of concrete construction.
      d. Certification of aggregate gradation.
      e. Certification of coarse aggregate impurities as relates to alkali-silica reactivity per ASTM C33, Appendix X.
      f. Certification of shrinkage test results.
   4. Test reports:
      a. Cement and SCM mill reports for all cement to be supplied.
      b. Provide test results for alkali-silica reactive impurities on coarse aggregates per referenced ASTM standards.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:
   1. Store cement and SCM in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
   2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
   3. Allow natural sand to drain until it has reached a relatively uniform moisture content before use.
   4. Do not use frozen or partially frozen aggregates.
   5. Do not use bottom 6 IN layer of stockpiled material in contact with ground.
   6. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.
      a. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure thorough distribution of ingredients.
      b. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics and performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers are acceptable:
   1. Non-shrink grout:
      a. BASF Corporation.
      b. Euclid Chemical Company.
      c. Five Star Products, Inc.
   2. Epoxy grout:
      a. BASF Corporation.
      b. Five Star Products, Inc.
      c. Euclid Chemical Company.
      d. Sika Corporation.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Cement:
   1. ASTM C150, Type II.
   2. Cement type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

B. SCM:
   1. Fly Ash:
      a. ASTM C618, Class F or Class C.
      b. Non-staining.
      c. Suited to provide hardened concrete of uniform light gray color.
      d. Compatible with other concrete ingredients and having no deleterious effects on the hardened concrete.
      e. Produced by source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
      f. Evaluate and use in accordance with ACI 232.2R.
   2. Cement and SCM type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

C. Admixtures:
   1. Air entraining: ASTM C260.
   2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and provisions of ACI 212.3R.
   3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.
   4. All concrete mixes require the use of water reducers to maintain the specified water-to-cement ratios without additional cement.
   5. SCM: Per above.
   6. Admixtures to be chloride free.
      a. Do not use calcium chloride.
   7. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
   8. Provide admixtures certified by manufacturer to be compatible with other admixtures.
   9. Shrinkage reducing admixtures:
      a. Admixture used to reduce the shrinkage of Portland Cement concrete.
      b. Utilize at dosage necessary to help achieve required shrinkage value stated herein.
      c. Similar to:
         1) Eclipse 4500 by GCP Applied Technologies, Inc.
         2) Conex by Euclid Chemical Co.
         3) MasterLife SRA 20 or MasterLife CRA 007 by BASF Corporation.

D. Water:
   1. Potable.
   2. Clean and free from deleterious substances.
   3. Free of oils, acids and organic matter.

E. Aggregates for Normal Weight Concrete:
   1. ASTM C33.
   2. Fine and coarse aggregates to be regarded as separate ingredients.
   3. Provide aggregates approved for bridge construction by the Department of Transportation of the State the project is located.
   4. Coarse aggregate:
      a. Use only washed aggregates.
      b. Coarse aggregate sieve analysis:
         1) Per Table 1 IN the PART 2 MIXES Article.
   5. Fine aggregates to be natural, not manufactured.
   6. Do not use aggregates that may be deleteriously reactive when combined with alkalis in cement.
      a. Evaluate proposed aggregates for potential deleterious expansion due to alkali silica reactivity per ASTM C33 (Appendix X), ASTM C227, ASTM C1260, ASTM 1293, or ASTM C1567.

F. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight percent of cement in accordance with ASTM C1218:

G. Non-shrink Grout:
   1. Non-shrink, nonmetallic, noncorrosive, and nonstaining.
      a. Conform to ASTM C1107.
   2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
   3. Grout to produce a positive but controlled expansion.
      a. Mass expansion shall not be created by gas liberation or by other means.
   4. Minimum 28 day compressive strength: 7,000 PSI.
   5. Acceptable manufacturers:
      a. BASF Admixtures, Inc. "Masterflow, 713 IN.
      b. Euclid Chemical "NS Grout".
      c. Sika Corporation "Sika Grout 212 IN.
      d. Sauereisen, Inc. "F-100 Level Fill Grout".

H. Epoxy Grout:
   1. Three-component epoxy resin system:
      a. Two (2) liquid epoxy components.
      b. One (1) inert aggregate filler component.
   2. Adhesive acceptable manufacturers:
      a. BASF “Masterflow 648 IN.
      b. Five Start Products, Inc. "DP Five Start Epoxy Grout."
      c. Euclid Chemical "E3-G."
      d. Sika "Sikadur Hi-Mod."
   3. Aggregate acceptable manufacturers:
      a. BASF “Masterflow 648 IN.
      b. Five Start Products, Inc. "DP Five Start Epoxy Grout."
      c. Euclid Chemical "Euclid aggregate."
      d. Sika aggregate.
   4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
   5. The aggregate shall be compatible with the adhesive.
   6. Each component furnished in separate package for mixing at jobsite.

I. See Specification Section 03 31 31 for Grout Schedule of use.

2.3 MIXES

A. General:
   1. Provide concrete capable of being placed without aggregate segregation and, when cured, of developing all properties specified.
   2. Ready-mixed concrete shall conform to ASTM C94/C94M.
   3. All concrete to be normal weight concrete, weighing approximately 145 to 150 LBS per cubic foot at 28 days after placement.

B. Concrete Mixes: Refer to Table 1 below.

C. Air Entrainment:
   1. Provide air entrainment in concrete resulting in a total air content percent by volume per Table 1 below.
      a. Adjust dosage rate as necessary to compensate for shrinkage reducing admixtures.

D. Slump:
   1. Measure slump at point of discharge into concrete members.
   2. Walls and columns:
      a. 8 IN maximum, 4 IN minimum measured at the point of discharge into the concrete member.
      b. Slump shall be obtained by use of mid-range or high-range water reducer conforming to ASTM C494.
   3. All other members:
      a. Concrete using a water reducer per ASTM C494: 8 IN maximum, 4 IN minimum measured at the point of discharge into the concrete member.
      b. Concrete without a water reducer per ASTM C494: 5 IN maximum, 1 IN minimum measured at point of discharge into the concrete member.
   4. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
   5. Provide additional water or water reducing admixture at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping.
      a. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ration is not exceeded.
   6. Slump may be adjusted in the field through the use of water reducers.
      a. Coordinate dosage and mixing requirements with concrete supplier.
   7. Slump tolerances shall comply with the requirements of ACI 117.

E. Proportioning:
   1. General:
      a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
      b. Proportion ingredients to produce proper placability, durability, strength and other required properties.
   2. Normal weight concrete target cementitious materials contents and maximum water cementitious ratios per Table 1 below.
      a. Target cementitious materials contents are intended to provide a crack free, durable finished product, not one with excessive strength
   3. SCM:
      a. Fly ash:
         1) For cast-in-place concrete only, a maximum of 25 PCT by weight of Portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
         2) If fly ash is used, the water to fly ash plus cement ratio not to exceed the maximum water cement ratio specified in this Specification Section.

4. Water reducing, retarding, and accelerating admixtures:
    a. Use in accordance with manufacturer's instructions.
    b. Add to mix at batching plant.
    c. Use water-reducing or high-range water reducing admixture in concrete, as required, for placement and workability.
        1) Water reducers are required to maintain specified maximum water to cement ratios.
5. High range water reducers (superplasticizers):
    a. Use required for:
        1) All concrete to be pumped except slabs on grade.
        2) All concrete for water containing structures.
        3) Other concrete members at Contractor's option.
    b. Use required for all non-pumped concrete except slabs on grade and foundations.
    c. Maximum concrete slump before addition of admixture to be 3 IN maximum slump after addition to be 8 IN.
    d. Reference Specification Section 03 31 31 for additional requirements.
6. Concrete mix proportioning methods for normal weight concrete:
    a. Method 1:
        1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
        2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three (3) different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.
        3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5 PCT specified.
        4) For each water cement ratio or cement content, make at least three (3) trial strength tests for specified test age, and cure in accordance with ASTM C192.
            a) Cylinder size: Per ASTM C31.
            b) Test for strength at 28 days in accordance with ASTM C39.
                (1) Quantity of cylinders per trial strength test:
                    (a) 6 IN DIA cylinders: Two (2).
                    (b) 4 IN DIA cylinders: Three (3).
        5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.
        6) From this curve select water cement ratio or cement content to be used to produce required average strength.
        7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.
        8) Base field control on maintenance of proper cement content, slump, air content and water cement ratio.
        9) See paragraph hereafter for definition of required average strength.
    b. Method 2:
        1) In lieu of trial mixes, field test records for concrete made with similar ingredients may be used.
        2) Use of proposed concrete mix proportions based on field test records subject to approval by Engineer based on information contained in field test records and demonstrated ability to provide the required average strength.
        3) Field test records to represent materials, proportions and conditions similar to those specified.
            a) Changes in the materials, proportions and conditions within the test records shall have not been more restricted than those for the proposed concrete mix.
            b) Field test records shall meet the requirements of ACI 350 Paragraph 5.3.
        4) Required concrete proportions may be established by interpolation between the strengths and proportions of two (2) or more test records each of which meets the requirements of this Specification Section.

7. Required average strength to exceed the specified 28 day compressive strength by the amount determined or calculated in accordance with ACI 350, Chapter 5 using the standard deviation of the proposed concrete production facility as described in ACI 350, Chapter 5.

F. Flowable Fill, Controlled Low-Strength Material (CLSM):
   1. A mixture of cement, fly ash, fine sand, water and air having a consistency which will flow under a very low head.
   2. Flowable Fill and Controlled Low-Strength Material are synonymous.
   3. Approximate quantities of each component per cubic yard of mixed material:
      a. Cement (Type I or II): 50 LBS.
      b. Fly ash: 200 LBS.
      c. Fine sand: 2,700 LBS.
      d. Water (approximate): 420 LBS.
      e. Air content (approximate): 10 PCT.
   4. Actual quantities shall be adjusted to provide a yield of 1 CY with the materials used.
   5. Approximate compressive strength should be 85 to 175 PSI.
   6. Fine sand shall be an evenly graded material having not less than 95 PCT passing the No. 4 sieve and not more than 5 PCT passing the No. 200 sieve.

G. Allowable Shrinkage:
   1. Per Table 1 when tested in accordance with ASTM C157 at 28 Days.
   2. Continue testing to 64 weeks for informational purposes.

TABLE 1

TYPE OF CONCRETE	28 DAY COMPRESSIVE STRENGTH	W/C RATIO	TARGET TOTAL CEMENT	SCM	ASTM C33 Size No.	AIR CONTENT	ALLOWABLE SHRINKAGE LIMIT
Normal weight lean concrete	3000 PSI	0.45	517	Note 1	7	5-1/2 to 8	None
Normal weight concrete fill utility encasement concrete	3000 PSI	0.45	517	Note 1	57	4-1/2 to 7-1/2	None
Normal weight water-bearing concrete	4500 PSI	0.42	564	Note 1	57	4-1/2 to 7-1/2	0.032 PCT
Normal weight all other concrete	4000 PSI	0.45	564	Note 1	57	4-1/2 to 7-1/2	0.048 PCT

Table 1 Notes:
1. If fly ash is proposed for use, the weight of fly ash plus weight of Portland cement shall be used to meet total target cement requirement.

2.4 SOURCE QUALITY CONTROL

A. To assure stockpiles are not contaminated or materials are segregated, perform any test for determining conformance to requirements for cleanness and grading on samples secured from aggregates at point of batching.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Special Inspection:
   1. See Specification Section 01 45 33.
   2. See Specification Section 03 05 05.

B. Perform concrete tests per Specification Section 03 05 05.
   1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
      a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.

END OF SECTION

SECTION 03 31 31
CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mixing, placing, jointing, and curing of concrete construction.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 05 05 - Concrete Testing and Inspection.
   4. Section 03 11 13 - Formwork.
   5. Section 03 21 00 - Reinforcement.
   6. Section 03 31 30 - Concrete, Materials and Proportioning.
   7. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
   8. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. CT-13, Concrete Terminology.
      b. 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
      c. 304.2R, Placing Concrete by Pumping Methods.
      d. 305.1, Specification for Hot Weather Concreting.
      e. 306.1, Standard Specification for Cold Weather Concreting.
      f. 308.1, Specification for Curing Concrete.
      g. 309R, Guide for Consolidation of Concrete.
      h. 350, Code Requirements for Environmental Engineering Concrete Structures.
      i. 360R, Guide to Design of Slabs-on-Ground.
   2. ASTM International (ASTM):
      a. C94/C94M, Standard Specification for Ready-Mixed Concrete.
      b. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      c. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
      d. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
      e. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
      f. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   3. Corps of Engineers (COE):
      a. CRD-C572, Specifications for Polyvinylchloride Waterstop.
   4. National Ready Mixed Concrete Association (NRMCA):
      a. Checklist for Certification of Ready Mixed Concrete Production Facilities.
   5. NSF International (NSF).

B. Qualifications:
   1. Ready Mixed Concrete Batch Plant: Certified by NRMCA.
   2. Waterstop manufacturer's representative shall provide on-site training of waterstop installation, field splicing, welding and inspection procedures prior to construction, and at no additional cost.

1.3 DEFINITIONS

A. Words and terms used in this Specification Section are defined in ACI CT-13.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
         1) Procedure for adding high-range water reducer at the jobsite.
      c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction joints, control joints, expansion joints (as applicable) and joint profile dimensions for each joint type.
      d. Manufacturers and types:
         1) Joint fillers.
         2) Curing agents.
         3) Construction joint bonding adhesive.
         4) Waterstops.
   3. Certifications:
      a. Ready mix concrete plant certification.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Copies of concrete delivery tickets.
   3. Description of proposed curing methods.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Concrete Delivery:
   1. Prepare a delivery ticket for each load of ready mixed concrete.
   2. Truck operator shall hand ticket to Contractor at the time of delivery.
   3. Ticket to show:
      a. Mix identification.
      b. Quantity delivered.
      c. Amount of material in each batch.
      d. Outdoor temperature in the shade.
      e. Time at which cement was added.
      f. Time of delivery.
      g. Time of discharge.
      h. Amount of water that may be added at the site without exceeding the specified water-cement ratio.
      i. Amount of water added at the site.

1.6 PROJECT CONDITIONS

A. Adjust concrete mix design when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
   1. Do not use revised concrete mixes until submitted to and approved by Engineer.

1.7 SEQUENCING AND SCHEDULING

A. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
   1. Approval of concrete mix design does not relieve Contractor of his responsibility to provide concrete that meets the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Subject to compliance with the Contract Documents, the manufacturers listed in this article are acceptable.

B. Neoprene Expansion Joint Fillers:
   1. Acceptable manufacturers:
      a. Permaglaze.
      b. Rubatex.
      c. Williams Products.
   2. Materials:
      a. Closed cell neoprene.
      b. ASTM D1056, Type 2, Class A or C.
      c. Grade: Compression deflection as required to limit deflection to 25 PCT of joint thickness under pressure from concrete pour height.

C. Asphalt Expansion Joint Fillers:
   1. Acceptable manufacturers:
      a. W.R Meadows.
      b. J and P Petroleum Products.
   2. Materials: ASTM D994.

D. Fiber Expansion Joint Fillers:
   1. Materials: ASTM D1751.

E. Waterstops, PVC Type:
   1. Acceptable manufacturers:
      a. Greenstreak Plastic Products.
      b. W.R Meadows.
      c. Vinylex Corporation.
      d. Bometals, Inc.
   2. Materials:
      a. Virgin polyvinyl chloride compound not containing any scrap or reclaimed materials or pigment.
      b. Cast-in-place type: COE CRD-572.
   3. Approved profiles as listed.
      a. Construction joints:
         1) Ribbed: 6 IN wide by 3/8 IN.
         2) Greenstreak Plastic Products Style #679, or equal.
      b. In joints noted on Drawings:
         1) 4 IN wide by 3/16 IN thick bulb type.
         2) Greenstreak Plastic Products Style #701.
      c. Control joints:
         1) 6 IN wide by 3/8 IN thick with ribs and center bulb.
         2) Greenstreak Plastic Products Style #705, or equal.
      d. Expansion joint:
   4. In expansion joints:
      a. 6 IN wide by 1/8 IN thick tear web type waterstop.
      b. 2 IN minimum horizontal movement without rupturing.
      c. Greenstreak Plastic Products Style #698.
      d. 9 IN by 3/8 IN, with center bulb 3/4 IN ID, 1-1/4 OD.
         1) Greenstreak Plastic Products Style #718, or equal.
   5. Provide factory-made waterstop fabrications at all changes in direction, intersections and transitions, leaving only straight butt splices for the field. Butt welds to be a minimum 6 IN from the intersection.

6. Factory prepunched (12 IN centers, each edge) for wire supports.
    a. Provide hog rings or grommets at maximum 12 IN OC along the length of the waterstop at Contractor's option.
7. See Drawings for application and other requirements.

F. Waterstops, Preformed Strip Type:
1. Acceptable manufacturers:
    a. Greenstreak Plastics, Inc. (Hydrotite).
    b. Adeka Ultra Seal USA (MC-2010MN).
    c. DeNeef (Swellseal Plus).
2. Hydrophilic, nonbentonite composition.
3. Manufactured solely for the purpose of preventing water from traveling through construction joints.
4. Volumetric expansion limited to 3 times maximum.
5. See Drawings for application and other requirements.

G. Water Swelling Sealant:
1. Compatible with strip-type waterstop.
2. Single component, gun applied.
3. Moisture cured.
4. Minimum 70 PCT volumetric expansion swelling capability.

H. Curing Products to conform to one or more of the following:
1. Absorbent Covers.
2. Moisture Retaining Covers.
    a. Moisture Retaining Fabric.
3. Dissipating curing compound:
    a. Fugitive dye, waterborne, membrane-forming.
    b. ASTM C309, Type 1D, Class A or B, shall be composed of hydrocarbon resins, and dissipating agents that begin to break down upon exposure to UV light, and traffic, approximately four to six weeks after applications, providing a film that is removable with standard degreasing agents, and mechanized scrubbing actions so as to not impair the later addition and performance of applied finishes.
    c. Acceptable Products:
        1) Dayton Superior Corporation; Day Chem Rez Cure (J-11-WD).
        2) Euclid Chemical Company (The); Kurez DR VOX.
        3) L&M Construction Chemicals, Inc.; L&M Cure R.
4. Clear, water-borne, membrane-forming curing and sealing compound:
    a. ASTM C1315, Type 1, Class A.
    b. Moisture loss shall be not more than 0.40 Kg/m^2 when applied at 300 SQFT/GAL.
    c. Manufacturer's certification is required.
    d. Subject to project requirements, provide one of the following products:
    e. Products:
        1) Euclid Chemical Company (The); Super Diamond Clear VOX.
        2) L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
        3) Meadows, W.R., Inc.; Vocomp-30.

I. Sand cement grout, non-shrink grout and epoxy grout: See Specification Section 03 31 30.

2.2 SOURCE QUALITY CONTROL

A. The concrete plant shall conform to the Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:
   1. Complete formwork.
      a. See Specification Section 03 11 13.
   2. Remove earth, snow, ice, water, and other foreign materials from areas that will receive concrete.
   3. Secure reinforcement in place.
      a. See Specification Section 03 21 00.
   4. Position expansion joint material, anchors and other embedded items.
   5. Obtain approval of reinforcement erection and placement prior to placing concrete.
   6. Do not place concrete during rain, sleet, or snow, unless adequate protection is provided and approval is obtained.
      a. Plan size of crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete as required to obtain good surfaces and avoid unplanned cold joints.
      b. Do not allow rainwater to increase mixing water nor to damage surface finish.
   7. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment and formwork.
   8. Provide slabs and beams of minimum indicated required depth when sloping structural foundation base slabs and elevated slabs to drains.
      a. For floor slabs on grade, slope top of subgrade to provide slab of required uniform thickness.

B. Preparation of Subgrade for Slabs On Ground:
   1. Subgrade to be wetted without standing water immediately prior to placing concrete.
   2. Obtain approval of subgrade compaction density prior to placing slabs on ground.

C. Edge Forms and Screeds:
   1. Set accurately to produce designated elevations and contours of finished surface.
   2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
   3. Use strike off templates, or approved vibrating type screeds, to align concrete surfaces to contours of screed strips.

3.2 CONCRETE MIXING

A. General:
   1. Provide all concrete from a central plant conforming to Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.
   2. Batch, mix, and transport in accordance with ASTM C94/C94M.

B. Control of Admixtures:
   1. Control at the batch plant:
      a. All admixtures to be introduced at the batch plant in accordance with manufacturer's recommendations.
      b. Charge admixtures into mixer as solutions.
         1) Measure by means of an approved mechanical dispensing device.
         2) Liquid considered a part of mixing water.
         3) Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
      c. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
      d. Complete addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.

2. Control of Admixtures in the field:
    a. Additional quantities of admixtures (with the exception of retarders) may be added in the field provided:
        1) Addition of admixtures shall be under the supervision of the ready mix quality control representative.
        2) Addition of each admixture to be documented on the delivery ticket.
        3) Provide additional mixing per ASTM C94.

C. Tempering and Control of Mixing Water:
1. Mix concrete only in quantities for immediate use.
2. Discard concrete which has set.
3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in ASTM C94/C94M.
4. Addition of water at the jobsite:
    a. See Specification Section 03 31 30 for specified water cement ratio and slump.
    b. Do not exceed maximum specified water cement ratio or slump.
    c. Incorporate water by additional mixing equal to at least half of total mixing required.

3.3 PLACING OF CONCRETE

A. General:
1. Place concrete as such a rate that concrete, which is being integrated with fresh concrete, is still workable.
    a. Select placement equipment and manpower in order to assure timely delivery of concrete into forms to avoid cold joints and placement issues.
2. Comply with ACI 304R and ACI 304.2R.
3. Do not begin placing concrete during rain, sleet, or snow.
    a. Protect fresh concrete from ensuing inclement weather.
4. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
5. Begin work only when work of other trades affecting concrete is complete.
6. Deposit concrete:
    a. Continuously to avoid cold joints.
7. Locate construction joints at locations approved by Engineer.
    a. Plan size of crews with due regard for effects of concrete temperature and atmosphere conditions to avoid unplanned cold joints.
8. Spreaders:
    a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
    b. Embedded:
        1) Obtain approval of Engineer.
        2) Materials: Concrete or metal.
        3) Ends of metal spreaders coated with plastic coating 2 IN from each end.
9. Deposit concrete as nearly as practicable in its final position to avoid segregation.
    a. Maximum free fall: 4 FT.
    b. Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 4 FT of surface placed upon.
10. Perform the following operations before bleeding water has an opportunity to collect on surface:
    a. Spread.
    b. Consolidate.
    c. Straightedge.
    d. Darby or bull float.
11. No water shall be added to the concrete surface to ease finishing operation.

B. Cold Weather Concrete Placement:
1. Comply with ACI 306.1.
2. Do not place concrete on subgrade that are below 32 DEGF or contain frozen material.

3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
4. Temperature of concrete when discharged at site: Per ACI 306.1.
5. Heat subgrade forms, embedments and reinforcement to between 45 and 70 DEGF, when temperature of surrounding air is 40 DEGF or below at time concrete is placed.
    a. Remove all frost from subgrade, forms and reinforcement before concrete is placed.
6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 DEGF.
7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 DEGF.
8. Follow ACI 360R-10 for specific requirements dealing with elevated steel troweled slabs that will be exposed to freeze-thaw cycles.

C. Hot Weather Concrete Placement:
1. Comply with ACI 305.1.
2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
3. Temperature of concrete at point of delivery (i.e. truck discharge) when placed:
    a. Not to exceed 90 DEGF.
    b. Not so high as to cause:
        1) Shrinkage cracks.
        2) Difficulty in placement due to loss of slump.
        3) Flash set.
4. Temperature of forms and reinforcing when placing concrete:
    a. Not to exceed 90 DEGF.
    b. May be reduced by spraying with water to cool below 90 DEGF.
        1) Leave no standing water to contact concrete being placed.
5. Prevent plastic shrinkage cracking and/or slab curling due to evaporation.

D. Consolidating:
1. Consolidate in accordance with ACI 309R except as modified herein.
2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.
    a. Eliminate:
        1) Air or stone pockets.
        2) Honeycombing or pitting.
        3) Planes of weakness.
3. Use suitable form vibrators located just below top surface of concrete, where internal vibrators cannot be used in areas of congested reinforcing.
    a. Size and coordinate external vibrators to specifically match forming system used.
4. Internal vibrators:
    a. Minimum frequency of 8000 vibrations per minute.
    b. Insert and withdraw at points approximately 18 IN apart.
        1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.
    c. Use in:
        1) Beams and girders of framed slabs.
        2) Columns and walls.
        3) Vibrating concrete around all waterstops.
    d. Size of vibrators shall be in accordance with ACI 309R, Table 5.1.5.
5. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or other approved means.
6. Do not use vibrators to transport concrete within forms.
7. Provide spare vibrators on jobsite during all concrete placing operations.

8. Bring a full surface of mortar against form by vibration supplemented if necessary by spading to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
9. Prevent construction equipment, construction operations, and personnel from introducing vibrations into freshly placed concrete after the concrete has been placed and consolidated.

E. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or loss of ingredients and in a manner which will assure that required quality of concrete is maintained.
   1. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94/C94M.
   2. Horizontal belt conveyors:
      a. Mount at a slope which will not cause segregation or loss of ingredients.
      b. Protect concrete against undue drying or rise in temperature.
      c. Use an arrangement at discharge end to prevent segregation.
      d. Do not allow mortar to adhere to return length of belt.
      e. Discharge conveyor runs into equipment specially designed for spreading concrete.
   3. Metal or metal lined chutes:
      a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.
      b. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
      c. Provide end of each chute with a device to prevent segregation.
   4. Pumping or pneumatic conveying equipment:
      a. Designed for concrete application and having adequate pumping capacity.
      b. Control pneumatic placement so segregation is avoided in discharged concrete.
      c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 IN.
      d. Do not convey concrete through pipe made of aluminum or aluminum alloy.
      e. Provide pumping equipment without Y sections.

3.4 JOINTS AND EMBEDDED ITEMS

A. Construction Joints - General:
   1. Locate joints as indicated on Contract Drawings or as shown on approved Shop Drawings.
      a. Where construction joint spacing shown on Drawings exceeds the joint spacing indicated in Paragraph B. below, submit proposed construction joint location in conformance with this Specification Section.
   2. Unplanned construction joints will not be allowed.
      a. If concrete cannot be completely placed between planned construction joints, then it must be removed.
   3. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam.
   4. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise.
      a. At Contractor's option, beam pockets may be formed into concrete walls.
      b. Size pockets to allow beam reinforcing to be placed as detailed on Drawings.
   5. Place beams, girders, column capitals and drop panels at same time as slabs.
   6. Place corbels monolithically with walls.
      a. Locate wall vertical construction joints midway between corbels.
      b. Where only a single corbel is located place it also monolithically with wall and locate wall vertical construction joint a minimum of 3 FT from face of corbel.
   7. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints.
   8. Provide the following joints unless noted otherwise on Drawings:
      a. Roughen joints: horizontal construction joints.
      b. Keyed joints: vertical construction joints.

9. Roughen construction joints:
    a. Clean the previously hardened concrete interface and remove all laitance.
    b. Intentionally roughen the interface to a full amplitude of 1/4 IN.
10. Minimum time before placement of adjoining concrete construction:
    a. All concrete: 72 HRS.

B. Construction Joints - Spacing Unless Otherwise Specified:
1. Structures not intended to contain liquid:
    a. Wall vertical construction joints:
        1) 50 FT maximum centers.
        2) At wall intersections, 4 FT minimum from corner.
    b. Base slab, floor, and roof slab construction joints:
        1) Placements to be approximately square and not to exceed 2500 SQFT.
        2) Maximum side dimension of a slab pour to be 70 FT.
2. Water retaining structures:
    a. Wall vertical construction joints:
        1) 30 FT maximum centers.
        2) At wall intersections, 10 FT minimum from corner.
    b. Floor slab, construction joints:
        1) Placements to be approximately square and not to exceed 2000 SQFT.
        2) Maximum side dimension of a slab pour to be less than:
            a) Twice the length of the short side.
            b) 60 FT.

C. Construction Joints - Bonding:
1. Obtain bond between concrete pours at construction joints by thoroughly cleaning and removing all laitance from construction joints.
2. Before new concrete is placed, all construction joints shall be coated with cement grout, or dampened, as outlined below:
3. Roughen construction joints:
    a. Roughen the surface of the concrete to expose the coarse aggregate uniformly with 1/4 IN minimum amplitude.
        1) Remove laitance, loosened particles of aggregate or damaged concrete at the surface, or at the Contractor's option, use an approved chemical retarder which delays but does not prevent setting of the surface of the mortar in accordance with the manufacturer's recommendations.
            a) Retarded mortar shall be removed within 24 HRS after placing to produce a clean exposed aggregate bonding surface.
    b. Dampen the hardened concrete immediately prior to placing of fresh concrete or grout.
4. Keyed construction joints:
    a. Thoroughly clean construction joints and remove all laitance.
    b. Dampen the hardened concrete immediately prior to placing of fresh concrete.

D. Slab On Grade Joints:
1. Locate construction and control joints in slabs on grade as indicated on Drawings.
2. Time cutting properly with set of concrete, if saw cut joints are required or permitted.
    a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.
    b. Complete before shrinkage stresses become sufficient to produce cracking.

E. Expansion Joints:
1. Do not permit reinforcement or other embedded metal items bonded to concrete (except smooth dowels bonded on only one side of joint) to extend continuously through an expansion joint.
2. Use neoprene expansion joint fillers, unless noted otherwise on Drawings.
3. Seal expansion joints as shown on Drawings.
    a. See Specification Section 07 92 00 for requirements.

F. Waterstops - General:
1. Waterstop to be continuous with splices in accordance with manufacturer's instructions and create water tight joints.
2. Do not mix different types of waterstop materials in the same structure without specific approval from the Engineer unless shown on Drawings.
3. Preformed strip type:
   a. Locate waterstop at center of wall, unless noted otherwise on Drawings.
      1) Maintain at least 3 IN from edge of concrete.
   b. Install in a bed of swelling sealant on smooth surface of hardened concrete by use of nails, adhesive or other means as recommended by manufacturer to prevent movement of waterstop during placement of concrete.
   c. Roughened joints shall be especially prepared during concrete placement to provide smooth surface for proper water stop installation.
   d. Use in joints against existing concrete where indicated on Drawings.
4. PVC waterstops:
   a. Position waterstop accurately in joints, with adequate clearance from all reinforcing.
   b. Secure waterstops in correct position using hog rings or grommets spaced 24 IN maximum staggered along each edge full length and passed through the edge of the waterstop.
      1) Tie wire to adjacent reinforcing.
   c. Hold horizontal waterstops in place with continuous supports.
   d. Install according to manufacturer's instructions.
      1) Do not displace reinforcement from required location.
   e. Splice ends and intersections with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions.
      1) Use factory fabricated "T" and corner intersection fittings.
      2) Field splice straight runs of material.
   f. Unless otherwise noted, use for all construction joints in new construction for all structures indicated on Drawings.

G. Other Embedded Items:
1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to initiating concreting.
   a. Give Contractor whose work is related or integral to concrete, or supported by it, ample notice and opportunity to furnish and install items before placing concrete.
2. Do not route electrical conduit, drains, or pipes in concrete slabs, walls, columns, foundations, beams or other structural members unless approved by Engineer.

H. Placing Embedded Items:
1. Support against displacement.
2. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
3. Provide adequate means for anchoring waterstop in concrete.
   a. Provide means to prevent waterstops in the forms from being folded over by the concrete as it is placed.

3.5 FINISHING

A. See Specification Section 03 35 00.

B. Coordinate mixing and placing with finishing.

3.6 INSTALLATION OF GROUT

A. Grout Schedule of Use:
1. Non-shrinking non-metallic grout:
   a. Filling form tie holes.
   b. Under column and beam base plates.
   c. Other uses indicated on the Drawings.

2. Epoxy grout:
    a. Patching cavities in concrete.
    b. Grouting of dowels and anchor bolts into existing concrete.
    c. Grouting of equipment base plates where driving motor is 500 HP and above.
    d. Other uses indicated on the Drawings.

B. Grout Installation:
1. Non-shrink non-metallic grout:
    a. Clean concrete surface to receive grout.
    b. Saturate concrete with water for 24 HRS prior to grouting.
    c. Mix in a mechanical mixer.
    d. Use no more water than necessary to produce flowable grout.
    e. Place in accordance with manufacturer's instructions.
    f. Provide under beam, column, and equipment base plates, in joints between precast concrete filter slabs, and in other locations indicated on the Drawings.
    g. Completely fill all spaces and cavities below the top of base plates.
    h. Provide forms where base plates and bed plates do not confine grout.
    i. Where exposed to view, finish grout edges smooth.
    j. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
    k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.
2. Epoxy grout:
    a. Mix and place in accordance with manufacturer's instructions.
    b. Apply only to clean, dry, sound surface.
    c. Completely fill all cavities and spaces around dowels and anchors without voids.
    d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.
    e. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.7 CURING AND PROTECTION

A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury immediately after placement, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.
1. Follow recommendations of ACI 308.1 except as modified herein.
2. All traffic shall be kept from the surface as necessary to protect the concrete but not less than the first 48 HRS of curing.

B. For surfaces of non-water bearing structures, apply one of the following curing procedures immediately after completion of placement and finishing (surfaces not in contact with forms).
1. Ponding or continuous sprinkling. Take care to avoid eroding the surface of freshly placed concrete.
2. Application of wet Absorbent Covers:
    a. Minimum lap: 12 IN.
    b. Provide continuous uniform supply of moisture, such as sprinklers or soaker hoses as required to keep concrete surface continuously wet.
    c. Monitor Absorbent Covers as required to prevent cover materials or concrete surface from drying out.
3. Application of sand kept continuously wet.
4. Continuous application of steam (not exceeding 150 DEGF) or mist spray.
5. Application of Moisture Retaining Cover sheet materials.
    a. Place as soon as possible after final finishing and without marring the surface.
    b. Minimum lap: 12 IN.
    c. Seal all edges to make water-tight.
    d. Place Moisture Retaining Cover in intimate contact with the concrete surface, without wrinkles and weighted to hold in place.

e. Hold cover and edges in place as required to prevent wind from displacing the cover.
f. Moisture Retaining Fabric:
    1) Install in accordance with manufacturer's written recommendations.
    2) Saturate concrete surface and fabric side of cover immediately prior to placing.
g. Monitor continuously during the curing period:
    1) Repair any holes, tears or displaced cover.
    2) Rewet as required to keep concrete moist under cover.

6. Application of other moisture retaining covering as approved by Engineer.
7. Water used for curing shall be within 20 DEGF of the concrete temperature.
8. Application of a curing compound.
    a. Apply curing compound in accordance with manufacturer's recommendations immediately after any water sheen, which may develop after finishing, has disappeared from concrete surface.
    b. Do not use on any surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.
    c. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two coats of the curing compound.
        1) Apply the first coat of curing compound to a vertical surface immediately after form removal.
        2) The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.
        3) Allow the preceding coat to completely dry prior to applying the next coat.
        4) A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.
    d. Curing compounds used in water treatment plant construction shall be non-toxic and taste and odor free, and NSF approved.
        1) Alternately, all tank surfaces shall be cleaned to remove non-NSF approved curing compound without damaging the concrete finish.
9. Surfaces In Contact with Forms:
    a. Formed surfaces: Cure formed concrete surfaces utilizing final curing methods per ACI 308.1, including underside of beams, supported slabs, and other similar surfaces,
        1) See Section 03 11 13.
    b. Minimize moisture loss from and temperature gain of concrete placed in forms exposed to heating by sun by keeping forms wet and cool until they can be safely removed.
    c. Make provisions to keep concrete wall moist while stripping forms and until curing measures are in place.
    d. After form removal, cure concrete until end of time prescribed.
    e. Use one of the methods listed above.
    f. Forms left in place shall not be used as a method of curing in hot weather.
    g. The term "hot weather", where used in these specifications, is defined in ACI 305.1.
    h. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete.

C. For Surfaces of Water Bearing Structures:
1. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury immediately after placement, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.
    a. Follow recommendations of ACI 308.1 except as modified herein.
    b. Use Evaporation Retardant to reduce surface moisture evaporation of slabs during concrete placement. Comply with all the manufacturer's instructions of use as required to obtain the intended results.
2. Apply one of the following moist curing procedures immediately after completion of placement and finishing, for concrete surfaces not in contact with forms.
    a. Ponding or continuous sprinkling.
    b. Application of absorptive mats or fabric kept continuously wet and in intimate contact with concrete.

c. Surfaces shall be covered with a double layer of absorptive mats or fabric, wetted before placing, and overlapped at least 6 IN.
d. Application of sand kept continuously wet.
e. Continuous application of steam (not exceeding 150 DEGF) or mist spray.
f. Ponding and sprinkling in conjunction with application of waterproof sheet materials, conforming to ASTM C171 and only with a program as approved by the Engineer that will keep the surface continuously wet.
g. Ponding and sprinkling in conjunction with application of other moisture retaining covering as approved and only with a program as approved by the Engineer that will keep the surface continuously wet.

3. After seven full days of moist curing, application of a curing compound conforming to ASTM C309 may be substituted for moist curing.
    1) Apply curing compound in accordance with manufacturer's recommendations immediately after any water sheen which may develop during moist curing has disappeared from concrete surface.
    2) Do not use on any surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.
    3) Where a surface is cured with a curing compound, the surface shall be covered with a minimum of two coats of the curing compound, 30 MILS thick each coat.
        a) Apply the first coat of curing compound immediately after form removal or discontinued moist curing and before the surface displays water loss. Apply in one direction only, covering uniformly to a minimum thickness of 30 MILS.
        b) The concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.
        c) Allow the preceding coat to completely dry prior to applying the next coat.
        d) Apply second coat in direction perpendicular to the first coat application direction, covering uniformly to a minimum thickness of 30 MILS.
    4) Curing compounds used in water treatment plant construction shall be non-toxic and taste and odor free and be NSF approved.
        a) Alternately, all tank surfaces shall be cleaned to remove non-NSF approved curing compound without damaging the concrete finish.
4. Curing Concrete In Contact with Forms:
    a. Minimize moisture loss of concrete placed in forms by keeping forms wet and cool until they can be safely removed.
    b. Moist cure the top surface of concrete placed in forms as specified.
    c. After form removal, cure concrete until end of time prescribed.
        1) Use one of methods listed above.
        2) When approved by the Engineer, placement of the second pour at joints may occur prior to the end of the curing period.
    d. Forms left in place shall not be used as a method of curing in hot weather.
    e. The term "hot weather", where used in these specifications, is defined in ACI 305R.
    f. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete and commence moist curing as specified.

D. Curing Period:
1. Continue curing for at least seven days for all concrete except Type III, high early strength concrete for which period shall be at least three days.
    a. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is seven days old, provided concrete is not permitted to become surface dry during transition.

E. Cold Weather:
1. Follow recommendations of ACI 306.1.
2. Maintain temperature of concrete per ACI 306.1 for a minimum of 72 HRs after concrete is placed, when outdoor temperature is 40 DEGF, or less.

a. Maximum temperature rate of decrease: Per ACI 306.1.

3. Use heating, covering, insulating, or housing of the concrete work to maintain required temperature without injury due to concentration of heat.
4. Do not use combustion heaters unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
5. Interior slabs in areas intended to be heated shall be adequately protected so that frost does not develop in the supporting subgrade.

F. Hot Weather:
1. Follow recommendations of ACI 305.1 and ACI 308.1.
2. Make provision for cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.
4. Maximum temperature rate of decrease: Per ACI 305.1.

G. Rate of Temperature Change:
1. Keep changes in temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing period.

H. Protection from Mechanical Injury:
1. Protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
3. Do not load self-supporting structures in such a way as to overstress concrete.

3.8 FIELD QUALITY CONTROL

A. Special Inspection:
1. See Section 01 45 33.
2. See Section 03 05 05.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete finishing and repair of surface defects.
2. Chemical Sealers.
3. Polymer Modified Cementitious Coating.
4. Resurfacing Mortar.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. Section 03 11 13 - Formwork.
4. Section 03 31 30 - Concrete, Materials and Proportioning.
5. Section 03 31 31 - Concrete Mixing, Placing, Jointing and Curing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. American Concrete Institute (ACI):
   a. CT-13, Concrete Terminology.
   b. 117, Specification for Tolerances for Concrete Construction and Materials.
   c. 303R, Guide to Cast-in-Place Architectural Concrete Practice.
   d. 308, Standard Practice for Curing Concrete.
2. ASTM International (ASTM):
   a. C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
   b. C150, Standard Specification for Portland Cement.
   c. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   d. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   e. C666, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
   f. C779, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
   g. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
   h. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
   i. D4259, Standard Practice for Abrading Concrete.
   j. E1155, Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers.
   k. E1486, Standard Test Method for Determining Floor Tolerances Using Waviness, Wheel Path and Levelness Criteria.
3. International Concrete Repair Institute (ICRI):
   a. 310.2R, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
4. National Council Highway Research Program (NCHRP):
   a. 244, Concrete Sealers for the Protection of Bridge Structures.
5. The Society for Protective Coatings/NACE International (SSPC/NACE):
   a. SP 13/NACE No. 6, Surface Preparation of Concrete.

B. Qualifications:
   1. Chemical Sealer CS-2:
      a. Applicator shall be factory trained and approved, in writing, by the manufacturer to apply the product.
      b. Applicator shall have a minimum of five (5) year's experience successfully applying materials specified.

C. Mock-Ups.
   1. General:
      a. Construct additional mock-ups as required until accepted.
      b. Mock-ups constitute minimum standard of quality for actual construction.
      c. Maintain mock-up during construction.
      d. Remove when directed by Engineer.
   2. Construct mock-up for each type of wall finish specified for review and acceptance by Engineer.
      a. Minimum 4 x 4 FT area for each different wall finish specified.
      b. Mock-ups shall include:
         1) Sample of patched tie hole.
         2) Sample of all jointery being used in the walls.
      c. Include mock-up of wall having polymer modified cementitious coating.
         1) Mock-up shall be stepped to show surface preparation, repairs and coating in all stages of application.
   3. Construct mock-up floor slab for review and acceptance by Engineer.
      a. Minimum 10 x 10 FT.

1.3 DEFINITIONS

A. Vertical Surface Defects:
   1. Any void in the face of the concrete deeper than 1/8 IN, such as:
      a. Tie holes.
      b. Air pockets (bug holes).
      c. Honeycombs.
      d. Rock holes.
   2. Scabbing:
      a. Scabbing is defect in which parts of the form face, including release agent, adhere to concrete.
   3. Foreign material embedded in face of concrete.
   4. Fins 1/16 IN or more in height.

B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

C. Other words and terms used in this Specification Section are defined in ACI CT-13.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Certifications:
      a. Certification of aggregate gradation.
      b. Certification of manufacturer experience qualifications and performance history.
      c. Certification of applicator's qualifications.
         1) Refer to Qualifications paragraph.

2) Provide manufacturer's written approval of applicators.
3) Provide references substantiating specialty experience.

B. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations and requirements for materials used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Bonding Agents:
a. BASF Master Builders Solutions.
b. Euclid Chemical Co.
c. Laticrete - L&M Construction Chemicals.
2. Chemical Sealers:
a. BASF Master Builders Solutions.
b. Euclid Chemical Co.
c. Laticrete - L&M Construction Chemicals.
d. Tnemec Chemprobe.
3. Polymer Modified Cementitious Coating:
a. Aquafin International.
b. BASF Master Builders Solutions.
c. Euclid Chemical Co.
4. Patching Mortar:
a. BASF Master Builders Solutions.
b. Euclid Chemical Co.
c. Laticrete - L&M Construction Chemicals.
d. Sika Corporation.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Patching Mortar: Trowelable cementitious repair mortar for vertical, overhead, and horizontal repairs.
1. Portland cement-based, rapid set repair mortar for interior or exterior use.
2. Compressive Strength, ASTM C109:
a. Minimum 3000 PSI at 7 days.
b. Minimum 5000 PSI at 28 days.
3. Freeze Thaw Durability, ASTM C666: 96.75 PCT at 300 Cycles.
4. Shrinkage, ASTM C157: 0.069 PCT.
5. Euclid Chemical Speed Crete Red Line.

B. Bonding Agents:
1. For use only on concrete surfaces not receiving liquid water repellent coating:
a. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
1) BASF Master Builders MasterEmaco A 660.
2) Euclid Chemical Co. Flex-Con.
3) Laticrete L&M Everbond.

2. For use only on concrete surface receiving liquid water repellent:
    a. Non-acrylic base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.

C. Cement:
1. ASTM C150, Type II Portland for areas exposed to sewage.
2. ASTM C150, Type III Portland elsewhere.

D. Aggregate:
1. Sand: Maximum size #30 mesh sieve.
2. For exposed aggregate finish surfaces: Same as surrounding wall.

E. Water: Potable.

F. Polymer modified cementitious coating:
1. Polymer modified Portland cement based coating for concrete and masonry.
    a. Waterproof.
    b. Resistant to both positive and negative hydrostatic pressure.
    c. Breathable.
2. BASF MasterSeal 581 or Euclid Chemical Tamoseal.
    a. Color:
        1) Interior surfaces: Standard gray.
        2) Exterior surfaces: Standard gray.
    b. Texture: Fine.

G. Nonshrink Grout: See Specification Section 03 31 30 and Specification Section 03 31 31.

2.3 MIXES

A. Bonding Grout: One (1) part cement to one (1) part aggregate.

B. Patching Mortar:
1. One (1) part cement to two and one-half (2-1/2) parts aggregate by damp loose volume.
    a. Substitute white Portland cement for a part of gray Portland cement to produce color matching surrounding concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. For methods of curing, see Specification Section 03 31 31.

B. Surface Preparation:
1. Clean surfaces in accordance with ASTM D4258 to remove dust, dirt, form oil, grease, or other contaminants prior to abrasive blasting, chipping, grinding or wire brushing.
2. Prepare surfaces in accordance with ASTM D4259 and SSPC SP 13/NACE No. 6 to completely open defects down to sound concrete and remove laitance.
    a. Provide concrete surface profile (CSP) in accordance with ICRI 310.2:
        1) Areas to receive Repair Mortar:
            a) Areas larger than 1 SF or deeper than 1/4 IN Abrasive blast, scarify or needle scale to CSP No. 6-8.
    b. If additional chipping or wire brushing is necessary, make edges perpendicular to surface or slightly undercut.
    c. No featheredges will be permitted.
    d. Rinse surface with clean water to remove all dust, dirt, debris, loosened concrete, laitance, and other contaminants.

C. Preparation of Bonding Grout Mixture:
1. Mix cement and aggregate.
2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.

3. Add bonding agent/water mixture to cement/aggregate mixture.
4. Mix to consistency of thick cream.
5. Bonding agent itself may be used as bonding grout if approved by manufacturer and Engineer.

D. Preparation of Patching Mortar Mixture:
1. Mix specified patching mortar per manufacturer's published recommendations.
2. For repairs exceeding 2 IN in depth, mix with clean, pre-dampened 3/8 IN pea gravel in accordance with the manufacturer's recommendations.

E. Polymer modified cementitious coating:
1. Mix in accordance with manufacturer's recommendations using bonding agent acceptable to coating manufacturer.

3.2 INSTALLATION AND APPLICATION

A. Do not repair surface defects or apply wall or floor finishes when temperature is or is expected to be below 50 DEGF.
1. If necessary, enclose and heat area to between 50 and 70 DEGF during repair of surface defects and curing of patching material.
a. Use only clean fuel, indirect fired heating apparatus.
b. Exhaust combustion byproducts outside of work area.

B. Repairing Surface Defects:
1. This method is to be used on vertical concrete surfaces as indicated in the Concrete Finishes for Vertical Wall Surfaces paragraph of this Specification Section and similar concrete surfaces not otherwise specified to receive another finish or coating.
a. For surfaces indicated to receive finish or coating other than those specified herein; refer to the applicable Specification Section for surface preparation requirements:
1) High Performance Industrial Coatings: See Specification Section 09 96 00.
2. Fill and repair surface defects and tie-holes using patching mortar mix specified in the MATERIALS Article in PART 2.
a. Prime exposed reinforcing steel, embeds or other steel surfaces with primer as recommended by patching mortar manufacturer.
b. Scrub bond coat:
1) Wet substrate to a saturated surface dry (SSD) condition.
2) Mix patching mortar to a scrub coat or slurry consistency per manufacturer's published recommendations and apply to entire area.
c. As an alternate to the scrub bond coat, concrete may be primed with manufacturer's recommended epoxy primer.
d. Patching Mortar Application:
1) Mix and apply Patching Mortar per manufacturer's recommendations within the open time of the product scrub coat or any bonding agents.
2) Finish to level of surrounding concrete surface utilizing techniques recommended by manufacturer.
3. Consolidate patching mortar into place and strike off so as to leave patch slightly higher than surrounding surface.
4. Leave undisturbed until mortar has stiffened before finishing level with surrounding surface.
a. Do not use steel tools in finishing a patch in a formed wall which will be exposed to view.
5. Cure patching mortar in accordance with ACI 308.

C. Concrete Finishes for Vertical Wall Surfaces:
1. General:
a. Give concrete surfaces finish as specified below after removal of formwork and repair of surface defects.
b. Finish numbers not listed are "Not Used".

2. Finish #1 - As cast rough form finish:
    a. Selected forming materials are not required.
    b. Prepare surface in accordance with the PREPARATION Article in PART 3 of this Specification Section.
    c. Repair the following surface defects using patching mortar specified in PART 2:
        1) Tie holes.
        2) Honeycombs deeper than 1/4 IN.
        3) Air pockets deeper than 1/4 IN.
        4) Rock holes deeper than 1/4 IN.
    d. Chip or rub off fins exceeding 1/8 IN in height.
    e. Provide at unexposed surfaces such as:
        1) Foundations.
        2) Below-grade walls not to be waterproofed.
        3) As specified in Concrete Finish Schedule
3. Finish #2 - Grout rubbed finish:
    a. Form facing material shall produce a smooth, hard, uniform texture.
        1) Use forms specified for surfaces exposed to view in accordance with Specification Section 03 11 13.
        2) Comply with ACI 303R for formwork accuracy and form joint handling to prevent grout leakage.
    b. Prepare surface in accordance with the PREPARATION Article in PART 3 of this Specification Section and repair all surface defects.
    c. Begin finish operation one (1) day after form removal.
    d. Wet surface and rub with carborundum brick or other abrasive until uniform color and texture is achieved.
    e. Grout application:
        1) Wet surface to prevent absorption of water from grout.
        2) Apply grout uniformly over entire surface.
            a) Completely fill bugholes, voids or other blemishes.
    f. Immediately following application of grout, float the surface with a cork float, scouring the wall vigorously.
    g. Finish wall with sponge rubber float.
        1) Remove all excess grout.
        2) Do not remove grout from holes or depressions.
    h. Allow wall to dry thoroughly and then rub vigorously with burlap to completely remove any dried grout film.
4. Finish #3 - Smooth form finish:
    a. Use form facing material to produce a smooth, hard, uniform texture on concrete.
    b. Arrange facing material orderly and symmetrical, with number of seams kept to practical minimum.
    c. Support by studs or other backing capable of preventing excessive deflection.
    d. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.
    e. Patch tie holes and defects.
    f. Remove fins completely.
    g. When surface textures are impaired and form joints misaligned by more than 1/8 IN grind bush hammer, or otherwise correct affected concrete.
    h. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.
    i. Repair major mortar leakage as a defective area.

D. Related Unformed Surfaces (Except Slabs):
1. Strike smooth and level tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
2. Float surface to a texture consistent with that of formed surfaces.
    a. If more than one (1) finish occurs immediately adjacent to unformed surface, provide surface with most stringent formed surface requirement.

3. Continue treatment uniformly across unformed surfaces.

E. Concrete Finishes for Horizontal Slab Surfaces:
   1. General:
      a. Tamp concrete to force coarse aggregate down from surface.
      b. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains.
      c. Dusting of surface with dry cement or sand during finishing processes not permitted.
   2. Unspecified slab finish:
      a. When type of finish is not indicated, use following finishes as applicable:
         1) Exterior slabs, sidewalks, platforms, steps and landings, and ramps, not covered by other finish materials: Broom or belt finish.
         2) All slabs to receive a floated finish before final finishing.
   3. Scratched slab finish: After concrete has been placed, consolidated, struck off, and leveled to a Class B tolerance, roughen surface with stiff brushes or rakes before final set.
   4. Floated finish:
      a. After concrete has been placed, consolidated, struck off, and leveled to a Class B tolerance, do no further work until ready for floating.
      b. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operations.
         1) Use wood or cork float.
      c. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two (2) different angles.
   5. Cut down all high spots and fill all low spots to produce a surface with Class B tolerance throughout.
      a. Refloat slab immediately to a uniform texture.
   6. Troweled finish:
      a. Float finish surface to true, even plane.
      b. Power trowel, and finally hand trowel.
      c. First troweling after power troweling shall produce a smooth surface which is relatively free of defects, but which may still show some trowel marks.
      d. Perform additional trowelings by hand after surface has hardened sufficiently.
      e. Final trowel when a ringing sound is produced as trowel is moved over surface.
      f. Thoroughly consolidate surface by hand troweling.
      g. Finish in accordance with the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
         1) Leave finished surface essentially free of trowel marks, uniform in texture and appearance.
      h. On surfaces intended to support floor coverings, remove any defects that would show through floor covering.
   7. Broom or belt finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom or burlap belt across surface.
   8. Underside of concrete slab finish:
      a. Match finish as specified for adjacent vertical surfaces.
      b. If more than one (1) finish occurs immediately adjacent to underside of slab surface, provide surface with most stringent formed surface requirement.

3.3 FIELD QUALITY CONTROL

A. Tolerances:
   1. Finished floor slabs:
      a. Provide Floor Flatness (F_F) and Floor Levelness (F_L) in accordance with ACI 117.
         1) Measure in accordance with ASTM E1155.
      b. Slabs not indicated to be sloped:
         1) F_F: Equal or greater than 35.
         2) F_L: Equal or greater than 25.
      c. Slabs indicated to be sloped or curved:

1) Measure in accordance with ASTM E1486.
2) Provide slopes or curves as indicated on the Drawings.

d. Slabs indicated to receive polished concrete floor:
1) F_F: Equal or greater than 45.
2) F_L: Equal or greater than 35.
3) Refer to Room Finish Schedule on Drawings.

2. Horizontal surfaces other than finished floor slabs, including but not limited to, top of footings, top of walls, concrete fill in tankage, channels and similar applications:
a. Gap between a 10 FT straightedge placed anywhere and the finished surface shall not exceed:
1) Class A tolerance: 1/4 IN.
2) Class B tolerance: 3/8 IN.
3) Class C tolerance: 1/2 IN.

b. Accumulated deviation from intended true plane of finished surface shall not exceed 1/2 IN.

B. Unacceptable finishes shall be replaced or, if approved in writing by Engineer, may be corrected provided strength and appearance are not adversely affected.
1. High spots to be removed by grinding and/or low spots filled with a patching compound or other remedial measures to match adjacent surfaces.

C. Provide services of manufacturer's technical representative:
1. A certified manufacturer's representative experienced in the use of the products used shall be present on a full-time basis to observe and oversee all operations associated with the installation.
2. Contractor, along with manufacturer, shall be fully responsible for the proper application, including all means and methods incidental thereto necessary for a sound, secure and complete installation.
3. Manufacturer's representative shall be present for installation of:
a. Dry-shake Hardener.
b. Heavy-duty Metallic Aggregate Topping.

3.4 PROTECTION

A. All horizontal slab surfaces receiving chemical sealer shall be kept free of traffic and loads for minimum of 72 HRS following installation of sealer.

3.5 CONCRETE FINISH SCHEDULE

DRAWING NO.	STRUCTURE NAME	SURFACE TO BE FINISHED	FINISH NO.
S8.1	Pond Kettle	Harvest kettle Interior walls	2 or 3 (Note 1)
S8.1	Pond Kettle	Harvest kettle slab	Steel trowel
S8.1	Pond Kettle	Slab-on-grade	Light Broom
S8.1	Water control structure	Interior walls	2
S8.1	Water control structure	Exterior walls	1
S8.6	External Pond harvest kettle	Interior walls	2 or 3 (Note 1)
S8.6	External Pond harvest kettle	Harvest Kettle slab	Steel trowel
S8.6	External Pond harvest kettle	Slab-on-grade	Light broom
S8.7	Outlet structure	Interior walls	2
S8.7	Outlet control structure	Exterior walls	1
S9.1	Headtank	Interior walls	2 (Note 2)
S9.1	Headtank	Exterior walls	1

Note 1: Walls shall have an ultra-smooth finish similar to a steel trowel finish, free from all abrasions.
Note 2: Coordinate wall finish with coating manufacturer.

END OF SECTION

DIVISION 04

MASONRY

SECTION 04 05 13
MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Masonry mortar.
   2. Masonry grout.
   3. Integral water repellent admixture.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 04 22 00 - Concrete Masonry.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
      b. C144, Standard Specification for Aggregate for Masonry Mortar.
      c. C150/C150M, Standard Specification for Portland Cement.
      d. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
      e. C270, Standard Specification for Mortar for Unit Masonry.
      f. C404, Standard Specification for Aggregates for Masonry Grout.
      g. C476, Standard Specification for Grout for Masonry.
      h. C1019, Standard Test Method for Sampling and Testing Grout.
      i. C1093, Standard Practice for Accreditation of Testing Agencies for Masonry.
      j. C1384, Standard Specification for Admixtures for Masonry Mortars.
   2. Masonry Standards Joint Committee (MSJC):
      a. Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602); referred to herein as MSJC Specification.

B. Qualifications:
   1. Preconstruction Testing Laboratory shall be an independent agency qualified in accordance with ASTM C1093 for performing the testing indicated.
      a. Testing Laboratory shall have a minimum of 10 years of experience in the testing of mortar and grout.
      b. Technician conducting tests shall have minimum of five years of experience in the testing of mortar and grout.

1.3 DEFINITIONS

A. Coarse grout and fine grout are defined by the aggregate size used in accordance with ASTM C476.

B. Coarse aggregate and fine aggregate are defined in ASTM C404, Table 1.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. General:
         1) Product data for cementitious materials.

2) Source or producer of aggregates and gradation.
3) Integral water repellent manufacturer's dosage rate.

c. Proposed mortar mix design:
d. Proposed masonry grout mix design.

3. Test results:
   a. Preconstruction mortar test results.
   b. Preconstruction masonry grout test results.

B. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Qualifications of testing lab and technician.
3. Test results and inspection reports per Specification Section 01 45 33.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location.
1. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mixes in moisture-resistant containers.
1. Store preblended, dry mixes in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement:
1. ASTM C150/C150M, Type I or II.
2. No air entrainment.
3. Natural color.
4. Maximum percent of alkalis: 0.60 in accordance with ASTM C150/C150M, Table 2.

B. Hydrated Lime:
1. ASTM C207, Type S.
2. Type SA not acceptable.
3. Lime substitutes are not acceptable.

C. Mortar Aggregate: ASTM C144, free of gypsum.

D. Grout Aggregate: ASTM C404.

E. Water: Potable.

F. Integral Water Repellent Admixture:
1. Liquid polymeric admixture: ASTM C1384.
2. Verify compatibility with liquid water repellent admixture being used in the fabrication of concrete masonry units.

2.2 MIXES

A. Mortar and grout shall comply with MSJC Specification and building code.

B. Type "S" mortar shall be used:
1. Comply with ASTM C270, Table No. 1, Cement-Lime Mortar.
   a. Do not use masonry cement or mortar cement.
   b. No fly ash additives will be accepted.
2. Mix materials minimum of three minutes and maximum of five minutes.
3. Adjust consistency to satisfaction of mason.

4. Do not use admixtures unless otherwise indicated.
5. Provide integral water repellent admixture in mortar used for:
    a. Exterior concrete masonry work.
    b. Interior concrete masonry work in wet areas.

C. Masonry Grout:
1. ASTM C476.
    a. Minimum 28-day compressive strength: 2,000 PSI.
    b. Slump: 8 to 11 IN.
2. Mix 5 minutes minimum.
3. No admixtures allowed.
4. At Contractor's option, premixed or preblended grout meeting the above minimum requirements may be used.

2.3 SOURCE QUALITY CONTROL

A. Perform preconstruction laboratory tests on proposed masonry mortar and grout prior to start of masonry work.
1. Perform tests far enough in advance so that any necessary retesting can be accomplished before masonry construction begins.
    a. Test mortar per ASTM C270.
    b. Test grout per ASTM C1019.

B. Source Limitations for Mortar Materials:
1. Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and MSJC Specification.

B. Mortar:
1. If standard gray mortar begins to stiffen, it may be retempered by adding water and remixing [unless prohibited by water repellent admixture manufacturer].
    a. Standard gray mortar shall not be retempered more than one time.
2. All mortar must be used within 2-1/2 HRS maximum after initial mixing per MSJC Specification.
3. Engineer reserves right to alter mix design based on initial rate of absorption of masonry units.

C. Masonry Grout:
1. Use grout within 1-1/2 HRS maximum after initial mixing.
2. Use no grout after it has begun to set.
3. Do not retemper grout after initial mixing.
4. Place grout in lifts not exceeding [4] FT.
5. Use coarse grout in spaces with least dimension over 2 IN.
6. Consolidate all grout while installing.
    a. Consolidate grout pours 12 IN or less in height by mechanical vibration or by puddling.
    b. Consolidate grout pours exceeding 12 IN in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

3.2 FIELD QUALITY CONTROL

A. Masonry Mortar and Grout Testing and Inspection:
1. Testing and inspection services will be provided by the Owner's special masonry inspector.
    a. Do not include in the bid price the cost of these services.

2. Testing and inspection shall include, but is not limited to:
   a. Observe proportions of site-prepared mortar and grout.
   b. Observe grout space prior to grouting.
   c. Grout compressive strength sampling, testing and reporting per ASTM C1019.
      1) One strength test shall be the average of three specimens from the same sample, tested at 28 days.
   d. Grout slump test sampling, testing, and reporting per ASTM C143/C143M.
   e. Frequency of sampling: One sample (three specimens) collected each grouting operation during masonry construction.
3. Reporting: Special inspector to submit test results and inspection reports per Specification Section 01 45 33.

END OF SECTION

SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Masonry accessories.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 04 22 00 - Concrete Masonry.
   4. Section 05 50 00 - Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      b. A580, Standard Specification for Stainless Steel Wire.
      c. A951, Standard Specification for Steel Wire for Masonry Joint Reinforcement.
      d. A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
      e. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
      f. D412, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
      g. D2000, Standard Classification System for Rubber Products in Automotive Applications.
      h. D2240, Standard Test Method for Rubber Property—Durometer Hardness.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Tear resistance of flashing material.
      d. Manufacturer's recommendations for flashing adhesive.
      e. Manufacturer's data sheet on each product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Masonry anchors, horizontal joint reinforcing and miscellaneous anchors:
      a. Heckman.
      b. Hohmann & Barnard, Inc.
      c. Wire Bond.

2. Preformed control joint inserts:
    a. Hohmann & Barnard, Inc.
    b. Wire Bond.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MANUFACTURED UNITS

A. Horizontal Joint Reinforcing:
1. General:
    a. Conform to ASTM A951.
    b. Stainless steel, ASTM A580, Type 304 or 316.
    c. 9 GA side rods.
    d. 9 GA cross rods.
    e. Prefabricated corner and tee sections with minimum length of 30 IN from point of intersection.
2. Single wythe wall joint reinforcing: Ladder design.
3. Composite wall joint reinforcing: Ladder design with double side rod.

B. Rigid Steel Masonry Anchors:
1. 1 IN by 1/4 IN with ends turned up 2 IN.
2. Stainless steel, ASTM A666, Type 304 or 316.
3. Length:
    a. 24 IN unless noted otherwise.
    b. Where wall conditions such as jambs or other obstructions preclude the use of 24 IN anchors, shorter anchors may be used.

C. Mesh Wall Ties:
1. Stainless steel, ASTM E437, Type 304.
2. 16 GA, 1/2 IN square mesh.
3. Width: 2 IN less than nominal wall thickness.
4. Length: As necessary to embed minimum 6 IN into each wall.

D. Preformed Rubber Control Joint Inserts:
1. ASTM D2000, M2AA-805.
2. Hardness: ASTM D2240, Shore A Durometer, 80 +/-5.
3. Ultimate elongation: 350 PCT, ASTM D412.
4. Tensile strength: 1000 PSI, ASTM D412.
5. Hohmann & Barnard #RS Series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Butt joints of preformed control joint inserts tightly together and secure with adhesive or sealant acceptable to insert manufacturer.

C. Reinforcing Masonry:
1. General:
    a. Provide continuous horizontal joint reinforcing in all concrete masonry wall construction.
        1) Embed longitudinal side rods in mortar for entire length with minimum cover of 5/8 IN on exterior side of walls and 1/2 IN at other locations.
            a) For interior partitions, the "exterior" side of the wall is considered the side having the most corrosive atmosphere or the corridor side of the wall.
        2) Lap reinforcement minimum of 12 IN at ends.

a) Remove cross wires on one side of the lap splice and bend the side rods slightly so the lap is provided with 12 IN of uninterrupted wire lap occurring in the same plane.

3) Do not bridge control joints with horizontal joint reinforcing.
4) Do not bridge expansion joints with horizontal joint reinforcing.
5) At corners and wall intersections use prefabricated "L" and "T" horizontal joint reinforcing sections.
6) Cut and bend as necessary.

b. Install reinforcing at 16 IN OC vertically unless noted otherwise on Drawings.
c. Install reinforcing 8 IN OC vertically for a minimum of 24 IN at starter courses.
d. In concrete masonry, reinforce masonry openings over 12 IN wide with horizontal joint reinforcing placed in three horizontal joints above lintel and two horizontal joints below sill.
   1) Extend minimum of 32 IN beyond jambs of opening.

2. Reinforcing concrete masonry:
   a. Install reinforcing bars where indicated on Drawings.
      1) Provide means necessary to ensure position of vertical steel reinforcing meets requirements of the building code.
   b. At intersecting load-bearing walls, provide rigid steel anchors 16 IN OC vertically, embed ends in grout filled cores.
      1) Alternate rigid steel anchors with horizontal joint reinforcing.
   c. At intersecting non-load bearing walls or at intersecting load bearing/non-load bearing walls provide mesh wall ties in mortar joint at 16 IN OC vertically.
      1) Extend minimum 6 IN into each wall.
      2) Alternate mesh wall ties with horizontal joint reinforcing.
3. Anchor intersecting new interior concrete masonry to existing wall with adjustable pintle and wall plate type anchors.
   a. Install veneer anchors at16 IN OC or as noted on the Drawings.
4. Provide column ties at all masonry wall and steel column intersections.
   a. Weld ties to steel column.
   b. Provide column ties at 16 IN OC on every side of column where masonry wall abuts column.
   c. Alternate column ties with horizontal joint reinforcing when possible.
   d. Fill block cells with grout at column tie locations.
5. Repair all galvanized coatings damaged as a result of welding.
   a. See Specification Section 05 50 00 for galvanizing repair system.

END OF SECTION

SECTION 04 22 00
CONCRETE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete masonry construction (CMU), including:
      a. Standard concrete masonry.
      b. Precast concrete lintels.
   2. Integral water repellent admixture.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 21 00 - Reinforcement.
   4. Section 03 31 30 - Concrete, Materials and Proportioning.
   5. Section 04 01 20 - Masonry Cleaning.
   6. Section 04 05 13 - Masonry Mortar and Grout.
   7. Section 04 05 23 - Masonry Accessories.
   8. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. C55, Standard Specification for Concrete Building Brick.
      c. C90, Standard Specification for Loadbearing Concrete Masonry Units.
      d. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
      e. C426, Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.
      f. C1357, Standard Test Methods for Evaluating Masonry Bond Strength.
      g. E514, Standard Test Method for Water Penetration and Leakage Through Masonry.
   2. Masonry Standard Joint Committee (MSJC):
      a. Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602); referred to herein as MSJC Specification.
   3. National Concrete Masonry Association (NCMA):
      a. TEK 2-3A, Architectural Concrete Masonry Units.
      b. TEK 3-4B, Bracing Concrete Masonry Walls During Construction.
      c. TEK 8-2A, Removal of Stains from Concrete Masonry.
      d. TEK 8-3A, Control and Removal of Efflorescence.

B. Concrete masonry unit manufacturer shall be licensed or qualified, in writing, by manufacturer of integral water repellent admixture to produce masonry units containing manufacturer's admixture.
   1. Concrete masonry unit manufacturer shall have a minimum of five years experience producing masonry units containing manufacturer's admixture.

C. All masonry units of any one particular type, color or face style shall be from the same production run.
   1. Special shapes shall be factory fabricated unless noted otherwise.

1.3 DEFINITIONS

A. Definitions to be in accordance with Standard Unit Nomenclature Table 1, NCMA TEK 2-3A.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Manufacturer's information on aggregate and cement type used in manufacture.
   3. Drawings:
      a. Scaled (minimum 1/8 IN per foot) plans showing proposed locations of masonry control joints.
      b. Wall elevations and sections, indicating special shapes, shape part numbers, applicable dimensions.
      c. Detail drawings for:
         1) Precast concrete lintels.
            a) Show profiles, cross-sections, reinforcement and steel components.
   4. Certifications:
      a. Certification that concrete masonry units meet or exceed requirements of standards referenced.
      b. Certification that fire-resistive rated units meet the requirements of the building code.
      c. Certification that integral water repellent admixture will not affect the use of coloring processes or alter the actual colors of factory colored masonry units.
      d. Data sheets on integral water repellent admixture being used in masonry unit manufacturing.
      e. Technical bulletins on cleaning masonry containing integral water repellent.
      f. Certification of integral water repellent admixture dosage rates from concrete masonry unit producer.
      g. Concrete masonry producer shall certify that integral liquid water repellent admixture has been provided at dosage rate recommended by admixture manufacturer for use in exterior wall construction.
      h. Certification that concrete masonry units meet all requirements for strength, absorption, density, moisture content and dimensions when tested according to ASTM C140.
      i. Submit test results prior to shipping masonry units to the job site.
   5. Qualifications of testing lab and technician.
   6. Test results for all masonry testing.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver units on pallets with tight covers or deliver in cubes and store on dunnage.

B. Protect units from damage.

C. Inspect units upon delivery for damage, to assure color match with [mock-up] or approved samples, dimensional quality, and trueness of unit.
   1. Remove damaged or otherwise unacceptable units from the Project Site.

D. Store units in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Standard masonry units:
      a. Any manufacturer capable of meeting the requirements of this Specification Section.

2. Integral water repellent admixture:
    a. GCP Applied Technologies, Inc.
    b. ACM Chemistries, Inc.

2.2 MATERIALS

A. Cement: Type I or II Portland, ASTM C150.

B. Aggregate: ASTM C33.

C. Reinforcing Bars: Refer to Specification Section 03 21 00.

D. Mortar: Refer to Specification Section 04 05 13.

E. Masonry Grout: Refer to Specification Section 04 05 13.

F. Masonry Accessories: Refer to Specification Section 04 05 23.

G. Sealants: Refer to Specification Section 07 92 00.

H. Integral Concrete Masonry Water Repellent:
1. Liquid polymeric admixture.
2. GCP Applied Technologies, Inc., "DRY-BLOCK".

2.3 MANUFACTURED UNITS

A. General:
1. Fire resistive units: Fabricate to meet the building code.
2. Fabricated in the manufacturing plant.
3. Provide bullnose corners as detailed on Drawings.

B. Concrete Masonry Units:
1. Modular units: ASTM C90.
    a. Normal weight units: Minimum of 125 LB/CUFT.
    b. Light weight [or medium weight] units are not acceptable.
2. Concrete bricks:
    a. Structural units: ASTM C55.
        1) Same material, texture and density as modular units.
3. Color:
    a. Interior units: Standard gray.
4. Design compressive strength: f'm=[1,500] PSI minimum.
    a. Determine in accordance with MSJC Specification.
        1) Unit strength method, sampled and tested in accordance with ASTM C140.
5. Provide masonry units manufactured with integral water repellent admixture.
6. Special shapes and faces:
    a. Corner units.
        1) Corner units shall maintain regular modular masonry coursing.
        2) 135 degree units where indicated on drawings.
    b. Finished end units.
    c. Other special shapes as indicated on Drawings or necessary to maintain coursing.

C. Precast concrete lintels:
1. Concrete: See Specification Section 03 31 30.
2. Reinforcing: See Specification Section 03 21 00.
3. Embedded steel components: Galvanized.
    a. See Specification Section 05 50 00.

2.4 PERFORMANCE AND DESIGN REQUIREMENTS:

A. Integral Concrete Masonry Water Repellent:
1. Water permeance of masonry: Capable of achieving a Class E Rating when evaluated using ASTM E514 with the test extended to 72 HRS, using the rating criteria specified in ASTM E514.

2. Flexural bond strength of masonry: An increase of 10 PCT, minimum, in masonry flexural bond strength shall occur as a result of adding integral water-repellent concrete masonry and mortar admixtures when compared to a control (containing no admixtures) concrete masonry and mortar tested in accordance with ASTM C1357.
3. Compressive strength validation shall be per unit strength method.
4. Drying shrinkage of masonry: Maximum 5 PCT increase in drying shrinkage of the concrete masonry units shall occur as a result of adding integral water repellent concrete masonry admixture when compared to a control (containing no admixtures) concrete masonry when tested in accordance with ASTM C426.
5. Grout shear bond strength: Maximum 5 PCT decrease in grout shear bond strength shall occur as a result of adding integral water repellent admixture to the concrete masonry units when compared to a control (containing no admixtures).

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that anchors and flashings are correct.

B. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.
   1. Properly locate openings, movement type joints, returns, and offsets [weep joints and weep vents].

3.2 INSTALLATION

A. General:
   1. Build in flashing, reinforcing, and related accessory items.
      a. See Specification Section 04 05 23 for installation of accessory items.
   2. Perform all cutting using masonry saw blades.
   3. Drill holes using masonry drill bits or core drill.
      a. Holes made by chipping unit will not be accepted.
   4. Install field units in running bond, unless noted otherwise.
      a. Provide special coursing where indicated on the Drawings.
   5. Cut as required to maintain bond pattern.
   6. Use solid units where cutting or laying would expose holes and as noted on Drawings.
   7. Avoid use of less than half size units, whenever possible.
   8. Do not use chipped, cracked, spalled, stained or imperfect units exposed in finish work.
   9. Provide units of uniform color, within the range demonstrated on the approved mock-up.
   10. Do not wet concrete masonry units.
   11. Build chases and recesses as indicated and required for work of other trades.
      a. Provide not less than 8 IN of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses unless detailed otherwise on the Drawings.
   12. In fire-resistive rated wall construction, install fire resistive units in accordance with the building code.

B. Concrete Masonry Units:
   1. Grout solid all cells containing steel reinforcing and as indicated on Drawings.
      a. Refer to Specification Section 04 05 13 for grouting.
   2. Install bullnose units at external corners and at jambs of openings.

C. Laying and Tooling:
   1. Lay masonry units with completely filled bed and head joints.
      a. Provide full mortar bed on all block cross webs and completely fill head joints.
         1) Do not slush head joints.
         2) Protect cells requiring grout fill from mortar droppings.
         3) Omit mortar from head joint at weep joint opening.
   2. Maintain nominal 3/8 IN joint widths.
      a. Cut joints flush where concealed [and where veneer plaster coating is required].

b. Tool exposed joints concave.
c. Compress mortar in below ground joints and in joints concealed by insulation in cavity wall construction.
d. Provide wider joints where noted on Drawings.
1) In no case shall any mortar joint be more than 3/4 IN wide.
e. Where masonry sits on top of steel support omit the mortar joint on top of the support and sit masonry directly on top of the thru wall flashing or the steel support member unless a mortar joint is required to maintain coursing.

3. During tooling of joints, enlarge any voids or holes [except weeps], and completely fill with mortar.
4. Point-up all joints at corners, openings, and adjacent work to provide neat, uniform appearance.
5. Remove masonry disturbed after laying.
a. Clean and relay in fresh mortar.
b. Do not pound units to fit.
c. If adjustments are required, remove units, clean, and reset in fresh mortar.
6. Where work is stopped and later resumed, rake back 1/2 masonry unit length in each course.
a. Remove loose units and mortar prior to laying fresh masonry.
7. As work progresses, build in items indicated on Drawings and specified.
a. Fill in solidly with mortar around built-in items.
b. Where built-in items are to be embedded in cores of hollow masonry units, place grout screen in joint below and fill core solid with mortar.

D. Control Joints and Sealants:
1. Provide vertical expansion, control and isolation joints where indicated on Drawings.
2. Where not indicated on Drawings, submit proposed control joint locations in accordance with the following requirements:
a. Provide control joints at maximum 24 FT OC.
b. Provide at all T intersections.
c. Locate joints so as to allow lintels and bond beams above and below openings to extend beyond the opening as indicated on the Drawings without control joints thru the lintel or bond beam.
3. Rake out mortar in joint.
4. Refer to Specification Section 07 92 00 for sealant installation requirements.
a. Seal control and expansion joints.

E. Tolerances:
1. Maximum variation from plumb in vertical lines and surfaces of columns, walls, and arises:
a. 1/4 IN in 10 FT.
b. 3/8 IN in a story height not to exceed 20 FT.
c. 1/2 IN in 40 FT or more.
2. Maximum variation from plumb for external corners, expansion joints, and other conspicuous lines:
a. 1/4 IN in any story or 20 FT maximum.
b. 1/2 IN in 40 FT or more.
3. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
a. 1/4 IN in any bay or 20 FT.
b. 1/2 IN in 40 FT or more.
4. Maximum variation from plan location of related portions of columns, walls, and partitions:
a. 1/2 IN in any bay or 20 FT.
b. 3/4 IN in 40 FT or more.
5. Maximum variation in cross-sectional dimensions of columns and thicknesses of walls from dimensions shown on Drawings:
a. Minus 1/4 IN.
b. Plus 1/2 IN.

6. Maximum variation in mortar joint width:
    a. Bed joints: 3/32 IN in 10 FT.
    b. Head joints:
        1) Minus 1/8 IN.
        2) Plus 1/8 IN.

3.3 FIELD QUALITY CONTROL

A. Bracing Concrete Masonry Walls During Construction:
    1. At a minimum, provide bracing in accordance with NCMA TEK 3-4B.
    2. Contractor is responsible for adequately bracing all masonry during construction.

B. Remove and replace loose, stained, damaged and other unacceptable units as directed by Engineer.
    1. Provide new units to match.
    2. Install in fresh mortar.
    3. Point to eliminate evidence of replacement.

C. Special Masonry Inspection:
    1. Masonry inspection services will be provided during the following construction activities:
        a. Cost of masonry inspection services will be paid by Owner.
        b. During laying of units:
            1) During the first day of the masonry construction, inspect proportions of site prepared mortar, construction of mortar joints, location of all reinforcing and connectors, size and location of structural elements, type, size and location of anchors, protection of masonry during cold weather.
            2) Inspection to be continuous the first full day of masonry construction which requires special inspection.
                a) Thereafter, a minimum of 3 HRS every third day of construction until the concrete masonry work is complete.
            3) Inspection while laying masonry units may be made concurrently with other inspection duties provided all inspection duties are adequately performed.
            4) When deficiencies are found, additional inspection shall be provided as required until deficiencies have been corrected.
            5) If masonry crews change, an additional full day of inspection is required during the first day the new crew is on-site.
        c. Placement of reinforcing steel:
            1) Verification of all reinforcing including size, grade, lap lengths, and type.
            2) Inspection may be periodic as required to verify all reinforcing.
            3) Inspector to be present during the concrete pour in which any dowels connecting concrete to masonry are cast.
                a) Inspector to verify proper location of dowels.
        d. Prior to each grouting operation, verify that grout space is clean, reinforcing is clean and connectors are properly placed, proportions of site-prepared grout are correct and mortar joints have been properly constructed.
            1) Inspection may be periodic as required to verify proper grout space.
        e. Verify compliance with building code and Specifications continuously during all grouting operations.
        f. Provide special inspection in accordance with the MSJC Specification Level B Quality Assurance] including observation of masonry work for conformance to the Contract Documents:
            1) Provide inspection reports to the Engineer, Building Official and Owner.
                a) Notify Contractor of discrepancies for correction.
                b) Notify Engineer, Building Official and Owner, in writing, when discrepancies have been satisfactorily corrected.

2) Submit final signed report stating that work requiring special inspection was, to the best of the inspector's knowledge, in conformance to the Contract Documents and the applicable workmanship previsions of the building code.

3.4 CLEANING

A. Clean concrete masonry as the wall is being constructed using fiber brushes, wooden paddles and scrapers.
   1. Do not use metal tools or wire brushes.
   2. No acid-based cleaning solutions shall be used unless approved in writing by Engineer.

B. Remove dirt and stains in accordance NCMA TEK 8-2A.

C. Remove primary efflorescence in accordance with NCMA TEK 8-3A.

END OF SECTION

DIVISION 05

METALS

SECTION 05 12 00
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel, including the fabrication and erection of support and bracing members, including connections.
   2. Connection detail design as required.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 15 19 - Anchorage to Concrete.
   4. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Institute of Steel Construction (AISC):
      a. 303, Code of Standard Practice for Steel Buildings and Bridges.
      b. 360, Specifications for Structural Steel Buildings.
      c. Quality Certification Program for Fabricators.
   2. American Society of Mechanical Engineers (ASME):
      a. B18.21.1, Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series).
   3. ASTM International (ASTM):
      a. A2, Standard Specification for Carbon Steel Girder Rails of Plain, Grooved, and Guard Types.
      b. A6/A6M, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
      c. A36/A36M, Standard Specification for Carbon Structural Steel.
      d. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      e. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
      f. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      h. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
      i. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
      j. A563, Standard Specification for Carbon and Alloy Steel Nuts.
      k. A992/A992M, Standard Specification for Structural Steel Shapes.
      l. A1064/A1064M, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
      m. F436, Standard Specification for Hardened Steel Washers.
      n. F959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
      o. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

p. F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

4. American Welding Society (AWS):
   a. A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
   b. A5.5/A5.5M, Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding.
   c. A5.17/A5.17M, Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
   d. A5.18/A5.18M, Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding.
   e. A5.20/A5.20M, Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.
   f. A5.23/A5.23M, Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding.
   g. A5.28/A5.28M, Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding.
   h. A5.29/A5.29M, Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding.
   i. D1.1/D1.1M, Structural Welding Code - Steel.
      1) Steel stud connectors and their installation to comply with requirements of AWS D1.1/D1.1M.
5. National Institute of Steel Detailing (NISD).
6. Research Council on Structural Connections (RCSC):
   a. Specification for Structural Joints Using High-Strength Bolts.
7. Building code:
   a. International Code Council (ICC):
      1) International Building Code and associated standards, Edition including all amendments, referred to herein as Building Code.

B. Qualifications:

1. Steel fabricator:
   a. Minimum of 10 years experience in fabrication of structural steel participate in the AISC Certification program and is designated an AISC Certified Plant, Category BU (formally known as STD), SBR at time of bid.
   b. Fabricator plant quality control and inspection program: Meet requirements of the Building Code and/or be an Approved Fabricator.
   c. Plants that are not an Approved Fabricator may be acceptable, provided:
      1) Plant meets all remaining qualifications.
      2) Contractor reimburses the Owner the cost of required Special Inspection services.
2. Steel erector:
   a. Minimum of 10 years of experience in erection of structural steel similar in the scope of this project or certified as CSE under the AISC Quality Certification Program.
   b. With an active and enforced quality assurance program in place, as described in the applicable Codes.
3. Qualify welding procedures and welding operators in accordance with AWS.

1.3 DEFINITIONS

A. Owner: May mean the Owner's Designated Representative for Construction as defined by the AISC 303.

B. Galvanizing: Hot-dipped galvanizing per ASTM A153/A153M and/or ASTM A123/A123M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by aforementioned standards.

C. Approved Fabricator: Approved by the Building Official to perform the Building Code required Special Inspections.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Detailed supplemental specification relating to load indicator washers or high-strength bolts.
         1) Alternate design for Engineer approval (submitted at Contractor's option if desired by Contractor for use).
      d. Source and certification of quality for high-strength bolts, nuts and washers.
   3. Fabrication and/or layout drawings:
      a. Prepare Shop Drawings under NISD Quality Procedures Program certification.
      b. Complete Shop Drawings for all of the work showing clearly all pieces, sizes, dimensions, details, connections materials and shop coatings.
         1) All Shop Drawings must be checked and signed "approved" before submittal.
         2) Show all cuts, copes, and holes.
         3) Indicate all shop and field bolts.
         4) Indicate all shop and field welds using AWS symbols.
      c. Prepare complete erection drawings showing the location and marks of all pieces.
         1) Copies of up-to-date erection drawings shall accompany the Shop Drawings.
         2) Use match marks on the erection drawings to indicate the sheet number on which each particular member is detailed.
      d. Correct any incorrect or unacceptable material or fabrication due to incorrect detailing, shop work, or erection, without additional charge.
   4. Certifications:
      a. Certificates of compliance with standards specified for all major components and fasteners incorporated into work.
      b. Copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.
      c. Welder qualification data and prequalified procedures.
      d. Special Inspections reports.
      e. Source Quality Control Documentation, including certificate of compliance stating that the work performed in the fabrication shop was done in accordance with the approved construction documents.
         1) Certification is required only if the fabricator is fabricator approved by the Building Official.
   5. Test reports:
      a. Certified copies of mill tests.
      b. Manufacturer's load test and temperature sensitivity data for post-installed anchor bolts.
      c. Test reports for all structural steel work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store steel members above ground on skids or other supports.
   1. Keep free of dirt and other foreign material and protect against corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. High-strength bolts:
      a. Portland Bolt and Manufacturing Company.
      b. Lewis Bolt & Nut Company.
      c. Nucor Fasteners.
      d. St. Louis Screw and Bolt Company.
   2. Load indicator washers for high-strength bolts:
      a. Portland Bolt and Manufacturing Company.
      b. Mid-South Bolt and Screw Co., Inc.
      c. J and M Turner, Inc.
   3. Alternate design high-strength bolts:
      a. T. C. Bolt Corporation.
      b. Construction Fastener Systems Division of Bristol Machine Company.
      c. LeJuene Bolt Co.
   4. Headed studs and deformed bar anchors:
      a. Nelson Stud Welding Division, TRW, Inc.
      b. Stud Welding Products, Inc.
   5. Mechanical anchor bolts:
      a. See Section 03 15 19.
   6. Adhesive anchors bolts:
      a. See Section 03 15 19.
   7. Anchor bolt sleeves:
      a. Sinco/Wilson.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Steel, Structural Shapes and Plate (unless noted otherwise on Drawings):
   1. All W-shapes and WT-shapes: ASTM A992/A992M.
   2. All other plates, bars and rolled shapes: ASTM A36/A36M.

B. Pipe: ASTM A53/A53M, Grade B (Type E or S) (Fy=35).

C. Hollow Structural Sections (HSS):
   1. Round: ASTM A500/A500M, Grade B (Fy=42).
   2. Square or rectangular: ASTM A500/A500M, Grade B (Fy=46).

D. High-Strength Bolts, Nuts and Washers:
   1. ASTM F3125, Grade A325 with ASTM A563 nuts galvanized:
   2. High-strength bolts:
      a. Provide two ASTM F436 washers for all bolts galvanized.
      b. Provide beveled washers at connections of sloped/tapered sections.

E. Bolts, Non-high Strength: ASTM A307, Grade A.

F. Threaded Rod: ASTM F1554, Grade 36.

G. Washers, Plain (for Non-high Strength Bolts): ASME B18.22.1, Type B.

H. Welding Electrodes:
   1. Shielded metal arc: AWS A5.1/A5.1M or AWS A5.5/A5.5M, E70XX or E801X-X.
   2. Submerged arc: AWS A5.17/A5.17M or AWS A5.23/A5.23M, F7XX-EXXX or F8XX-EXXX-XX.
   3. Gas metal arc: AWS A5.18/A5.18M, E70S-X or E70U-1 or AWS A5.28/A5.28M, ER80S-XX, E80C-XXX.

4. Flux cored arc: AWS A5.20/A5.20M, E7XT-X (except 2, 3, 10, GS), AWS A5.29/A5.29M, E7XT-X or E8XTX-X, E8XTX-XM.

I. Anchor Rods and Bolts:
   1. See Section 03 15 19.

J. Headed Studs and Deformed Bar Anchors:
   1. Headed studs:
      a. ASTM A108, complying with AWS D1.1/D1.1M, Section 7, Type B; minimum yield strength 50,000 PSI, minimum tensile strength 60,000 PSI.
      b. Uniform diameter.
      c. Heads: Concentric and normal to shaft.
      d. Weld end: Chamfered and solid flux.
   2. Deformed bar anchor:
      a. ASTM A1064/A1064M, complying with AWS D1.1/D1.1M, Section 7, Type C.
      b. Minimum yield strength: 70,000 PSI.
      c. Minimum tensile strength: 80,000 PSI.
      d. Straight, unless indicated otherwise.
      e. Solid flux.
   3. After welding, remove ceramic ferrules and maintain free from any substance which would interfere with function, or prevent bonding to concrete.

K. Nonshrink Grout: See 03 31 30.

L. Mechanical and Adhesive Anchor Bolts for Fastening to Concrete:
   1. See Specification Section 03 15 19.

2.3 FABRICATION

A. Comply with requirements of applicable Building Code and AISC 360 with modifications and additional requirements specified herein.
   1. Identify high-strength steel material in fabricated members in accordance with ASTM A6/A6M.

B. Minimize the amount of field welding.
   1. Shop assemble components into largest size possible commensurate with transportation and handling limitations.
   2. Shop connections: Bolted with high-strength bolts or welded.

C. Connection Details:
   1. Provide as a minimum, two, 3/4 IN DIA, high-strength bolts for all bolted connections unless otherwise specified.

D. Provide bearing type connections for all bolted connections, unless otherwise noted.

E. Field Connections:
   1. Provide bolts for all field connections except where shown otherwise on the Drawings.
   2. Use high-strength bolts unless shown or specified otherwise.
   3. Use of high-strength bolts: Conform to RCSC Specification for Structural Joints Using High-Strength Bolts.
   4. Unfinished bolts may be used for attaching stair treads to stringers.
   5. If structural steel details (field welds versus shop welds, etc.) shown on design Drawings are not compatible with selected erection procedures, submit proposed modifications for review.
   6. Connections to structural steel provided by others: Provide all connectors and coordinate location of bolt holes to match connection holes in steel provided by others.

F. Accurately mill column end bearing surfaces to true plane.

G. Fabricate and erect beams with non-specified camber in accordance with AISC 360, Chapter L1.

H. Cut, drill, or punch holes at right angles to surface of metal.
   1. Do not make or enlarge holes by burning.
   2. Make holes clean cut, without torn or ragged edges.
   3. Remove outside burrs resulting from drilling or reaming operations with tool making 1/16 IN bevel.
   4. Provide holes in members to permit connection of work of other trades or contractors.

I. Make splices only where indicated or where approved.

J. Cope at 45 DEG, corners of stiffener plates at junction of member flanges with webs.

K. Flame cut bevels for welds, provided such cutting is done automatically.
   1. Leave free of burrs and slag by grinding or planing the cut edges.

L. Grind smooth all rough welds and sharp steel edges shall be ground to approximately 1/8 IN radius.

M. Tolerances (unless noted otherwise on Drawings):
   1. When material received from the mill does not satisfy ASTM A6/A6M tolerances for camber, profile, flatness or sweep, Contractor is permitted to perform corrective work by the use of controlled heating, and mechanical straightening, subject to the limitations of the AISC 360.
   2. Fabrication tolerance:
      a. Member length:
         1) Both ends finished for contact bearing: 1/32 IN.
         2) Framing members:
      b. Member straightness:
         1) Compression members: 1/1000 of axial length between points laterally supported.
         2) Non-compression members: ASTM A6/A6M tolerance for wide flange shapes.
      c. Specified member camber (except compression members):
         1) 50 FT or less: -0/+1/2 IN.
         2) Over 50 FT: -0/+1/2 IN (+1/8 IN per 10 FT over 50 FT).
         3) Members received from mill with 75 PCT of specified camber require no further cambering.
         4) Fabricate beams/trusses without specified camber so after erection, camber is upward.
         5) Measure camber in fabrication shop in unstressed condition.
      d. Use filler plates at bolted splices to take up depth deviation.
         1) At welded joints, adjust weld profile to conform to variation in depth.
         2) Slope weld surface per AWS requirements.
      e. Free finished members from twists, bends and open joints.
         1) Sharp kinks, bends and deviation from the above tolerances are cause for rejection of material.

2.4 WELDING

A. Comply with AWS D1.1/D1.1M, and other requirements indicated herein, for all welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work.
   1. Qualify joint welding procedures or test in accordance with AWS qualification procedures.

B. Test and qualify welders, welding operators and tackers in compliance with AWS D1.1/D1.1M for position and type of welding to which they will be assigned.
   1. Conduct tests in presence of approved testing agency.
   2. Certification within previous 12 months will be acceptable, provided samples of the welder's work are satisfactory.

C. Before Starting Welding:
   1. Carefully plumb and align members in compliance with specified requirements.
   2. Fully tighten all bolts.

3. Comply with AWS D1.1/D1.1M, Section 5 for assembly and surface preparation.
4. Preheat base metal to temperature stated in AWS D1.1/D1.1M.
    a. When no preheat temperature is given in AWS D1.1/D1.1M and base metal is below 50 DEGF, preheat base metal to at least 70 DEGF.
    b. Maintain temperature during welding.
    c. Preheat surface of all base metal within distance from point of welding equal to thickness of thicker part being welded or 3 IN, whichever is greater, to specified preheat temperature.
    d. Maintain this temperature during welding.
5. Mark welds with an identifying mark unique to each welder.

D. Make flange welds before making web welds.

E. Where groove welds have back-up plates, make first three passes with 1/8 IN round electrodes.
    1. Use backup plates in accordance with AWS D1.1/D1.1M, extending minimum of 1 IN either side of joint.

F. Flame cut edges of stiffener plates at shop or field butt weld.
    1. Do not shear.

G. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.

H. Low Hydrogen Electrodes: Dry and store electrodes in compliance with AWS D1.1/D1.1M.

I. Do not perform welding when ambient temperature is lower than 0 DEGF or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.

2.5 SHOP COATING

A. Refer to Specification Section 09 96 00 and coordinate shop primer, surface preparation and coating with field applied primers and coatings where specified.

B. Provide suitable methods of handling and transporting painted steel to avoid damage to coating.

C. Do not coat following surfaces:
    1. Machined surfaces, surfaces adjacent to field welds, and surfaces fully embedded in concrete.
    2. All other members for which no coating is specified.
    3. Contact surfaces at bolted slip-critical connections, unless surface condition conforms to the RCSC Specification for Structural Joints Using High-Strength Bolts, Part 3.2.2.

D. Clean thoroughly all surfaces not coated before shipping.
    1. Remove loose mill scale, rust, dirt, oil and grease.
    2. Protect machined surfaces.

2.6 SOURCE QUALITY CONTROL

A. Special Inspection and Testing:
    1. See Specification Section 01 45 33.
    2. If the fabricator is not an Approved Fabricator, Owner will employ the services of an independent testing agency to inspect and test structural steel shop work for compliance with Specifications.
        a. Contractor provides sufficient notification and access so inspection and testing can be accomplished.
    3. Contractor responsible for testing to qualify shop welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.

B. Approved Fabricator or Testing Agency Responsibilities:
    1. Inspect shop and field welding in accordance with AWS D1.1/D1.1M, Section 6 including the following non-destructive testing:
        a. Visually inspect all welds.

b. In addition to visual inspection, test 50 PCT of full penetration welds and 20 PCT of fillet welds with liquid dye penetrant.
c. Test 20 PCT of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.

2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 9.
   a. Verify proper pretension for slip-critical bolted connection only.
   b. Verify direct tension indicator gaps for slip-critical bolted connection only.
3. Inspect stud welding in accordance with AWS D1.1/D1.1M, Section 7.8.
4. Prepare and submit inspection and test reports to Engineer.

2.7 GENERAL

A. Contractor is solely responsible for safety.
   1. Construction means and methods and sequencing of work is the prerogative of the Contractor.
   2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, bracing or rigid connections are installed.
   3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
   4. Until all elements of the permanent structure and lateral bracing system are complete, provide temporary bracing designed, furnished, and installed by the Contractor for the partially complete structure.

B. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including wind, construction activities, and operation of equipment, is the responsibility of the Contractor.
   1. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding work is in place, and temporary work is no longer necessary.
   2. Use temporary guys, bracing, shoring, and other work to prevent injury or damage to adjacent work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
   3. Design of the temporary bracing system and consideration of the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel members by partially or completely installed work, including work of all other trades, is the Contractor's responsibility.
      a. If not obvious from experience or from the Drawings, confer with the Engineer to identify those structural steel elements that must be complete before the temporary bracing system is removed.
   4. Remove and dispose of all temporary work and facilities off-site.

C. Examine work-in-place on which specified work is in any way dependent to ensure that conditions are satisfactory for the installation of the work.
   1. Report defects in work-in-place which may influence satisfactory completion of the work.
   2. Absence of such notification will be construed as acceptance of work-in-place.

D. Field Measurement:
   1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
   2. Contractor is responsible for the accurate fit of the work.

E. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.
   1. Notify Engineer of any errors or deviations found by such checking.

PART 3 - EXECUTION

3.1 ERECTION

A. Framing member location tolerances after erection shall not exceed the framing tolerances listed in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.

B. Erect plumb and level; introduce temporary bracing required to support erection loads.

C. Use light drifting necessary to draw holes together.
   1. Drifting to match unfair holes is not allowed.

D. Welding:
   1. Conform to AWS D1.1/D1/1M and requirements of this Specification Section.
   2. Join two (2) sections of steel of different ASTM designations using welding techniques in accordance with a qualified AWS D1.1/D1.1M procedure.

E. Shore existing members when unbolting of common connections is required.
   1. Use new bolts for rebolting connections.

F. Clean stored material of all foreign matter accumulated during erection period.

G. Clean bearing and contact surfaces before assembly.

H. Set beam and column base and bearing plates accurately, as indicated, on nonshrink grout.
   1. Set and anchor each base plate to proper line and elevation.
   2. Use metal wedges, shims or setting nuts as required and tighten anchor bolts.
      a. Use same metal as base plate.
      b. Cut off protrusions of wedges and shims flush with edge of base plate.
   3. Fill sleeves around anchor bolts with nonshrink grout.
   4. Pack grout solidly between bottom of plate and bearing surface.
   5. Refer to 03 31 30 for nonshrink grout requirements.

I. Cast-in-place Anchor Bolts:
   1. See Specification Section 03 15 19.

J. Install high strength bolts with hardened washers.
   1. Install and tighten in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 8.
   2. Coordinate installation with inspection.
      a. Do not start installation until coordination with Testing Agency is complete.
   3. Bearing-type connections: High-strength bolts shall be tightened to snug-tight condition.
   4. Slip-critical connections:
      a. Perform calibration testing for all methods of installation of high-strength bolts in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts, Section 8.2.
      b. Turn-of-nut tightening:
         1) Inspector shall observe the pre-installation verification testing.
         2) Subsequently, ensure by routine observation that the bolting crew properly rotates the turned element relative to the unturned element by the amount specified.
         3) Alternatively, when fastener assemblies are match-marked after the initial fitup of the joint but prior to pretensioning, visual inspection after pretensioning is permitted in lieu of routine observation.
      c. Calibrated wrench tightening: Calibrate on a daily basis.
      d. Direct tension indicator tightening: If previously approved by Engineer.
      e. Installation of alternate design bolts: If previously approved by Engineer.
   5. In the event any bolt in a connection is found to be defective, check and retighten all bolts in the connection.

K. Do not use gas cutting to correct fabrication errors.
   1. In case members do not fit or holes do not match, ream out the holes and insert the next larger size bolt.
      a. Drill new holes if the connections require new holes.
      b. Make no such corrections without prior approval of the Engineer.
   2. Burning of holes is not permitted.

L. Prior to making field connections to existing structural steel, remove completely all paint from existing steel which will be in contact with new steel and new welds.

M. Tighten and leave in place erection bolts used in welded construction.

N. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1 in 20 with a plane normal to bolt axis.

O. After bolts are tightened, upset threads of non-high strength bolts and anchor bolts to prevent nuts from backing off.

P. After Erection:
   1. Grind smooth all sharp surface irregularities resulting from field cutting or welding.
   2. Power tool clean welds, bolts, washers and abrasions to shop coat removing all rust and foreign matter.

Q. Mechanical Anchor Bolts and Adhesive Anchor Bolts:
   1. See Specification Section 03 15 19.

3.2 FIELD QUALITY CONTROL

A. Special Inspection and Testing:
   1. See Specification Section 01 45 33.
   2. Special Inspection to be in accordance with the Building Code.
   3. Special Inspection is required for:
      a. Material verification of high-strength bolts, nuts, and washers.
         1) Frequency: All high-strength bolts, prior to being covered up or substantial completion.
      b. Inspection of high-strength boltings:
         1) Frequency:
            a) All high-strength bolts, prior to being covered up or substantial completion.
            b) Pretensioned and slip-critical joints using turn-of-nut without match marking or calibrated wrench methods of installation require continuous inspection.
      c. Material verification of structural steel.
         1) Frequency: Prior to being covered up or substantial completion,
      d. Material verification of weld filler materials.
         1) Frequency:
            a) Prior to welding on site.
            b) Randomly thereafter.
      e. Inspection of welding.
         1) Frequency:
            a) Visually inspect all welds.
      f. Inspect structural steel which has been erected.
         1) Frequency: Prior to members being covered up or substantial completion.
      g. Inspect stud welding in accordance with AWS D1.1/D1.1M, Section 7.8.

B. Erected Framing Tolerance, unless noted otherwise on the Drawings:
   1. Do not exceed cumulative effect of rolling, fabrication and erection tolerance for overall finished dimensions.
   2. Erection tolerances are defined relative to member working points and working lines as follows:
      a. Actual centerline of top flange or surface at each end for horizontal members.
      b. Actual center of member at each end for all other members.

c. Other points may be used, providing they are based on these definitions.
d. Working line is straight line connecting member working points.

3. Tolerances on position and alignment are as specified in the Code, unless otherwise modified.
   a. Provide "adjustable items" such as lintels, wall supports, curb angles, window mullions and similar members with adjustable connections to supporting structural framing.
4. Certification by steel erector:
   a. Certify the location of erected structural steel is acceptable for plumbness, level and aligned within tolerances specified.
   b. Provide certification upon completion of any part of work.
   c. Provide certification prior to start of work by other trades that may be supported; attach to structural steel work.

3.3 CLEANING AND REPAIR OF SHOP PRIMER PAINT

A. After erection, clean all steel of mud or other foreign materials, and repair any damage.
   1. Touchup coatings to comply with Specification Section 09 96 00.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections.
   2. Design of all temporary bracing not indicated on Drawings.
   3. Design of systems and components, including but not limited to:
      a. Stairs.
      b. Landings.
      c. Ladders.
      d. Railings.
      e. Modular framing system.
      f. Masonry lintels.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 15 19 - Anchorage to Concrete.
   4. Section 03 31 30 - Concrete, Materials and Proportioning.
   5. Section 05 12 00 - Structural Steel.
   6. Section 05 52 05 - Steel Railings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
      a. ADM 1, Aluminum Design Manual.
   2. American Association of State Highway and Transportation Officials (AASHTO):
      a. HB, Standard Specifications for Highway Bridges.
   3. American Institute of Steel Construction (AISC):
      a. 325, Manual of Steel Construction.
      b. 360, Specifications for Structural Steel Buildings (referred to herein as AISC Specification).
   4. American Society of Civil Engineers (ASCE):
      a. 7, Minimum Design Loads for Buildings and Other Structures.
   5. ASTM International (ASTM):
      a. A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
      b. A36, Standard Specification for Carbon Structural Steel.
      c. A47, Standard Specification for Ferritic Malleable Iron Castings.
      d. A48, Standard Specification for Gray Iron Castings.
      e. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      f. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
      g. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      h. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      i. A197, Standard Specification for Cupola Malleable Iron.
      j. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

k. A276, Standard Specification for Stainless Steel Bars and Shapes.
l. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
m. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
n. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
o. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
p. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
q. A536, Standard Specification for Ductile Iron Castings.
r. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
s. A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
t. A563, Standard Specification for Carbon and Alloy Steel Nuts.
u. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
v. A668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
w. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
x. A786, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
y. A992, Standard Specification for Steel for Structural Shapes.
z. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
aa. A1011, 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.
bb. B26, Standard Specification for Aluminum-Alloy Sand Castings.
cc. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
dd. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ee. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
ff. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
gg. B632, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
hh. F436, Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
ii. F467, Standard Specification for Nonferrous Nuts for General Use.
jj. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
kk. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
ll. F835, Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws.
mm. F879, Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws.
nn. F1789, Standard Terminology for F16 Mechanical Fasteners.
oo. F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

6. American Welding Society (AWS):
   a. A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
   b. D1.1, Structural Welding Code - Steel.
   c. D1.2, Structural Welding Code - Aluminum.

d. D1.6/D1.6M, Structural Welding Code - Stainless Steel.

7. National Association of Architectural Metal Manufacturers (NAAMM):
   a. AMP 510, Metal Stairs Manual.
   b. AMP 555, Code of Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).
   c. MBG 531, Metal Bar Grating Manual.
8. NACE International (NACE).
9. Nickel Development Institute (NiDI):
   a. Publication 11 007, Guidelines for the welded fabrication of nickel-containing stainless steels for corrosion resistant services.
10. Occupational Safety and Health Administration (OSHA):
    a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
11. Building code:
    a. International Code Council (ICC):
       1) International Building Code and associated standards, 2015 Edition including all amendments, referred to herein as Building Code.
    b. A117.1, Accessible and Usable Buildings and Facilities.

B. Qualifications:
1. Qualify welding procedures and welding operators in accordance with AWS.
2. Fabricator shall have minimum of 10 year's experience in fabrication of metal items specified.
3. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of Iowa.

1.3 DEFINITIONS

A. Fasteners: As defined in ASTM F1789.

B. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

C. Hardware: As defined in ASTM A153/A153M.

D. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Contractor designed systems and components:
   a. Certification that manufactured units meet all design loads specified.
   b. Shop Drawings and engineering design calculations:
      1) Indicate design live loads.
      2) Sealed by a licensed professional engineer, registered in the State of Iowa.
      3) Engineer will review for general compliance with Contract Documents.
   c. Contractor designed systems and components include the following:
      1) Fish Crowders.

B. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Certification of welders and welding processes.
   a. Indicate compliance with AWS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Abrasive stair nosings (embedded in concrete stairs):
      a. American Safety Tread.
      b. Balco.
   2. Mechanical anchor bolts:
      a. See Section 03 15 19.
   3. Epoxy adhesive anchor bolts:
      a. See Section 03 15 19.
   4. Concrete screw anchors:
      a. See Section 03 15 19.
   5. Castings, trench covers and accessories:
      a. Neenah Foundry Co.
      b. Deeter Foundry Co.
      c. Barry Craft Construction Casting Co.
      d. McKinley Iron Works.
   6. Galvanizing repair paint:
      a. Clearco Products Co., Inc.
      b. ZRC Products.
   7. Modular framing system:
      a. Unistrut Building Systems.
      b. B-Line Systems.
      c. Kindorf.
      d. Superstrut.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Steel:
   1. Structural:
      a. W-shapes and WT-shapes: ASTM A992, Grade 50.
      b. All other plates and rolled sections: ASTM A36.
   2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
   3. Structural tubing:
      a. ASTM A500, Grade B (46 ksi minimum yield).
   4. Bolts, high strength:
      a. Galvanized, ASTM A153/A153M
   5. Nuts, high strength:
      a. ASTM A563.
   6. Washers (hardened):
      a. ASTM F436.
      b. Provide two (2) washers with all bolts.
   7. Bolts and nuts (unfinished):
      a. ASTM A307, Grade A.
   8. Welding electrodes: AWS D1.1, E70 Series.
   9. Steel forgings: ASTM A668.

B. Iron:
   1. Ductile iron: ASTM A536.
   2. Gray cast iron: ASTM A48 (minimum 30,000 PSI tensile strength).
   3. Malleable iron: ASTM A47, ASTM A197.

C. Stainless Steel:
   1. Stainless steel in welded applications: Low carbon 'L' type.
   2. Minimum yield strength of 30,000 PSI and minimum tensile strength of 75,000 PSI.
      a. Bars, shapes: ASTM A276, Type 304.
      b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
      c. Strip, plate and flat bars: ASTM A666, Type 304 or 316.
      d. Bolts and nuts: ASTM F593, Type 304 or 316.
   3. Minimum yield strength of 25,000 PSI and minimum tensile strength of 70,000 PSI.
      a. Strip, plate and flat bar for welded connections, ASTM A666, Type 304L or 316L.
   4. Welding electrodes: In accordance with AWS for metal alloy being welded.

D. Aluminum:
   1. Alloy 6061-T6, 32,000 PSI tensile yield strength minimum.
      a. ASTM B221 and ASTM B308 for shapes including beams, channels, angles, tees and zees.
      b. Weir plates, baffles and deflector plates, ASTM B209.
   2. Alloy 6063-T5 or T6, 15,000 PSI tensile yield strength minimum.
      a. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
   3. ASTM B26 for castings.
   4. ASTM F468, alloy 2024 T4 for bolts.
   5. ASTM F467, alloy 2024 T4 for nuts.
   6. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.

E. Washers: Same material and alloy as found in accompanying bolts and nuts.

F. Embedded Anchor Bolts:
   1. See Specification Section 03 15 19.

G. Mechanical Anchor Bolts and Adhesive Anchor Bolts:
   1. See Specification Section 03 15 19.

H. Galvanizing Repair Paint:
   1. High zinc dust content paint for regalvanizing welds and abrasions.
   2. ASTM A780.
   3. Zinc content: Minimum 92 PCT in dry film.
   4. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."

I. Dissimilar Materials Protection: See Specification Section 09 96 00.

2.3 MANUFACTURED UNITS

A. Abrasive Stair Nosings:
   1. Exterior cast-in-place concrete stairs:
      a. One piece cast aluminum with wing anchors.
      b. Diamond abrasive pattern.
      c. Babcock Davis "BSTCA-C3W".

B. Aluminum Grating:
   1. NAAMM MBG 531.
   2. Bearing bars: Rectangular, 1-1/2 by 3/16 IN at 1-3/16 IN OC spacing (unless noted otherwise on Drawings).
   3. Cross bars:
      a. Welded, swaged or pressure locked to bearing bars:
      b. Maximum 4 IN/OC spacing.
   4. Top edges of bars: Smooth.

5. Finish: Mill, standard.
6. Clips and bolts: Stainless steel.
7. Seat angles: Aluminum or stainless steel

C. Loose Lintels:
1. Steel, ASTM A36 or ASTM A572 Grade 50, sizes as indicated on Drawings.
2. Hot-dip galvanized per ASTM A123/A123M.

D. Modular Framing System:
1. Materials:
   a. Steel: ASTM A1011, stainless steel, Grade 33.
      1) Hot-dipped galvanized, ASTM A123 or ASTM A153.
   b. Aluminum: ASTM B221 or ASTM B209.
   c. Stainless steel: ASTM A666.
2. Channels and inserts:
   a. Steel or stainless steel: Minimum 12 GA.
   b. Aluminum: Minimum 0.080 IN.
   c. Channels to have one (1) side with a continuous slot with in-turned lips.
      1) Width: 1-5/8 IN.
      2) Depth and configuration as necessary for loading conditions.
3. Fittings: Same material as system major components.
4. Fasteners:
   a. Nuts: Toothed groves in top of nuts to engage the in-turned lips of channel.
   b. Bolts: Hex-head cap screws.
   c. Same material as system major components.
5. End caps:
   a. At each exposed end of each piece mounted on walls, or guardrails, or suspended from framing 7 FT or less above the floor or platform.
      a) Plastic for all exposed ends 7 FT or more above floor or platform.
      b) Plastic or metallic for all other exposed ends.
6. Schedule:
   a. All areas: Hot-dipped galvanized steel.
7. Provide dissimilar materials protection in accordance with Specification Section 09 96 00.
8. Repair all cut ends or otherwise damaged areas of galvanized steel in accordance with ASTM A780.

2.4 FABRICATION

A. Verify field conditions and dimensions prior to fabrication.

B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
1. Grind smooth all rough welds and sharp edges.
   a. Round all corners to approximately 1/32 - 1/16 IN nominal radius.

C. Provide drilled or punched holes with smooth edges.
1. Punch or drill for field connections and for attachment of work by other trades.

D. Weld Shop Connections:
1. Welds to be continuous fillet type unless indicated otherwise.
2. Full penetration butt weld at bends in stair stringers and ladder side rails.
3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1/A5.1M.
4. Weld aluminum in accordance with AWS D1.2.
5. Weld stainless steel in accordance with AWS D1.6.
   a. Treat all welded areas in accordance with ASTM A380.
6. All headed studs to be welded using automatically timed stud welding equipment.
7. Grind smooth welds that will be exposed.

E. Passivate stainless steel items and stainless steel welds after they have been ground smooth.

1. ASTM A380.

F. Conceal fastenings where practicable.

G. Fabricate work in shop in as large assemblies as is practicable.

H. Tolerances:
   1. Rolling:
      a. ASTM A6.
      b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC Specification.
   2. Fabrication tolerance:
      a. Member length:
         1) Both ends finished for contact bearing: 1/32 IN.
         2) Framed members:
            a) 30 FT or less: 1/16 IN.
            b) Over 30 FT: 1/8 IN.
      b. Member straightness:
         1) Compression members: 1/1000 of axial length between points laterally supported.
         2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
      c. Specified member camber (except compression members):
         1) 50 FT or less: Minus 0/plus 1/2 IN.
         2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
         3) Members received from mill with 75 PCT of specified camber require no further cambering.
         4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
         5) Camber shall be measured in fabrication shop in unstressed condition.
      d. At bolted splices, depth deviation shall be taken up by filler plates.
         1) At welded joints, adjust weld profile to conform to variation in depth.
         2) Slope weld surface per AWS requirements.
      e. Finished members shall be free from twists, bends and open joints.
         1) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.

I. Fabricate grating and accessories using aluminum unless shown otherwise on Drawings.
   1. Finish:
      a. Mill, unless noted otherwise.
      b. Coat surfaces in contact with dissimilar materials.
         1) See Specification Section 09 96 00.

J. Fabricate grating in accordance with NAAMM MBG 531.
   1. Maximum tolerance for difference in depth between grating depth and seat or support angle depth: 1/8 IN.
   2. Distance between edge of grating and face of embedded seat angle or face of wall or other structural member: 1/4 IN.
      a. Tolerance: NAAMM MBG 531.
   3. Removable sections: Not wider than 3 FT and not heavier than 100 LBS.
   4. Ends and perimeter edges: Banded, with alternate bearing bars welded to band.
      a. Provide full depth banding unless noted otherwise.
      b. Banding at trenches and sumps to be 1/4 IN less than grating depth to allow for drainage.
   5. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
   6. Provide joints at openings between individual grating sections.
   7. Fabricate grating so that bearing bars and cross bars in adjacent sections are aligned.

K. See Specification Section 09 91 10 for preparation and painting of ferrous metals and other surfaces.

2.5 SOURCE QUALITY CONTROL

A. Surface Preparation:
   1. Refer to Specification Section 09 96 00 for surface preparation requirements.
   2. All miscellaneous metal fabrication item surfaces shall be inspected and approved by NACE certified coatings inspector prior to application of shop-applied coatings.
      a. Inspection shall be performed to determine depth of blast profile and cleanliness of surface.
      b. Fabricator shall reblast and or re-clean surfaces as required until acceptable.

B. Shop Applied Coating Application:
   1. Refer to Specification Section 09 96 00 for coating requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction in time to allow their installation.
   1. If such items are not provided in time for installation, cut in and install.

B. Prior to installation, inspect and verify condition of substrate.

C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
   1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.2 INSTALLATION

A. Set metal work level, true to line, plumb.
   1. Shim and grout as necessary.

B. Contractor is solely responsible for safety.
   1. Construction means and methods and sequencing of work is the prerogative of the Contractor.
   2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, and diagonal bracing or rigid connections are installed.
   3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
   4. Until all elements of the permanent structure and lateral bracing system are complete, temporary bracing for the partially complete structure will be required.

C. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including construction activities and operation of equipment is the responsibility of the Contractor.
   1. Plumb, align, and set structural steel members to specified tolerances.
   2. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding work is in place, and temporary work is no longer necessary.
   3. Use temporary guys, bracing, shoring, and other work to prevent injury or damage to adjacent work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
   4. Contractor shall be responsible for the design of the temporary bracing system and must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel members by partially or completely installed work, including work of all other trades.

a. If not obvious from experience or from the Drawings, confer with the Engineer to identify those structural steel elements that must be complete before the temporary bracing system is removed.

5. Remove and dispose of all temporary work and facilities off-site.

D. Examine work-in-place on which specified work is in any way dependent to ensure that conditions are satisfactory for the installation of the work.
   1. Report defects in work-in-place which may influence satisfactory completion of the work.
   2. Absence of such notification will be construed as acceptance of work-in-place.

E. Field Measurement:
   1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
   2. Contractor responsible for the accurate fit of the work.

F. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.
   1. Use surveyor's level.
   2. Notify Engineer of any errors or deviations found by such checking.

G. Framing member location tolerances after erection shall not exceed the frame tolerances listed in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.

H. Erect plumb and level; introduce temporary bracing required to support erection loads.

I. Use light drifting necessary to draw holes together.
   1. Drifting to match unfair holes is not allowed.

J. Welding:
   1. Conform to AWS D1.1 and requirements of the FABRICATION Article in PART 2 of this Specification Section.
   2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.

K. Shore existing members when unbolting of common connections is required.
   1. Use new bolts for rebolting connections.

L. Clean stored material of all foreign matter accumulated prior to the completion of erection.

M. Bolt Field Connections: Where practicable, conceal fastenings.

N. Field Welding:
   1. Follow AWS procedures.
   2. Grind welds smooth where field welding is required.

O. Field cutting grating or checkered plate to correct fabrication errors is not acceptable.
   1. Replace entire section.

P. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.

Q. Unless noted or specified otherwise:
   1. Connect steel members to steel members with 3/4 IN DIA ASTM F3125, Grade A325 high strength bolts.
   2. Connect aluminum to aluminum with 3/4 IN DIA stainless bolts.
   3. Connect aluminum to structural steel using 3/4 IN DIA stainless steel bolts.
      a. Provide dissimilar metals protection.
   4. Connect aluminum and steel members to concrete and masonry using stainless steel mechanical anchor bolts or adhesive anchor bolts unless shown otherwise.
      a. Provide dissimilar materials protection.
   5. Provide washers for all bolted connections.

6. Where exposed, bolts shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top of installed nut.
    a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.

R. Install and tighten ASTM F3125, Grade A325 high-strength bolts in accordance with the AISC 325, Allowable Stress Design (ASD).
1. Provide hardened washers for all Grade A325 bolts.
    a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.

S. After bolts are tightened, upset threads of ASTM A307 bolts or anchor bolts to prevent nuts from backing off.

T. Secure metal to wood with lag screws of adequate size with appropriate washers.

U. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.
1. Provide full penetration welded splices where continuity is required.

V. Provide each fabricated item complete with attachment devices as indicated or required to install.

W. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction.

X. Set beam and column base plates accurately on nonshrink grout as indicated on Drawings.
1. See Division 03 Specification Sections for non-shrink grout and anchorage.
2. Set and anchor each base plate to proper line and elevation.
    a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams.
        1) Wedges, shims and setting nuts to be of same metal as base plate they support.
        2) Tighten nuts on anchor bolts.
    b. Fill space between bearing surface and bottom of base plate with nonshrink grout.
        1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
    c. Do not remove wedges or shims.
        1) Where they protrude, cut off flush with edge of base plate.
    d. Fill sleeves around anchor bolts solid with non-shrink grout.

Y. Tie anchor bolts in position to embedded reinforcing steel using wire.
1. Tack welding prohibited.
    a. Coat projecting bolt threads and nuts with heavy coat of clean grease.
2. Anchor bolt location tolerance:
    a. Per Section 03 15 19.

Z. Attach grating to end and intermediate supports with grating saddle clips and bolts.
1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
2. Attach individual units of aluminum grating together with clips at 2 FT OC maximum with a minimum of two (2) clips per side.

AA. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification Section 09 96 00.

BB. Repair damaged galvanized surfaces in accordance with ASTM A780.
1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

3.3 FIELD QUALITY CONTROL

A. Tolerances shall meet structural requirements of Specification Section 05 12 00 for erecting items of structural nature.

B. Tolerances (unless otherwise noted on the Drawings):
   1. Frame placement, after assembly and before welding or tightening.
      a. Deviation from plumb, level and alignment: 1 IN 500, maximum.
      b. Displacement of centerlines of columns: 1/2 IN maximum, each side of centerline location shown on Drawings.
      c. Displacement of centerlines of columns: 1/2 IN maximum, each side of centerline location shown on Drawings.

C. OWNER Pays for Field Inspection and Testing:
   1. Owner will employ and pay for services of an independent testing agency to inspect and test structural steel shop and field work for compliance with this Specification Section.
   2. Contractor provides sufficient notification and access so inspection and testing can be accomplished.
   3. Contractor pays for retesting of failed tests and for additional testing required when defects are discovered.

3.4 CLEANING

A. After fabrication, erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.

B. All stainless steel products in addition to Paragraph A. above:
   1. Remove all heat tint, rusting, discoloration by passivation, ASTM A380, or other acceptable means as listed in NiDI 11 007 as approved by the Engineer.

C. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09 96 00.

END OF SECTION

SECTION 05 52 05
STEEL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel handrail, stair rail and guardrail.
   2. Steel guardrail gates.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 05 50 00 - Metal Fabrications.
   4. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. U.S. Department of Justice, Architectural and Transportation Barriers Compliance Board (Access Board):
      a. Americans with Disabilities Act (ADA):
         1) Accessibility Guidelines for Buildings and Facilities (ADAAG).
   2. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      d. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      e. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   3. American Welding Society (AWS):
      a. D1.1, Structural Welding Code - Steel.
   4. National Association of Architectural Metal Manufacturers (NAAMM):
      a. AMP 521, Pipe Railing Systems Manual.
   5. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

B. Qualify welding procedures and welding operators in accordance with AWS.

1.3 DEFINITIONS

A. Hardware: As defined in ASTM A153/A153M.

B. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

C. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.

D. Handrail: A horizontal or sloping rail intended for grasping by the hand for guidance or support.

E. Railing: A generic term referring to guardrail, handrail and/or stair rails.

F. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Fabrication and/or layout drawings.
      a. Plan showing profile, location, section and details of each railing, and type and details of anchorage system.
      b. Location and type of expansion joints.
      c. Materials of construction including shop-applied coatings.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Certification of welders and welding procedures indicating compliance with AWS.
   3. Certification that railings have been designed and fabricated to meet the loading requirements specified.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver and handle railings to preclude damage.

B. Store railings on skids, keep free of dirt and other foreign matter which will damage railings or finish and protect from corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Welded railing systems:
      a. Any manufacturer meeting this Specification Section.
   2. Galvanizing repair paint:
      a. ZRC Products.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Pipe: ASTM A53, Types E or S, Grade B, or ASTM A501.

B. Steel Sheet, Bar (Pickets) and Plate: ASTM A36.

C. Galvanizing Repair Paint:
   1. High zinc dust content paint for regalvanizing welds and abrasions.
   2. Dried film shall contain not less than 95 PCT zinc dust by weight.
   3. ZRC Products "ZRC."

D. Expansion and Adhesive Anchors: See Specification Section 03 15 19.

E. Welding Electrodes: AWS D1.1, E70 Series.

2.3 FABRICATION

A. General:
   1. Verify field conditions and dimensions prior to fabrication.
   2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
      a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
   3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
      a. Ease exposed edges to a radius of approximately 1/32 IN.
      b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   4. Form exposed connections with flush, smooth, hairline joints, using [galvanized steel] [stainless steel] splice locks to splice sections together or by welding.
   5. Provide for anchorage of type indicated on the Drawings or as required by field conditions.
      a. Drill or punch holes with smooth edges.
   6. Design railing and anchorage system in accordance with NAAMM AMP 521 to withstand loading as required by the building code.
   7. Design railings in accordance with accessibility requirements per the building code and ADAAG.

B. Custom fabricate pipe railings to dimensions and profiles indicated.
   1. Guardrails:
      a. 1-1/2 IN nominal diameter pipe.
      b. Top rails and intermediate rails: Schedule 40.
      c. Vertical posts: Schedule 80.
   2. Handrails mounted to walls or guardrail vertical posts: 1-1/4 IN nominal diameter Schedule 40 pipe.
   3. Where details are not indicated, space intermediate rails to requirements of the building code or OSHA Standards, whichever requires the more restrictive design.
   4. Vertical pickets: Minimum 0.50 IN DIA solid bars/rods.
      a. Where details are not indicated, set vertical pickets to requirements of the building code or OSHA Standards, whichever requires the more restrictive design.
   5. Space vertical posts as required by loading requirements but not more than 4 FT OC.
      a. Avoid locating vertical posts at changes in direction of railing.
      b. Hold vertical post back from corner and provide radiused corners.
   6. Space handrail brackets as required by loading requirements but not more than 4 FT OC.
   7. Base plate for vertical guardrail posts mounted to top of concrete surface:
      a. 3/8 x 6 x 6 IN square plate welded to the vertical post.
      b. Predrilled to accept four anchors.
   8. Base plate for vertical guardrail post mounted to metal structure:
      a. 3/8 x 2-1/2 x 8 IN plate welded to the vertical post.
      b. Predrilled to accept two fasteners.
   9. Mounting bracket for vertical guardrail post mounted to vertical concrete surface or web of metal structural member:
      a. Pair of 3/8 IN angles or bent plates welded to vertical posts.
      b. Predrilled to accept two fasteners each.
      c. Provide 1/4 x 4 IN high toe boards at elevated walkways and platforms, where indicated on the Drawings or required by OSHA Standards.
         1) Clearance between bottom of toe board and walking surface shall not exceed 1/4 IN.
      d. Guardrail gates:
         1) Constructed of same material and sizes as the guardrail system.
         2) Width of gate as shown on Drawings.
         3) Hinges:

a) Self-closing.
(1) Stainless steel torsion spring.
b) Similar to Wagner, Model "IR100."
4) Gate latch and stop:
a) Spring-loaded pin latch.
(1) Stainless steel spring.
b) Similar to Wagner, Model "IR101."

C. Welded Railing Fabrication:
1. All welding to be continuous in accordance with AWS D1.1.
a. All welded railing joints shall have full penetration welds.
2. All exposed welds to be ground and buffed smooth and flush to match and blend with adjoining surfaces.
a. NAAMM AMP 521, Type 2.
3. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
4. Fit exposed ends of guardrails and handrails with solid terminations.
a. Return ends of handrails to wall but do not attach to wall.
5. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.

D. Install weeps to drain moisture from hollow sections of railing at exterior locations and in high humidity areas.
1. Drill 1/4 IN weep hole in railings closed at bottom:
a. 1 IN above walkway surface at bottom of posts.
1) 1 IN above solid rod at removable railing sections.
b. At low point of intermediate rails.
c. Drill hole prior to galvanizing.
d. Do not drill weep holes:
1) In bottom of base plate.

E. Expansion Joints:
1. Joints to be designed to allow expansion and contraction of railing and still meet design loads required.
a. Top rail splices and expansion joints shall be located within 8 IN of post or other support.
b. Where railings span building [or tank] expansion joints; provide a railing expansion joint in the span crossing the building [or tank] expansion joint.
2. Provide expansion joints in any continuous run exceeding 20 FT in length.
a. Space expansion joints at not more than 40 FT on center.
3. Provide minimum 0.10 IN of expansion joint for each 20 FT length of top rail for each 25 DegF differential between installation temperature and maximum design temperature.
a. Maximum expansion joint width at time of installation shall not exceed 3/8 IN.
1) Provide additional expansion joints as required to limit expansion joint width.
4. Provide slip-joint with internal sleeve.
a. Extend slip joint min 2 IN beyond joint at maximum design width.
b. Fasten internal sleeve securely to one side
1) Provide allen-head set screw located in bottom of rail.
2) Rivets or exposed screw heads are not acceptable.

F. Finish:
1. Hot-dip galvanize after fabrication.
2. Powder coated:
a. Hot-dip galvanize after fabrication.
b. Prepare galvanized surfaces in accordance with ASTM D6386.

c. PVDF powder coating:
    1) Minimum 70 PCT resin content.
    2) Meet requirements of AAMA 2605.
d. Color: Per owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, inspect and verify condition of substrate.

B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

3.2 INSTALLATION

A. Install handrails and guardrails to meet loading requirements of the building code.

B. Install products in accordance with NAAMM AMP 521 and manufacturer's instructions.

C. Set work accurately in location, alignment and elevation; plumb, level, and true.
    1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.

D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
    1. Provide shims as required.

E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer.
    1. Lubricate expansion joint splice bar for smooth movement of railing sections.

F. Provide removable railing sections where indicated on Drawings.

G. Attach handrails to walls or guardrails with brackets designed for condition.
    1. Provide brackets which provide a minimum 1-1/2 IN clearance between handrail and nearest obstruction.
        a. Handrails shall not project more than 4-1/2 IN into required stairway width.
    2. Anchor handrail brackets to concrete or masonry walls with 1/2 IN stainless steel adhesive anchors and stainless steel hex head bolts.

H. Anchor railings to concrete with minimum 1/2 IN stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract documents.
    1. Where exposed, bolts shall extend minimum 1/2 IN and maximum 3/4 IN above the top nut.
        a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.
        b. Bevel the top of the bolt after cutting to provide a smooth surface.

I. Anchor railings to metal structure with minimum 3/4 IN stainless steel bolts, nuts and washers.

J. Install toeboards to fit tight to the walking surface.
    1. Attach to railing vertical post with manufacturer's standard mounting clamp:
        a. Adjustable.
        b. Designed to engage in extruded slot on back of toeboard.
    2. Provide splice bars, corner splices and brackets:
        a. Manufacturer's standard items as required for a complete installation.
    3. Notch toeboards at base plates or other obstructions.
    4. Bottom of toeboard shall not exceed 1/4 IN above walking surface.

K. Repair damaged galvanized surfaces in accordance with ASTM A780.
    1. Properly prepare surface in accordance with galvanizing repair paint manufacturer's recommendations.

2. Apply minimum 6 MILS DFT of galvanizing repair paint in accordance with manufacturer's recommendations.

L. Prepare and paint railings in accordance with Specification Section 09 91 10.

M. Provide railings as required for stair construction identified in Specification Section 05 50 00.

N. Install guardrail gate plumb and level in location shown on Drawings.
   1. Center gate in opening.
   2. Top of gate to match top of guardrail.
   3. Fasten hinges to gate and jamb post:
      a. Minimum three, 1/4 IN stainless steel countersunk machine screws per leaf.
      b. Drill and tap into railing and gate vertical posts.
   4. Provide not less than two hinges per gate.
   5. Install gate latch and stop on strike side of opening.
      a. Fasten to gate with 1/4 IN stainless steel countersunk machine screws.
      b. Drill and tap into gate vertical post.
      c. Drill hole in railing vertical post to receive latch pin.
   6. Adjust to provide smooth operation:
      a. Self-closing and self-latching.

END OF SECTION

DIVISION 06

WOOD, PLASTICS, AND COMPOSITES

SECTION 06 10 53
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Rough Carpentry, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Lumber Grading Rules and Species:
   1. US Department of Commerce (DOC):
      a. PS 20 American Softwood Lumber Standard.
   2. Western Wood Products Association (WWPA).
   3. Southern Forest Products Association (SFPA).

B. Plywood Grading Rules and Recommendations:
   1. US Department of Commerce (DOC):
      a. Softwood plywood: PS1 Structural Plywood.
   2. American Plywood Association (APA).

C. Preservative and Fire Retardant Treatment Standards:
   1. American Wood Protection Association (AWPA):
      a. AWPA U1Treated Wood.
      b. AWPA P5 Standard for Waterborne Preservatives.
   2. Underwriters Laboratories (UL)
   3. ASTM International requirements:
      a. ASTM E84 Standard Test Method for Surface Burning Characteristics
      b. ASTM D2898 Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing
      c. ASTM D3201 Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products

D. Factory Marking:
   1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.
   2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark and fire-retardant treatment for identification.
   3. International Building Code (IBC):
      a. Requirements for identification and labeling.

1.3 SUBMITTALS

A. Project Information:
   1. Certification of fire retardant treated material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire-retardant Treated Dimension Lumber and Plywood:
   1. Base:
      a. Hoover Treated Wood Products, Inc.

2. Optional:
    a. Lonza Group Limited
    b. Western Wood Preserving Company

B. Preservative Treated Lumber:
1. Base:
    a. Lonza Group Limited
2. Optional:
    a. Stella-Jones Incorporated
    b. Western Wood Preserving Company

2.2 MATERIALS

A. Dimensional Lumber and Plywood:
1. Thoroughly seasoned, non-treated, well-fabricated materials.
2. Longest practical lengths and sizes.
3. Application, except where treated types are indicated:
    a. Non-structural framing, blocking, backing, nailers, grounds, and similar members.
    b. Other locations where indicated.

B. Fire-retardant Treated Lumber and Plywood (FRT):
1. Flame spread index: Less than 25.
2. Smoke developed index: Less than 450.
3. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.
4. Kiln dried after treatment, (KDAT).
5. FRT material for interior and above grade locations:
    a. Base: Pyro-Guard by Hoover Treated Wood Products, Incorporated
    b. Optional:
        1) Dricon FRT by Lonza Group Limited
        2) FirePro by Western Wood Preserving Company.
    c. Natural wood products treated to add fire-retardant qualities.
    d. Type A: not more than 28 PCT moisture when tested according to ASTM D3201.
    e. Interior and above grade applications include but not limited to:
        1) Platforms and Stages.
        2) Wood in concealed spaces.
        3) Framing, blocking, cants and nailers within roof covering and waterproofing systems.
        4) Interior sleepers and sill plates in contact with concrete slabs-on-grade.
        5) Interior wood items in direct contact with exterior concrete and exterior masonry walls.
        6) Window frame blocking within exterior walls.
        7) Plywood backing panels for electrical, telecommunication equipment.
        8) Similar locations where wood products are indicated and building code does not permit non-fire-resistive treated products.
        9) Above grade dimensional lumber and plywood, unless indicated otherwise.
            a) Exception: Upgrade to exterior grade where scheduled in the following article.
6. FRT material for exterior and wet locations:
    a. Base:
        1) Exterior Fire-X by Hoover Treated Wood Products, Incorporated
    b. Optional:
        1) Dricon FRX by Lonza Group
    c. Natural wood products treated to add fire-retardant qualities plus decay and termite resistance.
    d. Non-leaching treatment under direct exposure to precipitation, sunlight, and effects of weather.

e. Exterior applications include but not limited to:
    1) Fire-treated wood that is directly exposed to weather.
    2) Fire-treated wood in areas of high-humidity, Greater than 80 PCT RH.
    3) Other areas where indicated.

C. Preservative Treated Lumber and Plywood:
1. Natural wood products treated to add decay and termite resistance.
2. Base:
    a. FrameGuard by Lonza Group Limited
3. Optional:
    a. Lumber Products by Stella-Jones Incorporated
    b. Advance Guard by Western Wood Preserving Company
4. Preservatives:
    a. Compatible with direct exposure to precipitation, sunlight and effects of weather.
    b. Authenticate by factory marking each piece with manufacturer's mark and applicable standards.
    c. Acceptable treatments:
        1) Alkaline Copper Quaternary (ACQ).
        2) Copper Boron Azole (CBA).
        3) Borate based (BORON).
5. Lumber Species:
    a. Southern Pine.
    b. Mixed Southern Pine.
    c. Hem-Fir.
    d. Spruce.
    e. Pine.
    f. Other species meeting requirements.
6. Plywood:
    a. Grading:
        1) PS1, B-C Grade.
        2) PS1, A-C Grade where exposed.
    b. Veneers:
        1) Softwood species.
        2) Glue with waterproof adhesives.
7. Application:
    a. Below grade, or in contact with earth.
    b. Where indicated in Drawings.

D. Sill Sealing Gaskets:
1. Closed cell neoprene foam.
2. Thickness: 1/4 IN 6 MM.
3. Match width of sill members indicated.

E. Adhesives for bonding furring, sleepers, sills and similar items to concrete or masonry:
1. Approved for indicated use by adhesive manufacturer.
2. Comply with ASTM D3498.

F. Water-Repellent Preservative:
1. Treat of exposed ends of posts and beams.
2. National Wood Window and Door Association (NWWDA) tested and accepted formulation.

2.3 FASTENERS

A. General:
1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.

2. Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity:
    a. Use fasteners with hot dip zinc coating complying with ASTM A153.
    b. Use fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: ASTM A307, Grade A steel bolts with ASTM A563 hex nuts and washers.

G. Expansion Anchors:
1. Tested in accordance with ASTM E488.
2. Anchor bolt and sleeve assembly:
    a. Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
    b. Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
3. Interior applications:
    a. Carbon-steel components.
    b. Zinc plated to comply with ASTM B633, Class Fe/Zn 5.
4. Exterior and wet applications:
    a. Stainless Steel components, ASTM F593 and ASTM F594 Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine conditions under which work is to be installed.

B. Verify measurements, dimensions, and details before proceeding.

C. Coordinate location of furring, nailers, blocking, grounds and similar supports.

D. Correct unsatisfactory conditions.

3.2 INSTALLATION OF ROUGH CARPENTRY

A. Form to shapes indicated.

B. Cut and fit accurately.

C. Set work to required levels and lines, plumb and true.

D. Shim as required.

E. Provide wood grounds or nailers as required for attachment of other work and surface applied items.

F. Grounds:
1. Dressed, key beveled lumber.
2. Minimum 1-1/2 IN 38 MM wide x thickness required to bring face of ground even with finish material.
3. Remove temporary grounds when no longer required.

G. Wall Blocking:
1. Provide in-wall fire-treated wood blocking reinforcement where following items are required to be wall-mounted to interior walls:
    a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
    b. Handrails at stairwells.
    c. Between studs at height of door stop, behind stop.

H. Anchor work to support applied loading.
   1. Provide washers under bolt heads and nuts.
   2. Fasten plywood in accordance with APA recommendations.
   3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
   4. Predrill holes to avoid splitting wood with fasteners.
   5. Do not drive threaded friction type fasteners.

3.3 INSTALLATION OF BLOCKING AND NAILERS FOR ROOFING AND PARAPETS

A. Install in accordance with ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used With Low Slope Roofing Systems.

B. Minimum Wood Member Size: 2 IN x 6 IN 50 MM x 150 MM nominal.

C. Fasteners:
   1. Corrosion resistant.
      a. Hot dip galvanized: Comply with ASTM A153 or ASTM A653, Class G185.
      b. Stainless steel: Types 304 or 316.
   2. Countersink heads of fasteners.
   3. Types required for substrate conditions.
   4. Fasteners of diameter and spacing required to resist forces indicated.
   5. Spacing:
      a. Threaded anchor bolts; 3/8 IN 9.5 MM or larger:
         1) Provide 5/8 IN 16 MM OD washers or larger.
         2) Maximum spacing: 48 IN 1200 MM OC.
         3) Stagger 1/3 nailer width.
      b. Other fastener types:
         1) Maximum Spacing:
            a) Typical: 12 IN 300 MM OC.
            b) Up to 16 IN 400 MM OC where necessary to match spacing of structural members.
         2) Stagger 1/3 nailer width.
         3) Install 2 fasteners and within 6 IN 150 MM of nailer ends.

D. Anchor nailers to resist minimum vertical force of 300 LBS/LF 446 kg/min any direction.
   1. Locate fasteners approximately 4 IN 100 MM from ends but not less than 3 IN 75 MM.
   2. Use minimum of 3 anchors for each nailer.
   3. Where members are wider than 6 IN 150 MM, stagger fasteners from side to side to avoid splitting of the wood member.
   4. Corner region enhancements:
      a. Double the above listed vertical force which must be resisted.
      b. Length and width of corners as prescribed by ANSI/SPRI RP-4:
         1) 40 PCT of the building height, but not less than 8-1/2 FT 2.6 m.

E. Nailers used for perimeter securement of roofing membranes:
   1. Install nailers where indicated and where required to secure perimeter of membrane roofing.
   2. Match height of nailers to adjacent insulation.
   3. Where multiple layers are required to match depth of insulation:
      a. Attach base layer as indicated in General Requirements above.
      b. Apply a bead of construction adhesive between laminations.
      c. Attach subsequent layers using fastener type which is appropriate for wood-to-wood securement.
      d. Size and locate fasteners as required to resist uplift loading indicated.

F. Install blocking as indicated for securement of sheet metal edge flashings, parapet copings, and similar items.

3.4 INSTALLATION OF FIRE RETARDANT TREATED WOOD

A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.

B. Use only fasteners approved by the manufacturer of fire-retardant-treated or preservative treated wood.

C. Field Cuts:
   1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
      a. Cross cuts, joining cuts, and drilling holes are permitted.
   2. Plywood: Fire retardant treated plywood may be cut in any direction.
   3. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWPA M4.

3.5 INSTALLATION – LEAD LINED PLYWOOD

END OF SECTION

SECTION 06 82 00
FIBERGLASS REINFORCED PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiberglass reinforced plastic (FRP) fabrications including but not limited to:
      a. Grating.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI):
   2. ASTM International (ASTM):
      a. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
   4. Building code:
      a. 2015 International Building Code:
         1) International Building Code and associated standards, 2015 Edition including all amendments, referred to herein as Building Code.

1.3 DEFINITIONS

A. Skid-resistant:
   1. Manufacturer's standard applied abrasive grit coating.
   2. Abrasive coated tape is not acceptable.

B. FRP: Fiberglass Reinforced Plastic.

1.4 SYSTEM DESCRIPTION

A. All fiberglass reinforced plastic support systems shall be designed by a registered professional structural engineer licensed in the State of Iowa.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer's recommendations on reinforcing field cut openings.
   3. Fabrication and/or layout drawings.
      a. Plan showing profile, location, section and details of each item including anchorage or support system(s).
      b. Materials of construction including shop applied coatings.
      c. Listing of all accessory items being provided indicating material, finish, etc.
   4. Certifications:
      a. Certification of Structural Engineer's qualifications.
      b. Certification that all components and systems have been designed and fabricated to meet the loading requirements specified.

5. Manufacturer's full line of colors available for each component.

B. Informational Submittals:
   1. Complete design calculations of all supporting structure and fastening conditions.
      a. Design calculations to be for information only.
      b. DSR will not review or take any action on submittal.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle each item to preclude damage.

B. Store all items on skids above ground.
   1. Keep free of dirt and other foreign matter which will damage items or finish and protect from corrosion and UV exposure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Grating and solid plate:
      a. American Grating.
      b. Enduro Composite Systems.
      c. Fibergrate Composite Structures, Inc.
      d. IKG Industries.
      e. International Grating Inc.
      f. Mona Composites.
      g. Seasafe, Inc.
      h. Strongwell.

B. Submit request for substitution in accordance with the General Conditions, 00700, Paragraph 5.2..

2.2 MATERIALS

A. Fiberglass Reinforced Plastic (FRP):
   1. Vinyl ester with fiberglass reinforcing.
      a. Type V.
   2. Fire retardant.
      a. Flame spread: ASTM E84, 25 or less.
   3. Color: To be selected by USER when more than one (1) color is available for any one (1) component.

B. Fasteners, Clips, Saddles, and Miscellaneous Components:
   1. Fiberglass where possible.
   2. Stainless steel may be used if fiberglass component is not available.

C. Adhesive: Recommended by manufacturer.

D. Skid-resistant Surfacing: Manufacturer-applied abrasive grit coating.

2.3 FABRICATION

A. General:
   1. Verify field conditions and dimensions prior to fabrication.
   2. Preassemble items in shop to greatest extent possible.
   3. All components shall be treated with UV inhibitor.
   4. Drill or punch holes with smooth edges.

B. Grating and Solid Plate Material:
   1. Design live load:
      a. 100 PSF uniform live load.
      b. 300 LBS concentrated load.
      c. Maximum deflection of l/300 of span under a superimposed live load.
      d. Design for the most severe loading condition noted above.
   2. Minimum grating depth: 1 IN.
   3. Bar span: Maximum of 1 IN center to center.
   4. Walking surface: Manufacturer's standard applied abrasive grit coating.

C. Embedded Grating Supports:
   1. Fiberglass.
   2. Size to suit depth of grating.
   3. Provide leg or strap for embedding and anchoring into concrete.
   4. Similar to Strongwell "Duradek Fiberglass Curb Angle."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Set work accurately in location, alignment and elevation, plumb, level, and true.
   1. Measure from established lines and levels.
   2. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
   3. Tolerances:
      a. Maximum variation from plumb in vertical line: 1/8 IN in 3 FT.
      b. Maximum variation from level of horizontal line: 1/4 IN in 20 FT.
      c. Maximum variation from plan location: 1/4 IN in 20 FT.

C. Coat all exposed surfaces of stainless steel fasteners with minimum 15 MIL gel coating to match component being anchored.

D. Attach grating to each end and intermediate support clip or saddle with bolts, nuts and washers.
   1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
   2. Attach clips or saddles to bearing bars only.
   3. Reinforce all field cut openings in accordance with manufacturer's recommendations.

E. File cut ends of all fiberglass to a 1/32 IN radius.

F. Seal cut ends of all items with catalyzed resin as recommended by manufacturer.
   1. Provide same resin used in fabrication of item as a minimum.

END OF SECTION

DIVISION 07

THERMAL AND MOISTURE PROTECTION

SECTION 07 26 00
UNDER SLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Under slab vapor retarder.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 302.2R, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
   2. ASTM International (ASTM):
      a. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
      b. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
      c. E96, Standard Test Methods for Water Vapor Transmission of Materials.
      d. E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
      e. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Product data sheet on vapor retarder sheet and vapor retarder tape.
      c. All accessories proposed for use.
      d. Manufacturer's installation instructions.
   3. Certifications.
   4. Test reports.

B. Informational Submittals: Manufacturer's recommendation on vapor retarder tape.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Vapor retarder:
      a. Fortifiber Corporation.
      b. Layfield Group
      c. Raven Industries.
      d. Reef Industries.
      e. Stego Industries.
      f. WR Meadows, Inc.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2

2.2 PERFORMANCE REQUIREMENTS

A. Vapor Retarder:
   1. ASTM E1745, Class A.
   2. Thickness: Minimum 15 MIL.
   3. Water vapor permeance: 0.03 maximum per ASTM E96.
   4. Puncture resistance: ASTM D1709, Method B, 2200 grams.
   5. Minimum tensile strength: 45 LBS/IN, ASTM D882.

2.3 ACCESSORIES

A. Pipe Boots: Manufacturer's standard boot fabricated to maintain the integrity of the vapor retarder system.

B. Vapor Retarder Tape: As recommended by vapor retarder manufacturers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions, ASTM E1643 and ACI 302.2R.

B. Provide vapor retarder where indicated on the Drawings.
   1. Place continuous vapor retarder above granular fill subgrade material, unless noted otherwise.

C. Lap minimum 6 IN and seal in accordance with ASTM E1643 and manufacturer's recommendations.

D. Extend to extremities of area and seal to adjacent elements.

E. Seal all penetrations: Provide pipe boot for all pipes or conduit penetrating the floor slab.

3.2 FIELD QUALITY CONTROL

A. Ensure proper precautions are implemented to prevent damage to installed vapor retarder membrane prior to and during pouring of concrete floor slab.

B. Inspect vapor retarder immediately prior to placement of concrete.
   1. Patch all punctures, tears, holes, etc.
      a. Repair with additional layer of vapor retarder and seal entire patch with vapor retarder tape or as recommended by manufacturer.
      b. Lap all repairs minimum 6 IN.

END OF SECTION

SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Architectural flashing and sheet metal work.
   2. Factory formed fascia systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 04 05 23 - Masonry Accessories.
   4. Section 07 31 00 – Fiberglass Shingles
   5. Section 07 42 13 – Preformed Metal Wall Panels
   6. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Architectural Manufacturers Association (AAMA):
      a. 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI):
      a. ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roof Systems.
   3. ASTM International (ASTM):
      a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
      b. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
      c. B32, Standard Specification for Solder Metal.
      d. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. FM Global (FM).
   5. National Roofing Contractors Association (NRCA).
   6. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
      a. Architectural Sheet Metal Manual, Seventh Edition, 2012.

B. Qualifications:
   1. Sheet metal fabricator shall have minimum 10 years experience in fabrication of sheet metal items similar to items specified.
   2. Sheet metal installer shall have minimum five (5) years experience installing sheet metal items specified.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

B. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
3. Fabrication and/or layout drawings.
    a. Scaled drawing showing expansion joint locations, special conditions, profile, fastening and jointing details.
        1) Minimum plan scale: 1/8 IN = 1 FT.
        2) Minimum detail scale: 1-1/2 IN = 1 FT.
4. Fabricator qualifications.
5. Installer qualifications.

B. Samples:
1. Finish and color samples for each product specified for color selection by Owner.
2. For final color selection, provide two (2) 2 IN x 3 IN colored metal samples for each color selected during the preliminary color selection.

C. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Warranty: Manufacturer's sample warranty language.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Pre-finished sheet metal:
    a. Carlisle.
    b. Firestone Building Products.
    c. Petersen Aluminum Corp.
2. Butyl sealant:
    a. Pecora.
    b. Sika.
    c. Tremco.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Sheet Metal:
1. Aluminum: ASTM B209.
2. Galvanized Steel: ASTM A653.
3. Galvalume Steel: ASTM A792.
4. Stainless Steel: ASTM A666.
    a. Type 304.

B. Fasteners: Non-ferrous compatible with sheet metal.

C. Sealants:
1. Non-curing Butyl Sealant:
    a. Pecora “BA-98 IN.
    b. Sika “SikaLastomer 511 IN.
    c. Tremco “TremPro JS-773 IN.
2. Building sealants:
    a. See Specification Section 07 92 00.

D. Fasteners: Non-ferrous compatible with sheet metal.

E. Retainer Clips and Continuous Cleats: Galvanized steel or stainless steel.

F. Solder: ASTM B32.

G. Dissimilar Metal Protection: Comply with Specification Section 09 96 00.

H. Reglets: See Specification Section 04 05 23.
   a.

2.3 FABRICATED ITEMS

A. General:
   1. Shop fabricate items to maximum extent possible.
      a. Fabricate true and sharp to profiles and sizes indicated on Drawings.
         1) Shop fabricate and weld or solder all corners.
   2. Pre-finished aluminum:
      a. Thickness: Minimum 0.040 IN.
      b. Texture: Smooth.
      c. Coated on exposed face with PVDF coating having a minimum 70 PCT resin content and a minimum 1.0 MIL dry film thickness.
         1) Meet requirements of AAMA 2605.
         2) Color: Match coping and fascia.
   3. Pre-finished steel:
      a. Galvanized, G-60 or Galvalume, AZ-55.
      b. Thickness: Minimum 24 GA.
      c. Texture: Smooth.
      d. Coated on exposed face with PVDF coating having a minimum 70 PCT resin content and a minimum 1.0 MIL dry film thickness.
         1) Meet requirements of AAMA 2605.
         2) Color: From Manufacturer’s available standardcolors.

B. Retainer Clips and Continuous Cleats:
   1. 0.050 IN stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction to Contractor in time to allow their installation.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions, SMACNA, and as indicated on Drawings.

B. Weld aluminum to achieve weathertight joints and required details.
   1. Do not weld slip joints.
   2. Touch-up damaged prefinished items.

C. Set top edges of membrane flashing and sheet metal flashing into reglets wherever practicable.
   1. Surface applied terminations will be allowed only where specifically detailed or otherwise approved in writing by the Engineer.
   2. Provide counterflashing at all reglets.
   3. Seal reglets and counterflashings in accordance with Specification Section 07 92 00.

D. Fasten materials at intervals recommended by SMACNA.

E. Install slip joints to allow for thermal movement as recommended by SMACNA and manufacturer.
   1. Maximum spacing: 10 FT OC.
   2. Provide slip joint 24 IN from corners.
   3. Provide slip joint at each vertical expansion joint location in wall.
      a. Provide break in continuous cleat at each vertical expansion joint.

b. The above expansion joints do not include brick veneer expansion joints.

F. Seal slip joints with two (2) beads of non-curing butyl sealant on each side of slip joint overlap.

G. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures.

H. Provide dissimilar metals and materials protection where dissimilar metals come in contact or where sheet metal contacts mortar, concrete masonry or concrete.

I. Provide all miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.
   1. Provide all components necessary to create weather-tight junctures between roofing and sheet metal work.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sealing all joints which will permit penetration of dust, air or moisture.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 09 91 10 – Architectural Painting
   4. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R, Guide for Concrete Floor and Slab Construction.
   2. ASTM International (ASTM):
      a. C834, Standard Specification for Latex Sealants.
      b. C920, Standard Specification for Elastomeric Joint Sealants.
      c. C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
   3. NSF International (NSF):
      a. 61, Drinking Water System Components -- Health Effects.
   4. Underwriters Laboratories, Inc. (UL).

B. Qualifications: Sealant applicator shall have minimum five years experience using products specified on projects with similar scope.

1.3 DEFINITIONS

A. Defect(ive): Failure of watertightness or airtightness.

B. Finish sealant: Sealant material per this specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.

C. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

D. "Interior wet areas": Incubation Room 101, Isolation Room 104, Egg Disinfection Room 107, Toilet Room 106,

E. "Seal," "sealing" and "sealant": Joint sealant work.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.

3. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
4. Certification of applicator qualification.

B. Test Results:
1. Provide adhesion test results for each sealant sample including adhesion results compared to adhesion requirements.
2. Manufacturer's authorized factory representative recommended remedial measures for all failing tests.

C. Samples:
1. Cured sample of each color for Engineer's color selection.
2. Color chart not acceptable.

D. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Compressible sealant:
a. Schul International Company, LLC.
b. Emseal by Sika.
c. Norton.
d. Sandell Moisture Protection Systems.
2. Expanding foam sealant:
a. M-D Building Products, Inc.
b. DAP Products, Inc.
c. FAI International, Inc.
3. Fire-resistant sealant:
a. See Specification Section 07 84 00.
4. Polyether sealants:
a. BASF Corporation.
b. Chem Link.
c. Tremco Commercial Sealants & Waterproofing.
5. Polyurea joint filler:
a. Dayton Superior Corporation.
b. Euclid Chemical Company.
c. L&M by LATICRETE International, Inc.
d. BASF Corporation.
6. Polyurethane sealants:
a. Pecora Corporation.
b. Sika.
c. BASF Corporation.
d. Tremco Commercial Sealants & Waterproofing.
7. Silicone sealants:
a. Chem Link.
b. GE Silicones.
c. Dow.

d. Tremco Commercial Sealants & Waterproofing.

8. Backer rod, compressible filler, primer, joint cleaners, bond breaker:
   a. As recommended by sealant manufacturer.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Sealants - General:
   1. Provide colors matching materials being sealed.
   2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
   3. Nonsagging sealant for vertical and overhead horizontal joints.
   4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
   5. Joint cleaner, primer, bond breaker: As recommended by sealant manufacturer.
   6. Sealant backer rod and/or compressible filler:
      a. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, non-bituminous material recommended by sealant manufacturer to:
         1) Control joint depth.
         2) Break bond of sealant at bottom of joint.
         3) Provide proper shape of sealant bead.
         4) Serve as expansion joint filler.

B. Compressible Sealant:
   1. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
      a. Schul "Sealtite B".
   2. Fire rated where required.
   3. Adhesive: As recommended by sealant manufacturer.

C. Expanding Foam Sealant:
   1. One or two component fire rated moisture cured expanding urethane.
   2. Shall not contain formaldehyde.
   3. Density: Minimum 1.5 PCF.
   4. Closed cell content: Minimum 70 PCT.
   5. R-value: Minimum 5.0/IN.
   6. Flame spread: Less than 25.
   7. Smoke developed: Less than 25.

D. Fire-Resistant Sealant: See Specification Section 07 84 00.

E. Polyether Sealant:
   1. Silyl-terminated polyether polymer.
   2. ASTM C920, Type S, Grade NS, Class 50, Use NT, M, A, and O.
      a. BASF MasterSeal 150.
      b. Chem Link DuraLink.
      c. Tremco Dymonic FC.

F. Polyurea Joint Filler:
   1. Two component, semi-rigid material for filling formed or saw-cut control joints in interior concrete slabs.
      a. Dayton Superior Corporation "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
      b. Euclid Chemical Company "EUCO QWIK" joint.
      c. L&M "Joint Tite 750".
      d. BASF MasterSeal “CR100" control joint filler.
   2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
   3. Color: Gray.

G. Polyurethane Sealant:
   1. One or two components.
   2. Paintable.
   3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
      a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.
      b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
      c. BASF MasterSeal NP-1, NP-II, SL-1 SL-2.
      d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.

H. Silicone Sealant:
   1. One component.
   2. Meet ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, O.
      a. Chem Link DuraSil.
      b. GE Silpruf, Silglaze II.
      c. GE Sanitary 1700 sealant for sealing around plumbing fixtures.
      d. Dow 786 for sealing around plumbing fixtures.
      e. Dow 7565, 790, 791, 795.
      f. Tremco Spectrem 1, Spectrem 3, Tremsil 600.
   3. Mildew resistant for sealing around plumbing fixtures.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.

B. Use only compatible materials.

C. Where required by manufacturer, prime joint surfaces.
   1. Limit application to surfaces to receive sealant.
   2. Mask off adjacent surfaces.

D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions and UL requirements.

B. Clean all joints.

C. Make all joints water and airtight.

D. At changes in direction of joints, joint intersections and where sealant joints interface with other construction, install continuous sealant as necessary to ensure a weather-tight seal.

E. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.

F. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:
   1. Take care to not puncture backer rod and compressible filler.
   2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.

G. Apply bond breaker where required.

H. Tool sealants using sufficient pressure to fill all voids.

I. Upon completion, leave sealant with smooth, even, neat finish.

J. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

K. Install compressible sealant to position at indicated depth.
   1. Size so that width of material is twice joint width.
   2. Take care to avoid contamination of sides of joint.
   3. Protect side walls of joint (to depth of finish sealant).
   4. Install with adhesive faces in contact with joint sides.
   5. Install finish sealant where indicated.

L. Install expanding foam sealant to minimum 4 IN depth or thickness of wall being penetrated if less than 4 IN or as indicated on Drawings.
   1. Provide adequate fire rated backing material as required.
   2. Hold material back from exposed face of wall as necessary to allow for installation of backer rod and finish sealant.
      a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
   3. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 SEALANT WORK

A. General:
   1. Work includes but is not limited to: Sealing all joints which will permit penetration of dust, air, or moisture.
   2. See Specification Section 07 84 00 for firestopping.

B. Concrete joints:
   1. Flooring joints.
   2. Isolation joints.
   3. Joints between paving or sidewalks and building.
   4. Construction, control and expansion joints.

C. Masonry:
   1. Masonry control joints.
   2. Between masonry and other materials.

D. Flashing, reglets and retainers.

E. Openings:
   1. Perimeters of door and window frames, louvers, grilles, etc.
   2. Door thresholds shall be set in a full bed of sealant.

F. Plumbing fixtures.

G. Penetrations of walls, floors and decks.

H. Other joints where sealant, expanding foam sealant or compressible sealant is indicated.

3.4 FIELD QUALITY CONTROL

A. Adhesion Testing:
   1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
      a. Water bearing structures: One test per every 1000 LF of joint sealed.
      b. Exterior precast concrete wall panels: One test per every 2000 LF of joint sealed.
      c. Chemical containment areas: One test per every 1000 LF of joint sealed.
      d. Building expansion joints: One test per every 500 LF of joint sealed.
      e. All other type of joints except butt glazing joints: One test per every 3000 LF of joint sealed.
      f. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.5 SCHEDULE

A. Furnish sealant as indicated for the following areas:
   1. Exterior areas:
      a. Above grade: Polyether.
      b. Below grade: Polyurethane.
   2. Interior areas:
      a. Noncorrosive areas:
         1) Wet exposure: Polyether.
            a) Toilet rooms, locker rooms, janitor closets or similar areas: Mildew resistant silicone.
         2) Dry exposure: Polyether, unless noted otherwise.
      b. Corrosive areas:
         1) Wet exposure: Polysulfide.
         2) Dry exposure: Polyurethane.
      c. Fire-rated construction: See Specification Section 07 84 00.
      d. Casework, countertops and solid surface materials: Silicone.
         1) Sinks, fixtures or other areas subject to potential splash, spillage or condensation: Mildew Resistant Silicone.
   3. Immersion:
      a. Prolonged contact with or immersion in:
         1) Potable water:
            a) Polysulfide.
            b) NSF 61 approved.
         2) Nonpotable water, wastewater or sewage: Polysulfide.
   4. Compressible sealant: Where indicated.
   5. Exterior wall penetrations: Expanding urethane foam, with finish sealant.
      a. Finish sealant:
         1) Exterior side:
            a) Above grade: Polyether.
            b) Below grade: Polyurethane.
         2) Interior side:
            a) Noncorrosive area:
               (1) Wet exposure: Polyether.
               (2) Dry exposure: Polyether, unless noted otherwise.
            b) Corrosive area:
               (1) Wet exposure: Polyurethane.
               (2) Dry exposure: Polyurethane.
   6. Interior concrete slab formed or saw-cut control joints: Polyurea joint filler.

END OF SECTION

DIVISION 08

OPENINGS

SECTION 08 11 00
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal doors and frames.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 08 70 00 - Finish Hardware.
   4. Section 09 91 10 - Architectural Painting.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. National Association of Architectural Metal Manufacturers (NAAMM):
      a. Hollow Metal Manufacturers Association (HMMA).
   3. Steel Door Institute (SDI):
      a. 117, Manufacturing Tolerances for Standard Steel Doors and Frames.
      b. All SDI publications.
   4. Steel Door Institute/American National Standards Institute (SDI/ANSI):
      a. A250.6, Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
      b. A250.7, Nomenclature for Standard Steel Doors and Steel Frames.
      c. A250.8, Specifications for Standard Steel Doors and Frames.
      d. A250.10, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
      e. A250.11, Recommended Erection Instructions for Steel Frames.

B. Qualifications: Manufacturer must be current member of SDI, and NAAMM (HMMA).

C. Wipe coat galvanized steel is not acceptable as substitute for galvanizing finish specified.

1.3 DEFINITIONS

A. As identified in SDI/ANSI A250.7.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Schedule of doors and frames using same reference numbers as used on Drawings.
   4. SDI certification.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store doors and frames in accordance with SDI/ANSI A250.11.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Metal doors and frames:
      a. Ceco Door by ASSA ABLOY.
      b. Steelcraft by Allegion PLC.
      c. Curries by ASSA ABLOY.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Steel Sheet: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

B. Frames: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

C. Supports and Reinforcing: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

D. Inserts, Bolts and Fasteners: Manufacturer's standard.

E. Primer: Manufacturer's standard coating meeting SDI/ANSI A250.10.

F. Galvannealed Coating Repair: See Specification Section 09 91 10.

G. Thermal Insulation: Polyurethane, CFC free.

H. Sound Insulation: Fiberglass batt insulation or impregnated Kraft honeycomb.

2.3 ACCESSORIES

A. Frame Anchors:
   1. Jamb anchors:
      a. Masonry wire anchors: Minimum 0.1875 IN wire, galvanized.
      b. Existing wall anchor: Minimum 18 GA, galvanized.
      c. Stud partition and base anchors: Minimum 18 GA, galvanized.

2.4 FABRICATION

A. General:
   1. SDI/ANSI A250.8.
   2. Fabricate rigid, neat in appearance and free from defects.
   3. Form to sizes and profiles indicated on Drawings.
      a. Beveled edge.
   4. Fit and assemble in shop wherever practical.
   5. Mark work that cannot be fully assembled in shop to assure proper assembly at site.
   6. Continuously wire weld all joints, dress exposed joints smooth and flush.
   7. Fabricate doors and frames to tolerance requirements of SDI 117.
   8. Fit doors to SDI clearances.
   9. All doors shall be handed.
   10. Hinge cut-out depth and size on doors and frames shall match hinge specified in Specification Section 08 70 00.
   11. Design and fabricate doors to requirements of the building code.

B. Hollow Metal Doors:
   1. General:
      a. 1-3/4 IN thick.

b. Fabricate with flush top caps.
1) Thickness and material to match door face.
2) Exterior doors: Seal weld top cap to door face and grind smooth and flush.
3) Interior doors:
a) Attach top cap to door with concealed fasteners or by welding.
b) Factory seal if attached with fasteners.
c) No exposed fasteners will be accepted.
c. Continuously wire weld all joints and dress, smooth and flush.
2. Exterior:
a. SDI/ANSI A250.8, Level 3, and physical performance level A, Model 2.
1) Face sheet minimum thickness: 16 GA.
2) Insulated: Minimum R10.
3. Interior:
a. SDI/ANSI A250.8, Level 2, and physical performance level "B", Model 2.
1) Face sheet minimum thickness: 18 GA.
b. Sound insulated, minimum STC-35.

C. Hollow Metal Frames:
1. Door frames:
a. Provide 2 IN face at all heads, jambs and mullions for frames in stud walls.
b. Provide 4 IN face at head where noted on Drawings or required by wall construction.
c. 26 GA galvannealed steel boxes welded to frame at back of all hardware cutouts.
d. Steel plate reinforcement welded to frame for hinge, strikes, closers and surface-mounted hardware reinforcing.
1) All plate reinforcement shall meet size and thickness requirements of SDI/ANSI A250.8.
e. Split type frames not acceptable.
1) All horizontal and vertical mullions and transom bars shall be welded to adjacent members.
f. Conceal all fasteners.
g. Frames shall be set up, all face joints continuously wire welded and dressed smooth.
h. Exterior (up to 4 FT wide): 16 GA.
i. Interior: 16 GA.
j. Provide removable spreaders at bottom of frame.
2. Borrowed lite frames:
a. 2 IN face at head, jamb, sill and mullions unless noted otherwise on Drawings.
b. 16 GA.
c. Field applied stops: Manufacturer's standard with finish to match frame.
d. Provide welded type frames.
1) Continuously wire weld all joints and dress smooth.

D. Prepare for finish hardware in accordance with hardware schedule, templates provided by hardware supplier, and SDI/ANSI A250.6.
1. Locate finish hardware in accordance with SDI/ANSI A250.8.
2. See Specification Section 08 70 00 for hardware.
3. Prepare doors for swing direction indicated.
a. Preparing doors for non-handed hinges is not acceptable.

E. After fabrication, clean off mill scale and foreign materials and prime with rust inhibiting primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors and frames in accordance with SDI/ANSI A250.11, the building code and manufacturer's instructions.

B. Plumb, align, and brace frames securely until permanently anchored.
   1. After completion of walls, remove temporary braces and spreaders.
   2. Anchor frames with minimum of three anchors per jamb.
      a. Number and location of anchors shall be in accordance with SDI and frame manufacturer's recommendations.

C. At new masonry or metal stud construction, place frames in conjunction with construction of walls or partitions.
   1. Masonry construction: Anchor frames using masonry wire anchors.
   2. Metal stud construction:
      a. Anchor frames using steel stud anchors.
      b. Attach wall anchors with self-tapping screws.

D. At concrete, precast concrete or existing masonry construction, place frames in rough opening using existing opening anchors.

E. Use plastic plugs to keep silencer holes clear during construction.

F. Immediately after erection, sand smooth rusted or damaged areas.
   1. Touch-up with rust-inhibiting primer.
   2. Finish paint door and frame in accordance with Specification Section 09 96 00.

G. Install three silencers on strike jamb of single door frame and two on head of double door frame.
   1. See Specification Section 08 70 00.

H. Protect doors and frames during construction.

END OF SECTION

SECTION 08 15 00
FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. FRP doors and frames.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 08 70 00 - Finish Hardware.
   4. Section 08 81 00 - Glass and Glazing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. Door and Hardware Institute/American National Standards Institute (DHI/ANSI):
      a. A115.1, Preparation of Mortise Locks in 1-3/8 IN and 1-3/4 IN Standard Steel Doors and Frames.
   3. National Fire Protection Association (NFPA):
      a. 80, Standard for Fire Doors and Other Opening Protectives.
   4. Steel Door Institute (SDI):
      a. 117, Manufacturing Tolerances for Standard Steel Doors and Frames.
      b. All applicable SDI publications.

B. Qualifications:
   1. Manufacturer shall have been producing products specified for minimum of 10 years.
   2. Installer shall have minimum of five (5) years experience in the installation of fiberglass reinforced plastic doors and frames.
      a. Experience shall include field repair of fiberglass and gel coating.

C. Doors and frames shall be fabricated and prepared for hardware by single manufacturer except for fire rated frames.

D. Door hardware and accessories are to be provided by others and installed in the field.

E. All door hardware is to be provided per Specification Section 08 70 00.

1.3 DEFINITIONS

A. Borrowed Lite: Four-sided frame installed in an interior partition prepared for field installation of stationary (fixed) glazing.

B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
3. Schedule of doors and frames specific to this Specification Section, using same reference numbers as used on Drawings.
4. Certification of manufacturer's qualifications.
5. Certification of installer's experience.
6. Certification that doors and frames have been protected against chemical exposures listed.
7. UL certification for fire rated doors and frames.

B. Samples:
1. Provide one (1) 6 x 6 IN sample of frame and one (1) 6 x 6 IN sample of standard door and sample of fire rated door specified.
    a. Frame sample shall show corner construction.
    b. Door sample shall show core specified and reinforcing construction.

C. Contract Closeout Information:
1. Operation and Maintenance Data:
    a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

D. Informational Submittals:
1. Warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store doors and frames in a dry, weather protected area.
1. Place units on wood skids providing a minimum 6 IN air space above the ground.
2. Do not store units flat, set frames and doors on edge providing a minimum 1/2 IN air circulation space between each unit.
3. Provide covering which will ensure air flow around each unit to prevent trapping moisture.
4. If door wrapper becomes wet, remove immediately and provide dry protection equivalent to wrapper removed.

B. Storage recommendations by unit manufacturer shall take precedence over the above requirements.

1.6 WARRANTY

A. Warranty all FRP components to be free of defects in materials and workmanship for one (1) year and from degradation or failure due to corrosion for minimum of five (5) years from date of building acceptance.
1. Warranty against door warpage of more than 1:100 when measured diagonally across the door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. FRP doors and frames:
    a. Corrim Company.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Face Panel: Fiberglass reinforced plastic.

B. Supports and Reinforcing: Non-swelling polymer or equivalent non-corrosive material.

C. Inserts, Bolts and Fasteners: Stainless steel.

D. Insulation: Polyurethane. Use balsa core in exterior doors if it meets U values called out on drawings.

E. Core:
   1. Non-fire rated:
      a. Rigid, end grain balsa.
      b. Thickness: Minimum 1-1/2 IN.
      c. Density: 8.5 - 9.0 PCF.
      d. Compressive strength: Minimum 1400 PSI.
   2. Fire rated:
      a. Mineral core.
      b. Intumescent seals factory applied to perimeter of door.
      c. Stiles and rails fabricated from pultruded fire retardant material.
      d. Provide stainless steel channels on the meeting edges of pairs of doors having surface mounted vertical rod exit devices.
      e. Rating as indicated on Drawings.

3. Exterior Doors (or where indicated on drawings):
   3. a. Urethane foam insulation:
   4. b. Meet ASTM E-84
   5. c. Insulation Value: Called out on drawings.

F. Frames:
   1. Non-fire rated: Fiberglass reinforced plastic.
   2. Fire rated: Steel, ASTM A1008.

2.3 ACCESSORIES

A. Frame Anchors:
   1. Jamb anchors in masonry: 9 GA steel, masonry wire anchor, galvanized per ASTM A153/A153M, G60 coating.
   2. Floor anchors: 12 GA steel, galvanized per ASTM A153/A153M, G60 coating.
   3. Anchors in existing openings: Stainless steel machine screws and stainless steel expansion shield.

B. Glass Panels in Doors:
   1. Fixed, applied stops on each face with snap-in retainer and trim fabricated from non-corrosive materials.
      a. No exposed fasteners on exterior of door allowed.
      b. Doors may be glazed at the factory or at manufacturer's option may be glazed in the field.
   2. Reinforce cut-out in door panel with minimum 1.5 IN SQ fiberglass tubing.
   3. Glass: See Specification Section 08 81 00.

2.4 FABRICATION

A. General:
   1. Fabricate rigid, neat in appearance and free from defects.
   2. Form to sizes and profiles indicated on Drawings.
      a. Sizes indicated in DOOR SCHEDULE are nominal.
      b. Refer to Architectural details for actual conditions affecting actual size of rough openings.
   3. Fit and assemble in shop wherever practical.
   4. Mark work that cannot be fully assembled in shop to assure proper assembly at site.
   5. For door frames, all surfaces, both exposed and concealed, shall be gel coated to prevent acid attack of the glass reinforcing.
   6. Fabricate doors and frames to tolerance requirements of SDI 117.
   7. Fit doors to SDIand NFPA 80clearances.

8. Provide fire doors which are approved and labeled by UL.
9. Doors shall be fabricated to withstand splash and spillage attack from the following chemicals for a period of 8 HRS.
    a. Chlorineliquid.

B. FRP Doors:
1. General:
    a. Construction:
        1) 1-3/4 IN thick, minimum.
        2) Face sheets, 0.125 IN thick, minimum.
        3) Fabricate with flush top closure.
        4) Doors with a maximum size of 48 IN wide x 96 IN tall shall be fabricated in one (1) piece.
        5) Fill and dress all joints.
        6) Resin: Polyester or vinyl ester as required to meet chemical resistance requirements.
        7) Fiberglass content (by weight): Minimum 30 PCT, maximum 40 PCT.
        8) UV stabilized.
        9) Core:
            a) End grain balsa for non-fire rated doors.
            b) Mineral core for fire rated doors.
    b. Finish:
        1) Minimum 15 MIL gel coat thickness.
        2) Gel coat color:
            a) Exterior doors: As selected by Owner.
            b) Interior doors: As selected by Owner.
2. Exterior:
    a. SDI Grade III, Model 4, seamless.
        1) Insulated minimum R10.
            a) ASTM C1363.
        2) Face sheet 0.125 IN thickness.
3. Fire rated:
    a. SDI Grade II, Model 4, flush seamless.
    b. Flame spread: 25 or less per ASTM E84.
    c. UL fire labeled.
        1) Meet requirements of UL 10C.
    d. Pairs UL fire labeled with astragal.
        1) Astragal: Steel.
            a) Coat astragal with minimum 15 MIL thick gel coat, color to match door.
4. Interior (except fire rated):
    a. SDI Grade II, Model 4, seamless with Balsa core.

C. Frames:
1. General:
    a. Frame size to be 2 IN x 5-3/4 IN (or as detailed on drawings) with equal rabbets on each side.
    b. One (1) piece or if shipped knocked down, all joints shall be filled with fiberglass compound, ground and sanded smooth and finished with gel coat.
    c. Minimum thickness: 0.1875 IN.
    d. Resin: Polyesteras required to meet chemical resistance requirements.
    e. Fiberglass content (by weight): Minimum 30 PCT, maximum 40 PCT.
    f. UV stabilized.
2. FRP frames:
    a. Corner reinforcement: Minimum 4 x 4 x 0.25 IN FRP angle attached to top reinforcing bar with concealed stainless steel screws.
    b. Hinge reinforcement: Minimum 0.25 IN thick polymer plate attached to frame.

c. Minimum 0.25 IN thick polymer plate reinforcement bonded and mechanically fastened to frame for strikes, closers and surface-mounted hardware.

D. Prepare for finish hardware in accordance with hardware schedule, templates provided by hardware supplier, and DHI/ANSI A115.1.
   1. Locate finish hardware in accordance with SDI.
   2. See Specification Section 08 70 00 for hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors and frames in accordance with SDI and manufacturer's instructions.
   1. Manufacturer's instructions take precedent over SDI.

B. Place frames prior to construction of enclosing walls and ceilings.

C. Plumb, align, and brace securely until permanently anchored.

D. After completion of walls, remove temporary braces and spreaders.

E. Install fire rated frames in accordance with NFPA 80 and manufacturer's instructions.
   1. Manufacturer's instructions take precedent over NFPA.

F. Use plastic plugs to keep silencer holes clear during construction.

G. Immediately after erection, repair damaged areas of gel coat.
   1. Fill corner miter joints with fiberglass compound as recommended by frame manufacturer.
      a. Filling miter joints with sealant is not acceptable.
   2. Sand filled area to match adjacent frame and coat with minimum 15 MIL gel coating to match adjacent frame finish.

H. On doors not requiring weatherstripping, sound seals or smoke seals, install three (3) silencers on strike jamb of single door frame and two (2) on head of double door frame.
   1. See Specification Section 08 70 00.

I. Number and location of anchors shall be in accordance with frame manufacturer's recommendation with minimum of three (3) anchors per jamb.

J. Protect frames during construction.

K. Cover all thru bolts and other stainless steel accessories with minimum 15 MIL gel coating to match door frame.

3.2 FIELD QUALITY CONTROL

A. Provide for services of manufacturer's authorized representative to be present during and observe the installation of the first three (3) doors and frames.
   1. If project has less than three (3) doors and frames, manufacturer's authorized representative shall be present for installation of all doors and frames.
   2. Manufacturer's representative shall instruct installer on proper methods for installing doors and frames in each type of wall construction, repairing damaged gel coating, repairing scratches in finish and filling and finishing all joints.

END OF SECTION

SECTION 08 70 00
FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Finish hardware.
   2. Inspection and testing of door operation.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 08 15 00 - Fiberglass Reinforced Plastic (FRP) Doors and Frames.

1.2 QUALITY ASSURANCE

A. All door hardware shall be provided by a single hardware supplier.
   1. Hardware is to be provided under this Specification Section, unless noted otherwise, for doors specified in:
      a. Specification Section 08 15 00.

B. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
      a. Accessibility Guidelines for Buildings and Facilities (ADAAG).
   2. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
      a. A156.1, Butts and Hinges.
      b. A156.3, Exit Devices.
      c. A156.4, Door Controls -Closers.
      d. A156.6, Architectural Door Trim.
      e. A156.8, Door Controls - Overhead Stops and Holders.
      f. A156.13, Mortise Locks and Latches Series 1000.
      g. A156.16, Auxiliary Hardware.
      h. A156.18, Materials and Finishes.
      i. A156.21, Thresholds.
   3. American National Standards Institute/Steel Door Institute (ANSI/SDI).
      a. A250.8, Specifications for Standard Steel Doors and Frames (SDI-100).
   4. Door and Hardware Institute (DHI).
   5. National Fire Protection Association (NFPA):
      a. 80, Standard for Fire Doors and Other Opening Protectives.
      b. 101, Life Safety Code.
   6. Underwriters Laboratories, Inc. (UL):
      a. Building Materials Directory.
   7. Building code:
      a. International Code Council (ICC):
         1) Iowa Building Code 2015 Edition including all amendments, referred to herein as Building Code.

C. Qualifications:
   1. Installation shall be inspected by a certified Architectural Hardware Consultant (AHC).

1.3 DEFINITIONS

A. AHC: Architectural Hardware Consultant, certified by DHI.

B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

C. All weather: Capable of operation from -50 to +120 DEGF.

D. Active Leaf: Right-hand leaf when facing door from keyed side unless noted otherwise on Drawings.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Qualifications
      a. AHC qualifications.
   3. Certification from AHC stating:
      a. All door hardware has been reviewed by AHC and verified to be compatible with doors and frames.
      b. No submittals will be reviewed until Engineer has received AHC certification.
   4. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   5. Schedule of all hardware being used on each door.
      a. Number hardware sets and door references same as those indicated on Drawings.
   6. Technical data sheets on each hardware item proposed for use.
   7. Manufacturer drawings and details.
   8. Warranty information for all hardware devices having extended warranties.

B. Informational Submittals:
   1. Certifications:
      a. Certification from AHC stating all door hardware has been provided per approved Shop Drawings, has been installed in accordance with manufacturer's recommended installation instructions and all doors have been inspected and tested and found to be in proper working order.
         1) Door assemblies required to swing in the direction of egress have been inspected and tested in accordance with NFPA 101.
         2) Fire-rated door assemblies have been inspected and tested in accordance with NFPA 80.

C. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 WARRANTY

A. Provide all individual manufacturers' extended warranties as advertised.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Hinges:
      a. Hager Hinge Co.
      b. McKinney Manufacturing Co.
      c. Stanley Works.

2. Locksets and latchsets:
    a. Best Access Systems.
    b. Corbin/Russwin.
3. Exit devices:
    a. Corbin/Russwin.
    b. Precision.
    c. Sargent.
    d. Von Duprin, Inc.
4. Closers:
    a. Corbin/Russwin.
    b. LCN.
    c. Norton.
5. Door stops and holders:
    a. Trimco.
    b. Rockwood.
    c. Ives.
6. Overhead stops:
    a. Glynn-Johnson Corp.
    b. Rockwood.
    c. Trimco.
    d. Rixson.
7. Weatherstripping and thresholds:
    a. Pemko Manufacturing Co.
    b. Reese Enterprises, Inc.
    c. Zero Weatherstripping, Inc.
    d. National Guard Products, Inc.
8. Door bolts, coordinators and strikes:
    a. Ives.
    b. Trimco.
    c. Hager.
    d. Rockwood.
    e. Dorma.
9. Other materials: As noted.

B. Submit request for substitution in accordance with Specification Section 0700, Paragraph 5.2.

2.2 MATERIALS

A. General: As indicated in the FABRICATION Article in PART 2 of this Specification Section.

B. Fasteners: Stainless steel or aluminum.

C. Closers:
1. Corrosion resistant closer:
    a. Body: Aluminum.
    b. All other components and fasteners: Stainless steel.
    c. Closer arm bushing: Bronze.

D. Kickplates:
1. Stainless steel.

E. Thresholds: Aluminum.

F. Overhead Stops and Wall Stops: Stainless steel or aluminum.

G. Keys: Brass or bronze.

H. Weatherstripping and Smoke Seals: Polypropylene, neoprene, or EPDM.

I. Silencers: Rubber.

2.3 COMPONENTS

A. Hinges:
   1. Butt hinges:
      a. ANSI/BHMA A156.1.
         1) A5111: Stainless steel, full-mortise, anti-friction bearing, Grade 1.
      b. Ball bearing.
      c. Flat button tips.
      d. Butt hinges:
         1) Hager BB1199.
         2) McKinney T4B3386.
      e. Hinge size:
         1) Doors up to and including 46 IN wide: 4.5 IN x 4.5 IN.
         2) Doors over 46 IN up to and including 60 IN wide: 5 IN high x 4.5 IN.

B. Mortise Locks and Latches:
   1. ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 1.
      a. Meet requirements of ADA.
   2. Antifriction two-piece mechanical latchbolt with stainless steel anti-friction insert.
      a. One-piece stainless steel deadbolt, minimum 1-1/4 IN x 9/ 16 IN thick with 1 IN throw.
      b. 2-3/4 IN backset.
      c. Cylinder: Brass, 6 pin, with interchangeable core.
      d. ADA compliant thumb turn lever.
   3. Locking, latching and retracting mechanism and lock case:
      a. Corrosion resistant: Non-ferrous lock case.
         1) Provide non-ferrous lock case on doors scheduled to receive corrosion resistant closers.
   4. Trim design: Corbin/Russwin "NSP".
      a. Functions as indicated in following table in accordance with ANSI/BHMA A156.13.

MORTISE LOCK NUMBERS		
ANSI	FUNCTION	CORBIN/RUSSWIN
F01	Passage	ML2010
F19	Privacy	ML2030
F05	Classroom	ML2055
F07	Storeroom	ML2057
F13	Entrance or Office	ML2065

C. Exit Devices:
   1. ANSI/BHMA A156.3, Grade 1.
   2. Single doors: Mortise.
   3. Pairs of doors: Concealed vertical rods.
   4. Trim: Sargent “ET”.
      a. Lever operation.
      b. Lever style: Sargent "L".
   5. Sargent "80 Series".
      a. Function as indicated on Hardware Schedule.

D. Bolts:
   1. ANSI/BHMAA 156.16.
   2. Provide stainless steel dustproof strikes for all doors with automatic or manual flush bolts or other bolts into floor.

3. Surface bolts: Rockwood 580 Series with top and bottom strikes.
4. Automatic flush bolts:
    a. Rockwood 2842.
    b. Provide extended bolt length on doors over 84 IN tall.

E. Coordinator:
1. Ives "Cor Series" or Rockwood 1600 Series.
2. Provide filler bar as required.
3. Finish of coordinator and filler bar to be anodized aluminum color to match other hardware finishes.
4. Mounting brackets as required.

F. Door Closers:
1. ANSI/BHMA A156.4, Grade 1.
2. Size door closers to comply with ANSI recommendations for door size and location.
3. Fabricate all closers with integral back check.
4. Provide integral stop unless noted otherwise.
    a. Do not provide integral stop at closers indicated to be installed on pull side of door.
    b. Provide all weather fluid for all closers used in exterior doorsand where otherwise indicated.
5. Full cover.
    a. Manufacturer's standard plastic cover.
6. Arms, brackets, and plates: As required for complete installation.
7. Closers:
    a. LCN 4040 Series or Norton 7500 Series or Corbin-Russwin DC6200 Series.
    b. Corrosion resistant: Norton 7500 SS Series.
8. Provide manufacturer's standard 10 year warranty.

G. Door Stops:
1. ANSI/BHMA A156.16.
    a. Wall stops: Ives WS406-CVX or WS406-CCV.

H. Overhead Door Holders/Stop:
1. ANSI/BHMA A156.8.
2. Provide 'hold-open' function on all stops unless noted otherwise.
    a. Do not provide ‘hold-open’ function at fire rated doors.
3. Surface mounted stops: Rockwood N14400 Series or Glynn Johnson 90 Series.
4. Concealed stops: Rockwood N11000 Series or Glynn Johnson 100 Series.

I. Kickplates:
1. ANSI/BHMA A156.6.
2. 8 IN high x 2 IN less than door width.
3. Beveled on all edges.
1. Thickness:
    a. Stainless steel: 0.050 IN.

J. Thresholds:
1. ANSI/BHMA A156.21.
2. One-piece unit.
3. Height: 1/2 IN high maximum.
    a. Meet requirements of ADA.
4. Width: 5 IN.
5. Provide required bolt cutouts.

K. Astragal: UL listed for labeled doors.
1. Coated with minimum 15 MIL gel coating per Specification Section 08 15 00.

L. Weatherstripping:
   1. Weather seal at jambs and head:
      a. Self-adhesive strip: Reese #797.
      b. Color: Black.
   2. Sweep at bottom of doors:
      a. Reese 701.
      b. Color: Clear anodized.
   3. Weather seal astragal at meeting edges of pairs of doors:
      a. Reese 92 each leaf.
      b. Color: Dark bronze anodized.

M. Smoke Seals:
   1. Self-adhesive strip: Reese #797.
   2. Color: Black.
   3. UL listed.

2.4 ACCESSORIES

A. Silencers:
   1. FRP frames: Trimco 1229A or Rockwood 608.
   2. Self-adhesive silencers are not acceptable.

B. Keying:
   1. Establish keying with Owner.
      a. Provide and set up complete visible card indexed system with key tags and control slips.
      b. Tag and identify keys.
      c. Provide two (2) keys for each lock or cylinder.
      d. Master key and key in groups as directed.
      e. Provide construction master keys for all exterior doors.
      f. Key to existing master key system.

C. Strikes:
   1. Curved lips.
      a. Extended lips when required.
   2. Furnish strike boxes.
   3. Appropriate for function and hardware listed.

2.5 FABRICATION

A. General:
   1. Generally prepare for Phillips head machine screw installation.
   2. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
   3. For mineral core doors use screws which thread to head to apply butt hinges.
   4. Provide concealed fasteners unless thru bolted.
   5. Through bolt closers on all doors.
   6. Furnish items of hardware for proper door swing.
   7. Furnish lock devices which allow door to be opened from inside room without a key or any special knowledge.

B. Hardware:
   1. Fabricate hardware for fire rated openings in compliance with UL and NFPA 80.
      a. This requirement takes precedence over other requirements for such hardware.
      b. Provide only hardware which has been tested and listed by UL for types and sizes of doors.
   2. Provide following ANSI/BHMA A156.18 finishes:
      a. Locksets, latchsets and strikes: 630.
      b. Door pulls, push bars, push plates: 630.

c. Kickplates:
    1) Stainless steel: 630.
d. Exit devices: 630 where available; 626 if 630 is not available.
    1) Provide 630 finish on trim.
e. Butt hinges: 630.
f. Door stops, dead locks, mortise bolts, and miscellaneous hardware: 630 where available, 626 if 630 not available.
g. Door overhead stops: 630.
h. Closers: 600 prime coat with 689 finish coat, unless noted otherwise.
    1) Corrosion resistant closers: 630.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's installation instructions.
    1. Perform installation by or under the direct supervision of an AHC.

B. Provide all hardware in accordance with Building Code.

C. Fit hardware before final door finishing.

D. Permanently install hardware after door finishing operations are complete.

E. Locate hardware in accordance with ANSI/SDI A250.8.

F. Butt Hinges:
    1. Provide non-removable pin (NRP) at:
        a. Exterior doors.
        b. Reverse handed doors equipped with locks.
    2. Quantities:
        a. Door height 61 - 90 IN: Three (3).
        b. Door height 91 - 114 IN: Four (4).
        c. Door height 115 - 144 IN: Five (5).
        d. Doors over 48 IN wide and over 96 IN high:
            1) Provide top butt hinge within 6 IN of the top of the door to top of hinge.
            2) Provide one (1) additional butt hinge approximately 6 IN below the bottom of the top butt hinge.

G. Closers:
    1. Mount closers on push side of doors unless noted otherwise.
    2. Mount closers on pull side of the door for the following doors: 102.

H. Provide coordinator when required by hardware specified.

I. Overhead Stops:
    1. Provide overhead stop when corrosion resistant closer is specified.
    2. Provide concealed overhead stop on doors scheduled to receive closer mounted on pull side of door.
    3. Provide at interior doors not scheduled to receive a closer as follows:
        a. Doors that swing more than 105 DEG without encountering a wall or obstruction.
            1) Stop shall limit swing of door from impacting wall or obstruction.
        b. Inactive leafs of pairs of doors.

J. Wall Mount Door Stops:
    1. Provide where specifically indicated on Hardware Schedule and at doors not otherwise indicated to receive:
        a. Overhead stop.
        b. Closer with integral stop.

K. Floor mounted stops are not acceptable unless noted otherwise in this Specification Section.

L. Install astragal on all pairs of UL labeled fire doors.

M. Provide silencers for door frames.

1. FRP frames: See Specification Section 08 15 00.

N. Provide weather seal, door sweep and threshold at all exterior doors and where scheduled on interior doors.
1. Set thresholds in a full bed of sealant.
2. Mount door sweeps on exterior face of door.
3. Mount weather seal astragal at meeting edges of pairs of doors on the exterior face of the doors.

O. Provide smoke seals on all fire rated doors.

P. Mount kickplates on push side of doors.

3.2 FIELD QUALITY CONTROL

A. Adjust and check each operating item of hardware to assure proper operation or function.
1. Lubricate moving parts with lubricant recommended by manufacturer.

B. During week prior to startup, make a final check and adjustment of all hardware items.
1. Clean and lubricate as necessary to assure proper function and operation.
2. Adjust door control devices to compensate for operation of heating and ventilating equipment.

C. Inspection and Testing:
1. AHC shall inspect and test all door assemblies and provide written certification that door assemblies are in proper working order.
   a. Door assemblies required to swing in the direction of egress shall be inspected and tested in accordance with NFPA 101.
   b. Fire-rated door assemblies shall be inspected and tested in accordance with NFPA 80.
2. Submit documentation and certification of testing in accordance with the certifications paragraph in the SUBMITTALS Article in PART 1 of this Specification Section.

3.3 SCHEDULES

A. Hardware Schedule:

HARDWARE SCHEDULE			
Hardware Set	Quantity	Unit	Description
HW-1	11/2	PR	Butts
	1	EA	Mortise Lockset - Entry Function
	1	EA	Closer w/Stop – Hold Open Device
	1	EA	Threshold
	1	SET	Weather Stripping
	1	EA	Drip Cap
	1	EA	Kick Plate
	1	EA	Door Sweep
HW-2	11/2	PR	Butts – Allow for 180 Degree Function
	1	EA	Closer – Allow for 180 Degree Swing
	1	EA	Mortise Lockset - Storeroom Function
	1	EA	Kick Plate

HARDWARE SCHEDULE			
Hardware Set	Quantity	Unit	Description
HW-3	11/2	PR	Butts
	1	EA	Mortise Lockset – Storeroom Function
	1	EA	Closer w/stop – Hold Open Device
	1	EA	Threshold
	1	SET	Weather Stripping
	1	EA	Drip Cap
	1	EA	Kick Plate
	1	EA	Door Sweep
HW-4	11/2	PR	Butts
	1	EA	Closer
	1	EA	Mortise Lockset – Storeroom Function
	1	EA	Kick Plate
HW-5	3	PR	Butts
	1	EA	Mortise Lockset – Entry Function
	1	EA	Closer – Active Leaf
	1	SET	Automatic Flush Bolts
	1	EA	Lock Strike – Inactive Leaf
	1	EA	Wall Stop
	1	EA	Dust Proof Floor Strike
HW-6	11/2	PR	Butts
	1	EA	Closer
	1	EA	Mortise Lockset – Privacy w/thumb turn
	1	EA	Coat Hook
HW-7	3	PR	Butts
	1	EA	Mortise Lockset – Entry Function
	1	EA	Lock Strike – Inactive Leaf
	1	EA	Closer – w/Stop & Hold Open Device
	2	EA	Kick Plates
	1	SET	Weatherstripping
	1	EA	Threshold – Full Opening
	2	EA	Door Sweeps
	1	SET	Automatic Flush Bolts
	1	EA	Dust Proof Floor Strike

END OF SECTION

SECTION 08 81 00
GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass and glazing.
   2. Fire resistance rated glass.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 07 92 00 - Joint Sealants.
   4. Section 08 11 00 - Hollow Metal Doors and Frames.
   5. Section 08 15 00 - Fiberglass Reinforced Plastic (FRP) Doors and Frames.
   6.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI):
      a. Z97.1, Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
   2. ASTM International (ASTM):
      a. C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
      b. C1036, Standard Specification for Flat Glass.
      c. C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
      d. C1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
      e. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
      f. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
   3. Code of Federal Regulations (CFR):
      a. Title 16 - Commercial Practices, Chapter ii - Consumer Product Safety Commission (CPSC), Subchapter B - Consumer Product Safety Act Regulations:
         1) 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
   4. Glass Association of North America (GANA):
      a. Glazing Manual.
   5. Underwriters Laboratories, Inc. (UL):
      a. 9, Standard for Fire Tests of Window Assemblies.
      b. 10B, Standard for Fire Tests of Door Assemblies.
      c. 263, Standard for Fire Tests of Building Construction and Materials.
   6. Building code:
      a. International Code Council (ICC):
         1) Iowa Building Code2015 Edition including all amendments, referred to herein as Building Code.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

B. Safety Glazing: Glazing meeting the requirements of the Building Code and CPSC 16 CFR 1201.

C. Other terms as identified in CSPC 16 CFR 1201.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Certification that glass has been tested and approved for use in fire resistance rated doors or walls.
         1) Copies of all test criteria.

B. Informational Submittals:
   1. Warranty.

1.5 WARRANTY

A. Provide manufacturer's written 10 year warranty to cover deterioration of glass, glass units, coatings and ceramic frit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Glass:
      a. Guardian Glass by Guardian Industries.
      b. Insulite Glass Co., Inc.
      c. Pilkington.
      d. Vitro Architectural Glass (formerly PPG Glass).
      e. Viracon.
   2. Gaskets, glazing compounds, setting blocks, spacers, sealant, sealant tape, etc., as recommended by glass manufacturer, glass unit fabricator.
      a. Provide materials as required by NFPA for use in fire-rated units.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2..

2.2 MATERIALS

A. General:
   1. ASTM C1036.
      a. Clear glass: Type I, Class 1, Quality Q3.

   2. Thickness: 1/4 IN, unless noted otherwise.

B. Heat Strengthened and Fully Tempered Glass: ASTM C1048.
   1. General use: Kind HS.
   2. Safety glazing: Kind FT.
      a. Meet requirements of ANSI Z97.1 and CSPC 16 CFR 1201.
   3. Condition:
      a. Clearvision glass: Condition A.
      b. Spandrel Glass (ceramic coated): Condition B.
      c. Coated vision glass: Condition C.
         1) ASTM C1376, Kind CV or CO.

2.3 MANUFACTURED UNITS

2.4 ACCESSORIES

A. Glazing Compounds:
   1. Non-sag, non-stain type.
   2. Pigmented to match frame units not requiring painting.
   3. Compatible with adjacent surfaces.
   4. One- or two-part polyurethane or silicone sealant for use in setting glass.
      a. Provide glazing compounds which will not be affected by chemicals stored in rooms where glazing compounds are used.

B. Sealant Tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.

C. Gaskets:
   1. Flexible polyvinyl chloride or neoprene.
      a. ASTM C864.
      b. Provide gaskets which will not be affected by chemicals stored in rooms where gaskets are used.
   2. Extruded of profile and hardness required to receive glass and provide a watertight installation.
   3. Provide gaskets in accordance with NFPA in fire resistance rated glazing.

D. Setting Blocks and Spacers:
   1. Neoprene or EPDM, compatible with sealants used.
      a. ASTM C864.

E. Compressible Filler Stock: Closed cell polyethylene or polyethylene jacketed polyurethane foam.

F. Shims, Clips, Screws and Other Miscellaneous Items: As required by condition.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with recommendations of manufacturer, GANA Glazing Manual and IGMA TM-3000.

B. Install setting blocks in adhesive or sealant.

C. Install spacers inside and out, of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing.

D. Provide 1/8 IN minimum bite of spacers on glass.

E. Spacer thickness to equal sealant width.

F. Prevent sealant exudation from glazing channels of insulating glass which is more than 1/2 IN thick; colored, heat absorbing, coated or laminated glass sizes larger than 75 united inches; and other glass more than 9/32 IN thick or larger than 125 united inches.
   1. Leave void at heel (or install filler) at jambs and head.
   2. Do not leave void (or install filler) at sill.

G. Miter cut and bond gasket ends together at corners.

H. Immediately after installation, attach crossed streamers to framing held away from glass.

I. Use polysulfide-based glazing sealants in window assembly and as perimeter sealant around frames in areas which may be exposed to chlorine gas or chlorine liquid splash or spillage.
   1. See Specification Section 07 92 00 for sealants.

J. Install fire resistance rated glass in accordance with manufacturer's recommendations and in accordance with applicable fire testing criteria.

3.2 FIELD QUALITY CONTROL

A. Do not install glass with edge damage.

B. Do not apply anything to surfaces of glass.

C. Remove and replace damaged glass.

3.3 CLEANING

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.

B. Wash and polish glass on both faces not more than seven days prior to acceptance of work in each area.
   1. Comply with glass manufacturer's recommendations.

3.4 SCHEDULES

A. General:
   1. Provide safety glazing for all applications where required by the Building Code and CPSC 16 CFR 1201.
   2. Provide heat strengthened glazing for all general use applications where safety glazing is not required.

B. Glass Type 1: Clear Monolithic Glass.

END OF SECTION

DIVISION 09

FINISHES

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gypsum board.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 06 10 53 - Rough Carpentry.
   4. Section 07 92 00 - Joint Sealants.
   5. Section 09 77 61 – Fiberglass Reinforced Plastic FRP Panels

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. C442, Standard Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
      c. C475, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
      d. C840, Standard Specification for Application and Finishing of Gypsum Board.
      e. C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
      f. C1396, Standard Specification for Gypsum Board.
      g. D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
      h. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
      i. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
   2. Gypsum Association (GA):
      a. GA-214, Recommended Levels of Gypsum Board Finish.
   3. Underwriters Laboratories, Inc. (UL):
      a. Building Materials Directory.
      b. Fire Resistance Directory.

1.3 DEFINITIONS

A. Wet Area:
   1. Toilet rooms, showers, laboratories, janitor closets, or similar areas.
   2. Areas within 5 FT of emergency showers, eye wash stations, service sinks, or mop sinks.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Drawings of unusual conditions.
      a. Control joint layout.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   4. Manufacturer's adhesive, joint treatment compound and tape recommendations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Gypsum board and accessories:
      a. American Gypsum.
      b. Georgia-Pacific Building Products.
      c. National Gypsum.
      d. USG Corporation.

B. Submit request for substitution in accordance with Specification Section 0700, Paragraph 5.2.

2.2 MATERIALS

A. General:
   1. Provide UL Listed materials in fire-resistant rated construction.
   2. Furnish in lengths as long as practicable.

B. Gypsum Board (GB):
   1. ASTM C1396.
   2. Thickness: 5/8 IN unless noted otherwise.
   3. Edges: Tapered.
   4. Fire-rated board: Type X.
   5. Water-Resistant Gypsum Board (WRGB):
      a. Water-resistant core and facers.
         1) Smooth face for finishing similar to standard gypsum board.
      b. Mold-resistant: ASTM D3273.
      c. USG "Sheetrock Mold Tough".

C. Abuse Resistant Panels (ARP):
   1. ASTM C1278.
   2. ASTM E119, Flame Spread: 5.
   3. ASTM E84, Smoke Developed: 0.
   4. Mold-resistant: ASTM D3273.
   5. Thickness: 5/8 IN.
   6. Edges: Tapered.
   7. USG "Fiberock Aqua-Tough AR."

D. Adhesive: As recommended by board manufacturer.

E. Joint Treatment Compound:
   1. ASTM C475.
   2. Recommended by manufacturer for specified board type and location.
   3. Do not use self-adhesive fiber mesh tape.

F. Joint Tape:
   1. ASTM C475.
   2. Recommended by manufacturer for specified board type and location.

2.3 ACCESSORIES

A. Trim:
   1. ASTM C1047.
   2. Galvanized: ASTM A653 G-60, unless noted otherwise.
   3. Corner bead:
      a. Standard type with perforated flanges.
      b. ClarkDietrich "#103 Deluxe Corner Bead".

4. Casing and trim bead:
    a. ClarkDietrich "#200-A Metal U-Trim.
5. Control and expansion joints:
    a. ClarkDietrich "#093 Zinc Control Joint."

B. Fasteners:
1. Gypsum board:
    a. Self-drilling Type S, corrosion-resistant bugle head screws.
    b. Provide stainless steel fasteners in wet areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Verify that and wood truss framing has been installed plumb, true, and in accordance with the Contract Documents.
2. Install gypsum board in accordance with ASTM C840.
3. Install board in fire-rated construction in accordance with UL requirements.
    a. Self-adhesive applied fire rated tape is not acceptable for use on board joints in fire rated walls.
    b. Tape all joints using conventional fire rated joint tape and joint treatment compound.
4. Erect all board horizontally with edges over supporting members.
5. Secure to each support or framing member with screws.
    a. Provide fasteners of sufficient length to penetrate framing member or stud not less than 3/8 IN.
6. Bring boards into contact, but do not force into place.
7. Fit neatly and carefully.
8. Stagger edge joints on opposite side of a partition so they occur on different framing members.
9. Hold board in firm contact with support while fasteners are being driven.
10. Proceed with attachment from center of board toward ends and edges.
11. Scribe board prior to cutting.
12. In fire-rated ceiling assemblies, fasten minimum 4 IN wide drywall strip continuous over all joints on backside of board.
13. Where gypsum board abuts concrete, masonry, metal deck, exterior doors, or other dissimilar material; provide 3/8 IN joint between edge of gypsum board and abutting material.
    a. Provide continuous casing bead trim on edge of board.
    b. Seal joint with sealant and backer rod.
    c. See Specification Section 07 92 00 for sealant.
14. Use water-resistant gypsum board (WRGB) in wet locations not scheduled to receive tile finish or abuse resistant panels (ARP).

B. Provide Abuse Installation:
1. Set fasteners between 3/8 and 1/2 IN from edges and 2 IN in from board corner.
    a. Space maximum of 12 IN on center at edges and in field of board.
    b. Where board butts at wall/ceiling juncture, hold fasteners back 6 IN from edges.
    c. Space fasteners closer if required by UL.
2. Install fasteners, in gypsum board, so that head rests in a slight dimple without cutting face paper or fracturing core or as recommended by board/panel manufacturer.

C. Control Joints:
1. Install prefabricated control joints to provide following maximum unjointed lengths or areas:
    a. Partitions: 30 FT, maximum straight run, and at lock side of jamb from head of each door opening to top of partition.

b. Ceilings:
1) 50 FT maximum in one (1) direction,
2) At change of direction or irregular shapes.
3) Ceiling area: 2500 SQFT, maximum.

2. Seal control joints.
a. Use color to match wall or ceiling color as closely as possible.
3. Where control or expansion joints occur in fire or sound rated assemblies, install suitable backing material to maintain required rating.
4. Where a partition or ceiling abuts a structural element or dissimilar wall or ceiling, install corner bead, casing bead or other trim as required.

D. Board Finishing:
1. Securely attach continuous corner beads to all external corners in accordance with manufacturer's recommendations.
2. Provide the following minimum levels of gypsum board finish in accordance with GA-214.
a. Areas exposed to view:
1) Surfaces to receive FRP covering: Level #5.
a) Finished gypsum board ceilings shall be free of any defects including but not limited to ridges, screws, joint or any telegraphing that will deter the installation of FRP panels and provide a smooth finish product.
b. Provide additional coats of joint compound as required to completely conceal joints, fasteners and accessories.
1) Joint photographing will not be acceptable.
3. Sand each coat to remove excess joint compound.
a. Avoid roughing paper facing on board.
4. Finish surface shall be smooth and free of tool marks and ridges.
5. Prime gypsum board surfaces in accordance with Specification Section09 91 10.
a. After primer has been applied, inspect surfaces and repair and refinish all areas which show defects.
6. Refer to ASTM C840 for additional finishing requirements.

END OF SECTION

SECTION 09 77 61
FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Fiberglass Reinforced Plastic Panels, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM Standards:
   1. ASTM D570 Standard Test Method for Water Absorption of Plastics
   2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer’s product data and literature indicating material and fire test information in compliance with specifications.

B. Samples:
   1. Two 12 IN 300 x 300 MM square pieces of each pattern and color as specified in Drawing I-001 Interior Notes and Finish Legend.
   2. Material samples of full range of standard and custom range of for selection of colors.

C. Contract Closeout Information:
   1. Maintenance data:
      a. See Section 01 78 23.
   2. Interior finish fire performance data:
      a. Provide for each finish material and type specified:
         1) Manufacturer's printed information including:
            a) Fire class.
            b) NFPA test number.
            c) Photograph.
         2) Proof of purchase.
         3) See Section 01 78 26.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:
   1. Base:
      a. Crane Composites.
   2. Optional:
      a. Marlite.
      b. Glasteel.
      c. Kal-Lite.
      d. Nudo.
      e. Graham.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Class A Fiberglass Reinforced Plastic (FRP) Wall and Ceiling Panels:
   1. For use on walls and ceilings, see Room Finish Schedule for locations.
   2. Panel thickness:
      a. 0.09 IN 2.3 MM.
   3. Barcol hardness not less than 50.
   4. Interior finish rating: Class A (I) when tested in accord with ASTM E84:
      a. Flame spread: Less than 25.
      b. Smoke developed: Less than 450.
   5. Water absorption no greater than 0.20 PCT at 24 HRS at 77 DEGF 25 DEGC in accordance with ASTM D570.
   6. Identify boards by manufacturer's standard marking on reverse side of panel.
   7. Embossed finish.
   8. Color: White.
   9. Adhesive:
      a. Compatible with panels and substrate.
      b. As recommended by panel manufacturer.
      c. Exposed fasteners are not allowed.
   10. Base product: Fire-X Glasbord by Crane Composites.
   11. Base product: Fire-X Glasbord FXE by Crane Composites.

B. Moldings:
   1. Manufacturer's standard extruded vinyl trim.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify suitability of substrate to accept installation.

B. Correct unsatisfactory conditions.

C. Start of installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations and approved shop drawings.

B. Install moldings to panels prior to erection.
   1. Apply moldings to panel edges.
   2. Apply silicone sealant to manufacturer's recommendations.

C. Apply adhesive full coverage at panel back.

3.3 CLEANING

A. Remove excessive sealant and adhesive with cleaner recommended by panel manufacturer.

B. Clean entire surface prior to closeout.

END OF SECTION

SECTION 09 91 10
ARCHITECTURAL PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface Preparation.
   2. Field application of:
      a. Architectural Coatings.
      b. Special Coatings.
      c. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
   3. Environmental controls for field application of coatings.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Division 04 - Masonry.
   4. Section 05 50 00 - Metal Fabrications.
   5. Section 08 11 00 –Hollow Metal Doors.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D523, Standard Test Method for Specular Gloss.
      b. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
      c. D4259, Standard Practice for Abrading Concrete.
      d. D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
      e. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
      f. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
      g. F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
      h. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. National Fire Protection Association (NFPA):
      a. 101, Life Safety Code.
   3. Steel Door Institute/American National Standards Institute (SDI/ANSI):
      a. A250.10, Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces for Steel Doors and Frames.
   4. The Society for Protective Coatings (SSPC):
      a. SP 1, Solvent Cleaning.
      b. SP 2, Hand Tool Cleaning.
      c. SP 3, Power Tool Cleaning.
      d. SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
   5. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 6/NACE No. 3, Commercial Blast Cleaning.
      b. SP 7/NACE No. 4, Brush-off Blast Cleaning.
      c. SP 13/NACE No. 6, Surface Preparation of Concrete.
   6. United States Environmental Protection Agency (EPA).

B. Miscellaneous:
   1. Coating used in all corridors and stairways shall meet requirements of NFPA 101 and ASTM E84.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified.

C. Exposed Exterior Surface:
   1. Exterior surface which is exposed to view.
   2. Exterior surface which is exposed to weather but not necessarily exposed to view.

D. Finished Area:
   1. An area that is listed in or has finish called for on Room Finish Schedule.
   2. An area that is indicated on Drawings to be painted.

E. Gloss Range:
   1. Specular gloss measured in accordance with ASTM D523:
      a. Flat: Below 15, at 60 DEG.
      b. Eggshell: Between 20 and 35, at 60 DEG.
      c. Semi-gloss: Between 35 and 70, at 60 DEG.
      d. Gloss: More than 70, at 60-degrees.

F. Paint includes the following:
   1. Architectural paints (AP) include: Acrylic latex or alkyd enamel coatings.
   2. Special coatings (SC) include: Water-based pigmented resin particles suspended in acrylic latex solution.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's surface preparation instructions.
      c. Manufacturer's application instructions.
      d. Product data to include environment conditions and substrate material is acceptable for each type of paint and coating system.

B. Samples:
   1. Manufacturer's full line of colors for Engineer's preliminary color selection.
   2. Gloss samples.
   3. After preliminary color selection by Engineer provide two (2) 8 by 10 IN samples of each final color and sheen selected.

C. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Test results.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:
   1. Name or type number of material.
   2. Manufacturer's name and item stock number.

3. Contents, by volume, of major constituents.
4. Warning labels.
5. VOC content.

B. Store materials in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 DEGF.

1.6 PROJECT CONDITIONS

A. Verify that atmosphere in area where painting is to take place is within paint manufacturer's acceptable temperature, humidity and sun exposure limits.
   1. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.
      a. Provide temporary dehumidification equipment properly sized to maintain humidity levels required by paint manufacturer.
      b. Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.
         1) Vent exhaust gases to exterior environment.
         2) No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.
   2. Do not apply coatings in snow, rain, fog or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products from a single manufacturer to the greatest extent practicable.

B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Architectural paints:
      a. Benjamin Moore.
      b. PPG Industries.
      c. Pratt & Lambert.
      d. Sherwin Williams.
      e. Tnemec.

C. No like, equivalent or "or-equal" item or substitution is permitted.

D. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. General:
   1. For unspecified materials such as thinner, provide manufacturer's recommended products.
   2. Unless noted otherwise, products listed are manufactured by the manufacturer listed below.
      a. Products of other manufacturers will be considered for use provided that the product:
         1) Is of the same generic formulation.
         2) Has comparable application requirements.
         3) Meets the same VOC levels or better.
         4) Provides the same finish and color options.
   3. Coatings shall comply with the VOC limits of EPAand, LEEDColors:
      a. Colors and gloss will be selected from the manufacturer’s complete offering, including special colors and premium offerings.

B. Architectural Paints:
   1. Product List:

Generic Description	Product
Acrylic Primer	PPG Pure Performance 9-900
Acrylic Latex	PPG Pure Performance 9-100/9-300/9-500 Series
Acrylic Gloss	PPG Speedhide 6-8534 Series
Concrete Filler/Surfacer	Tnemec Series 215 and/or Series 218
CMU Block Filler	Tnemec Series 54 Masonry Filler
Dry-Fall Primer	Tnemec Series V115 Uni-Bond DF
Epoxy Barrier Coat	Tnemec Series 135 Chembuild
Fluoropolymer	Tnemec Series 1070V/1071V/1072V Fluoronar
HDP Acrylic	Tnemec Series 1028/1029 Enduratone
Organic Zinc Primer	Tnemec Series 94-H_2O Hydro-Zinc
Polycarbamide	Tnemec Series 740/750 UVX
Waterborne Acrylate	Tnemec Series 156 Enviro-Crete

2.3 PAINT SYSTEMS:

A. General:
1. Refer to Specification Section 09 96 00 for:
   a. Items in corrosive or highly corrosive environments.
   b. Items subject to immersion service.
   c. Items subject to exterior exposure.
   d. Any other locations where High Performance Industrial Coatings (HPIC) are required.

B. Schedule:

Substrate	Prime Coat[1]	Intermediate Coat(s)[1]	Finish Coat[1]
Concrete Masonry	80 to 100 SQFT/GAL CMU Block Filler	100 to 200 SQFT/GAL Waterborne Acrylate	100 to 200 SQFT/GAL Waterborne Acrylate
Galvanized Structural Steel and Miscellaneous Metals[3]	2.0 to 4.0 MIL Dry-Fall Acrylic		2.0 to 3.0 MIL HDP Acrylic [2]
Steel Railings	4.0 to 6.0 MIL Epoxy Barrier Coat	2.0 to 3.0 MIL HDP Acrylic Gloss	2.0 to 3.0 MIL HDP Acrylic Gloss

Hollow Metal - Interior	4.0 to 5.0 MIL DFT Epoxy Barrier Coat	2.0 to 3.0 MIL HDP Acrylic2	2.0 to 3.0 MIL HDP Acrylic[2]
Hollow Metal - Exterior	4.0 to 5.0 MIL DFT Epoxy Barrier Coat	2.5 to 3.5 MIL Polycarbamide[2]	2.5 to 3.5 MIL Polycarbamide[2]

1. Application rates (SF/GAL) shown are for unthinned materials.
2. Sheen as scheduled or selected.

PART 3 - EXECUTION

3.1 ITEMS TO BE PAINTED

A. Exterior surfaces, including but not limited to:
   1. Miscellaneous ferrous metal surfaces:
      a. Items specifically noted on Drawings to be painted.
   2. Miscellaneous galvanized steel surfaces:
      a. Embed Plates.
      b. Loose lintels.
      c. Items specifically noted on Drawings to be painted.
   3. Doors and frames
      a. Hollow metal doors and frames.
      b. Hollow metal window frames.

B. Interior Areas:
   1. Refer to Room Finish Schedule on Drawings.
      a. If space is scheduled to be painted, paint all appurtenant surfaces within the space unless specifically noted otherwise.
      b. Provide coating manufacturer's recommended bonding primer.
      c. Appurtenant surfaces include but are not limited to:
         1) Columns, beams, bracing and similar components.
         2) Underside of roof or floor decks above.
         3) Conduit, boxes, covers and supports.
         4) Ductwork, duct insulation and duct supports.
         5) Piping, pipe insulation and jacketing.
         6) Miscellaneous ferrous metal surfaces.
   2.
   3. Concrete masonry.
   4. Doors and frames:
      a. Hollow metal doors and frames
      b. Hollow metal window frames.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in this Article, unless noted otherwise.

B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

C. Electrical equipment.

D. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.

E. Code labels, equipment identification or rating plates and similar labels, tagging and identification.

F. Contact surfaces of friction-type structural connections.

G. Stainless steel surfaces.

H. Aluminum Surfaces Except:
   1. Where specifically shown in the Contract Documents.
   2. Where in contact with concrete.
   3. Where in contact with dissimilar metals.
   4. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.

I. Fiberglass Surfaces Except:
   1. Fiberglass piping where specifically noted to be painted.
   2. Piping supports where specifically noted to be painted.
   3. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.

J. Galvanized steel items, unless specifically noted to be painted.

K. Architectural finishes:
   1. Standing and running trim.
   2. Fiberglass fabrications.
   3. Anodized aluminum.
   4. PVDF coated metals.
   5. Factory finished doors and frames.
   6. Finish hardware.
   7. Glass and glazing.
   8. Building specialties.
   9. Louvers.
   10. Casework and countertops.
   11. Pipe insulation and jacketing.
   12. Standing seam metal roof, fascia, trim, soffit and accessories.

3.3 EXAMINATION

A. Concrete Unit Masonry:
   1. Test pH of surface to be painted in accordance with ASTM D4262.
      a. If surface pH is not within paint manufacturer's required acceptable range, use methods acceptable to paint manufacturer as required to bring pH within acceptable limits.
      b. Retest pH until acceptable results are obtained.
   2. Verify that moisture content of surface to be painted is within paint manufacturer's recommended acceptable limits.
      a. Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.
         1) If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869.
         2) Provide remedial measures as necessary to bring moisture content within paint manufacturer’s recommended acceptable limits.
         3) Retest surface until acceptable results are obtained.

3.4 PREPARATION

A. General:
   1. Prepare surfaces to be painted in accordance with paint manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
      a. Where discrepancy between paint manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.
   2. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of paint to surface.
   3. Adhere to manufacturer's recoat time surface preparation requirements.
      a. Surfaces that have exceeded paint manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional paint in accordance with manufacturer's published recommendations.

B. Protection:
   1. Protect surrounding surfaces not to be coated.
   2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
   3. Protect code labels, equipment identification or rating plates and similar labels, tagging and identification.

C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.

D. Existing Surfaces:
   1. Wherever existing work is cut, patched or modified; repair and repaint to match new work.
   2. Where a wall or ceiling is disturbed and patched, paint entire wall or ceiling.

E. Ferrous Metal:
   1. Complete fabrication, welding or burning before beginning surface preparation.
      a. Chip or grind off flux, spatter, slag or other laminations left from welding.
      b. Remove mill scale.
      c. Grind smooth rough welds and other sharp projections.
   2. Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.
   3. Exterior exposure:
      a. Commercial blast clean in accordance with SSPC SP 6/NACE No. 3.
   4. Interior exposure:
      a. Hand tool cleaning in accordance with SSPC SP 2 and/or power tool cleaning in accordance with SSPC SP 3.

F. Hollow Metal:
   1. Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.
   2. Lightly sand primed surfaces with fine grit sandpaper as recommended by hollow metal manufacturer.

G. Galvanized Steel and Non-ferrous Metals:
   1. Solvent clean to remove all dust, grease, oil, compounds, dirt and other foreign matter.
   2. Brush-off blast in accordance with SSPC SP 16 or hand tool cleaning in accordance with SSPC SP 2 to remove surface contaminants.

H. Concrete Unit Masonry:
   1. Cure for minimum of 28 days.
   2. Remove all mortar spatters and protrusions.
   3. Clean in accordance with ASTM D4261.
      a. Remove all soil, grease, oil, efflorescence.
   4. Test pH and moisture content in accordance with EXAMINATION article in this specification section.

3.5 APPLICATION

A. General:
   1. Thin, mix and apply paints in accordance with manufacturer's installation instructions.
      a. Where discrepancy exists between manufacturer’s instructions and this Specification Section, the more stringent requirement shall apply.
      b. When materials have been thinned, adjust application rates as necessary to achieve film coverage indicated in Part 2 for unthinned materials.
      c. Backroll spray applied paints.
   2. Temperature and weather conditions:
      a. Do not paint surfaces when surface temperature is below 50 DEGF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
      b. Avoid painting surfaces exposed to hot sun.

c. Do not paint on damp surfaces.
3. Apply materials under adequate illumination.
4. Evenly spread to provide full, smooth coverage.
   a. All paint systems are "to cover."
      1) When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
   b. Finished paint system shall be uniform and without voids, bugholes, holidays, laps, brush marks, roller marks, runs, sags or other imperfections.
5. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
6. Work each application of material into corners, crevices, joints, and other difficult to work areas.
7. When painting rough surfaces, hand brush and backroll paint to work into all recesses.
8. Smooth out runs or sags immediately, or remove and recoat entire surface.
9. Allow preceding coats to dry before recoating.
   a. Recoat within time limits specified by paint manufacturer.
   b. If recoat time limits have expired re-prepare surface in accordance with paint manufacturer's printed recommendations.
10. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
11. Finish colors not otherwise indicated shall be selected by Engineer from paint manufacturer’s complete offering.

B. Fillers, surfacers or patching compounds:
   1. Provide fillers, surfacers or patching compounds in accordance with manufacturer’s recommendations and as specified herein as necessary to provide a smooth, defect free substrate.

C. Prime Coat Application:
   1. Prime all surfaces indicated to be painted.
      a. Apply prime coat in accordance with paint manufacturer's written instructions and as written in this Specification Section.
   2. Ensure field-applied paints are compatible with factory-applied paints or existing coatings.
      a. Employ services of coating manufacturer's qualified technical representative.
         1) Certify through material data sheets.
         2) Perform test patch.
      b. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
      c. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.
         1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.
   3. Special coatings prime coat application:
      a. Prime new gypsum board surfaces using sealer as recommended by manufacturer.
         1) Apply at rate per manufacturer’s recommendation.
      b. Prime and fill new concrete and masonry using sealer coat as recommended by manufacturer followed by modified epoxy filler as specified.
      c. Prime filled concrete and masonry surfaces with primer at rates and as recommended by manufacturer.
   4. Touch up damaged primer coats prior to applying finish coats.
      a. Restore primed surface equal to surface before damage.

D. Finish Coat Application:
   1. Apply finish coats in accordance with paint manufacturer's written instructions and in accordance with this Specification Section.

2. Touch up damaged finish coats using same application method and same material specified for finish coat.
    a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.
3. Hollow metal frames and doors:
    a. Finish coats shall be spray applied only.
    b. Finish edges same as faces of doors.

3.6 FIELD QUALITY CONTROL

A. Application Deficiencies:
    1. Surfaces showing runs, laps, brush marks, telegraphing of surface imperfections or other defects will not be accepted.
    2. Surfaces showing evidence of fading, chalking, blistering, delamination or other defects due to improper surface preparation, environmental controls or application will not be accepted.

B. Provide protection for painted surfaces.
    1. Surfaces showing soiling, staining, streaking, chipping, scratches, or other defects will not be accepted.

C. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.

D. Measure substrate humidity with humidity gage specifically designed for such.

E. Provide wet paint signs.

3.7 CLEANING

A. Clean paint spattered surfaces.
    1. Use care not to damage finished surfaces.

B. Remove masking, adhesive residue or other foreign materials.

C. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

D. Remove surplus materials, scaffolding, and debris.

END OF SECTION

DIVISION 10

SPECIALTIES

SECTION 10 14 23
SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Room identification signs.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
      a. Accessibility Guidelines for Buildings and Facilities (ADAAG).
   2. ASTM International (ASTM):
      a. B26, Standard Specification for Aluminum-Alloy Sand Castings.
   3. Building code:
      a. International Code Council (ICC):
         Iowa Building Code 2015 Edition including all amendments, referred to herein as Building Code.
   4. State of Iowa, Building ADA Signage Standards:

B. Wet and/or Corrosive Areas: For the purposes of this Specification Section, all rooms are considered wet and/or corrosive:

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Color charts for color selection by Owner.
         1) Color selection shall be made from manufacturer's complete color line including all premium and special colors.
   3. Schedule of all signs indicating text and graphics.
   4. Layout drawings of all signage showing size, letter style, text, border, finish, and installation detail.
      a. Provide drawings for:
         1) Room identification signs.

B. Samples:
   1. Room identification signs.
   2. Fire and/or smoke barrier identification signs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Room identification signs:

a. ASE - Architectural Signs and Engraving.
b. ASI Signage Innovations.
c. Best Sign Systems.
d. Mohawk Sign Systems.
e. Nelson-Harkins.
f. Southwell Co.
g. Stamprite Supersine Identification Specialists.

2. Fire and/or smoke barrier identification signs:
a. Brady.
b. Panduit.
c. Seton.
d. Carlton Industries.

B. Submit request for substitution in accordance with Specification Section 0700, Paragraph 5.2.

2.2 MATERIALS

A. Room Identification Signs:
1. Interior:
a. Dry, non-corrosive areas: Melamine plastic suitable for raised lettering and Braille.
b. Wet and/or corrosive areas: Aluminum or fiberglass suitable for raised lettering and Braille.
2. Exterior: Aluminum or fiberglass suitable for raised lettering and Braille.

B. Fire and/or Smoke Barrier Identification Signs:
1. Self-adhesive vinyl tape or vinyl cloth.

2.3 FABRICATION

A. Room Identification Signs:
1. General:
a. Raised text, border and graphics.
1) Minimum 1/32 IN height.
2) Provide international graphic symbology for all toilet, locker and shower rooms or combinations thereof, and for unisex toilet rooms and stairs.
3) Provide handicap symbol on all signs for rooms meeting handicap requirements.
b. Grade 2 Braille.
c. Finish: Eggshell.
1) Color: To be selected.
d. Text:
1) Typeface: Sans Serif.
2) Size: Minimum 3/4 IN high.
e. Text as indicated in the SCHEDULES Article in PART 3 of this Specification Section.
f. Exterior signs shall be rated for exterior use.
g. All signs shall comply with requirements of ADA including state or local authority, if appropriate.

B. Fire and/or Smoke Barrier Identification Signs:
1. Self-adhesive tape tags and signs:
a. Materials: Vinyl tape or vinyl cloth.
b. Size:
1) Surface: As required by text.
2) Thickness: 5 mils minimum.
c. Fabrication:
1) Indoor/Outdoor grade.
2) Weather and UV resistant inks.
3) Permanent adhesive.
4) Legend: Preprinted.
5) Self-laminating.

d. Color: White with black lettering or as specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Room Identification Signs:
   1. Install signs using foam tape for interior signs and stainless steel screws (minimum of two (2)) for exterior signs.
      a. Stainless steel screws shall be painted to match sign color.
   2. Mounting Locations:
      a. Tactile characters on signs shall be located 48 IN minimum above the finished floor or ground surface, measured from the baseline of the lowest tactile character and 60 IN maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
      b. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right side of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.
      c. Signs containing tactile characters shall be located so that a clear floor space of 18 IN minimum by 18 IN minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
   3. Interior and exterior signs identifying permanent rooms and spaces shall comply with ADA including state or local authority, if appropriate.

B. Fire and/or Smoke Barrier Identification Signs:
   1. Provide marking and identification in compliance with Building Code.
   2. Locate in accessible concealed floor, floor-ceiling, or attic spaces.
   3. Repeat at intervals not exceeding 15 FT measured horizontally.
   4. Lettering: Not less than 1/2 IN high.

3.2 SCHEDULES

A. Room Identification Signs:

BUILDING LOCATION	MOUNTING	VERBIAGE	REMARKS
COOL WATER BUILDING			
DOOR 102	INTERIOR	CHEMICAL STORAGE	2
DOOR 103B	INTERIOR	MECHANICAL / ELECTRICAL	3
DOOR 104B	INTERIOR	ISOLATION ROOM	3
DOOR 106	INTERIOR	UNISEX RESTROOM	1,3
FRAMED OPENING	INTERIOR	LOCKER ROOM	1

BUILDING LOCATION	MOUNTING	VERBIAGE	REMARKS
REMARKS: 1. Provide Universal Graphic Symbology. 2. Mount adjacent to pull side of door. 3. Mount adjacent to push side of door.			

B. Fire and/or Smoke Barrier Identification Signs:
   1. FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS

END OF SECTION

SECTION 10 44 33
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portable fire extinguishers.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 05 50 00 - Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
      a. 2010 ADA Standards for Accessible Design.
   2. National Fire Protection Association (NFPA):
      a. 10, Standard for Portable Fire Extinguishers.
   3. Underwriters Laboratories, Inc. (UL):
      a. 8, Water Based Agent Fire Extinguishers.
      b. 154, Carbon Dioxide Fire Extinguishers.
      c. 299, Dry Chemical Fire Extinguishers.
      d. 626, Water Fire Extinguishers.
      e. 711, Rating and Fire Testing of Fire Extinguishers.
      f. 2129, Halocarbon Clean Agent Fire Extinguishers.

1.3 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Building official, fire chief, fire marshal or other individual having statutory authority.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Ratings and classification of extinguishers.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and install filled and charged extinguishers just prior to building occupancy.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Fire extinguishers:
      a. Amerex Corporation.
      b. Ansul – Tyco Fire Protection Products.
      c. Badger Fire Protection.
      d. United Technologies - Kidde.
      e. Buckeye Fire Equipment.
   2. Fire extinguisher signs:
      a. Seton.
      b. Compliance Signs.
      c. Safety Sign.

B. Submit request for substitution in accordance with Specification Section 0700, Paragraph 5.2.

2.2 MANUFACTURED UNITS

A. Fire Extinguisher (FEXT):
   1. Steel bodied, all metal top (head) and valves.
   2. Multi-purpose dry chemical extinguisher with hose and nozzle.
   3. Provide one (1) listed 10 LB. 4A-60BC extinguisher for each fire extinguisher location (FEXT) indicated on Drawings.
   4. Finish: Red with epoxy finish coat.

B. Wall Brackets:
   1. Bracket type to fit specified extinguisher.
   2. Furnish bracket for each extinguisher not in cabinet.
   3. Bracket to be finished in red or black enamel.

C. Fire Extinguisher Signage:
   1. Single faced: SETON #21999.
   2. Double faced: SETON #22001.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and NFPA 10.
   1. Install units with extinguisher top not over 48 IN above floor.
   2. Install wall brackets to concrete or masonry substrate with self-tapping concrete anchors.
      a. See Specification Section 05 50 00.

B. Fire extinguisher locations shown on Drawings are approximate locations.
   1. Verify all extinguisher mounting locations with the AHJ.

C. Provide "FIRE EXTINGUISHER" sign for each extinguisher location.
   1. Provide single or double faced sign to provide optimum visibility for extinguisher location.

END OF SECTION

DIVISION 22

PLUMBING

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ball valves.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 61 03 - Equipment - Basic Requirements.
   4. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. D1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

B. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
   1. SP 110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.4 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Hayward Industrial
   2. GF Piping Systems
   3. Plast-O-Matic
   4. Valtorc

2.2 BALL VALVES

A. 3 IN and Smaller: 150 PSI at 73 DEG F water temperature, maximum service temperature: 140 DEG F ASTM D1785 PVC body and ball, lever handle, EPDM seals, teflon seats, full port, double union type with socket or threaded ends except where V-port is indicated in which case it

shall be GF characterized port or Hayward's slow opening characterized port or Valtorc or Plast-O-Matic 60 degree V-control. V-port or characterized port valves in 1 IN size shall have Cv between 15.5 and 21.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install 3/4 IN ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

C. Install valves with clearance for installation of insulation and allowing access.

D. Refer to Section 22 05 29 for pipe hangers.

E. Refer to Section 40 05 00 for piping materials applying to various system types.

3.2 VALVE APPLICATIONS

A. Install ball or gate valves for drain service at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Install ball valves in domestic water systems for shut-off service.

E. Install ball valves in domestic water systems for throttling service.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Firestopping accessories.

B. Related Sections:
1. Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. B31.5, Refrigeration Piping.
2. B31.9, Building Services Piping.

B. ASTM International (ASTM):
1. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
2. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
3. E814, Standard Test Method for Fire Tests of Through Penetration Fire Stops.
4. F708, Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. E1966, Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society (AWS):
1. D1.1, Structural Welding Code - Steel.

D. FM Global (FM):
1. Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
1. SP 58, Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. SP 69, Pipe Hangers and Supports - Selection and Application.
3. SP 89, Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc. (UL):
1. 263, Fire Tests of Building Construction and Materials.
2. 723, Tests for Surface Burning Characteristics of Building Materials.
3. 1479, Fire Tests of Through-Penetration Firestops.
4. 2079, Tests for Fire Resistance of Building Joint Systems.
5. Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263 or UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 HR fire rating.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to FM or UL for fire resistance ratings and surface burning characteristics.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

F. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Firestopping Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 IN water gage minimum positive pressure differential to achieve 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 65 50 - Product Delivery, Storage and Handling.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 DEG F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Anvil International.
2. PHD Manufacturing.
3. Cooper B-Line.
4. Erico International.
5. Tolco Inc.
6. Clic
7. Hangerlok

B. Materials of hangers and supports in paragraphs other than this, apply to Locker, Toilet and Electrical/Mechanical Rooms and ceiling supported piping in all rooms and wall supports more than 7' above floor in all rooms. Hangers and supports less than 7' above floor for piping in Chemical Storage, Disinfection, Incubation and Isolation Rooms shall have stainless steel, aluminum, plastic or galvanized bodies with stainless steel nuts and bolts.

C. Plumbing Piping - DWV:
1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 or MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 IN: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 IN and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 IN and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 IN and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

D. Plumbing Piping - Water:
1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 or MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 IN: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 IN and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 IN: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 IN and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 IN and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 IN and Smaller: Cast iron hook.
9. Wall Support for Pipe Sizes 4 IN and Larger: Welded steel bracket and wrought steel clamp.

10. Wall Support for Hot Pipe Sizes 6 IN and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 IN and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 IN and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.
   1. Electro-galvanized or cadmium plated after threads are cut.
   2. Rods less than 7' above floor for piping in Chemical Storage, Disinfection, Incubation and Isolation Rooms shall be stainless steel.

2.3 INSERTS

A. Manufacturers:
   1. Hilti.
   2. Simpson.
   3. Tolco.
   4. Cooper B-Line.
   5. Grinnell.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 LB/SQFT sheet lead.
   2. Soundproofing: 1 LB/SQFT sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: refer to Section 07 92 00.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. GPT Industries
   2. Proco Products, Inc.
   3. Flexicraft Industries.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and

pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Unistrut Corporation.
   2. Cooper B-Line.
   3. Erico.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 IN on center.

2.8 FIRESTOPPING

A. Manufacturers:
   1. Dow Corning.
   2. 3M Company.
   3. US Gypsum Co.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
   2. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   3. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
   4. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   5. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   6. Firestop Pillows: Formed mineral fiber pillows.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
   1. Mineral fiberboard or
   2. Mineral fiber matting or
   3. Sheet metal or
   4. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish UL listed products or products tested by independent testing laboratory.
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
   2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Obtain permission from Architect/Engineer before using powder-actuated anchors.

D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 IN and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 58 and MSS SP 69.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 IN space between finished covering and adjacent work.

D. Place hangers within 12 IN of each horizontal elbow.

E. Use hangers with 1-1/2 IN minimum vertical adjustment.

F. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Provide copper plated hangers and supports for copper piping.

I. Design hangers for pipe movement without disengagement of supported pipe.

J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.5 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 IN minimum above finished roof surface with lead worked 1 IN minimum into hub, 8 IN minimum clear on sides with 24 x 24 IN sheet size. For pipes through outside walls, turn flanges back into wall and seal, metal counter-flash, and seal.

C. Seal mop sink drains watertight to adjacent materials.

D. Adjust storm collars tight to pipe with bolts; seal around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Seal sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and sealant. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install plastic or stainless steel escutcheons at finished surfaces.

3.7 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Place intumescent coating in sufficient coats to achieve rating required.

E. Fire Rated Surface:
   1. Seal opening at wall as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 IN on both sides of building element.
      b. Size sleeve allowing minimum of 1 IN void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

F. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 IN on both sides of building element.
      b. Size sleeve allowing minimum of 1 IN void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
   2. Install escutcheons or ceiling plates where pipe, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Pipe markers.
   4. Labels.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. A13.1, Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTUERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Nameplates, Tags and Stencils:
      a. WH Brady Company.
      b. Panduit.
      c. Seton.
      d. National Band and Tag Company.
      e. Carlton Industries, Inc.

B. Submit request for substitution in accordance with Specification Section 0700, Paragraph 5.2.

2.2 NAMEPLATES

A. Laminated two-layer phenolic or DR (high impact) acrylic with engraved black letters on light contrasting background color.
   1. Thickness: Minimum 1/16 IN.
   2. Color: Manufacturer standard or as specified.

2.3 TAGS

A. Nonmetallic Tags:
   1. Fiberglass reinforced engraved black letters on light contrasting background color.
      a. Tag size: Minimum 1-1/2 IN.
      b. Thickness: Minimum 100 mils.
      c. Color: Manufacturer standard or as specified.

B. Metal Tags:
   1. Aluminum or stainless steel disc with stamped letters and finished edges.
      a. Tag size: Minimum 1-1/2 IN diameter.
      b. Thickness: Minimum 0.035 IN (20 Ga).
      c. Color: Black color filled into stamped text with natural metal background.

C. Tag Chart: Typewritten letter size list of applied tags and plastic laminated.

2.4 SELF ADHESIVE PIPE AND EQUIPMENT MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
   1. Thickness: Minimum 5 mils.
   2. Letter Height:
      a. Up to 2 IN Outside Diameter of Insulation or Pipe: 1/2 IN high letters.
      b. 2-1/2 to 6 IN Outside Diameter of Insulation or Pipe: 1 IN high letters.
      c. Over 6 IN Outside Diameter of Insulation or Pipe: 1-3/4 IN inches high letters.
      d. Equipment: 1-3/4 IN IN high letters.
   3. Indoor/outdoor grade.
   4. Weather and UV resistant inks.
   5. Permanent adhesive.

2.5 UNDERGROUND WARNING TAPE

A. Description: Polyethylene tape with metallic core for detection and location of piping with metal detector resistant to acids, alkalis and other soil components.
   1. Size: 0.004 IN thick; 6 IN wide.
   2. Color: As Specified.
   3. Service Marking: Printed text identifying the service of the pipe differentiating potable water, cold water, recirculating water, hot water and sanitary drains repeated at maximum 40 IN intervals.

2.6 TRACER WIRE

A. 12 GA AWG.

B. Solid.

C. Waterproof type wire nuts.

D. Brass split bolts.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 96 00 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Section 09 96 00.

B. Install identifying devices after completion of coverings and painting.

C. All identification devices to be printed by mechanical process. Hand printing is not acceptable.

D. Install nameplates with adhesive where equipment has sufficient surface area and texture.
   1. Attach tags with 1/8 IN flat head screws where adhesive application is not suitable.
   2. Attach tabs with plastic strap where screws should not or cannot penetrate substrate.

E. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.

F. Install tags using corrosion resistant chain. Number tags consecutively by location.

G. Install underground plastic pipe markers 6 to 8 IN below finished grade, directly above buried pipe.

H. Identify air tanks, and water treatment devices with nameplates. Identify in-line pumps and other small devices with tags.

I. Tag single items of equipment enclosed in a housing or compartment on outside of housing.
   1. Tag multiple items mounted inside a housing or compartment individually inside the housing.

J. Identify control panels and major control components outside panels with plastic nameplates.

K. Identify valves in main and branch piping with tags.

L. Tag automatic controls, instruments, and relays. Key to control schematic.

M. Identify piping, concealed or exposed, with pipe markers. Use tags on piping 3/4 IN diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 FT on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

N. Tracer Wire:
   1. Attach to buried nonmetallic pipe at maximum of 10 FT intervals with tape or tie-wraps.
   2. Install continuously from structure to structure including valve boxes and buildings.
   3. Splice wire with split bolts or wire nuts only as needed; use continuous strands of no less than 100 FT length.

3.3 SCHEDULES

A. Above Grade Piping:
   1. Install labels on all piping in accordance with Article 3.2.
      a. Self-adhesive labels.
   2. Color Coding: Per ASME A13.1.
      a. Black lettering on yellow background:
         1) Hazardous, flammable or high temperature fluids:
            a) Domestic Hot Water
            b) Domestic Hot Water Return
      b. White lettering on green background:
         1) Low temperature water:
            a) Domestic Cold Water
            b) Tepid Water
            c) Nonpotable Water

B. Below Grade Piping
   1. Use underground warning tape in accordance with Article 3.2.
      a. Lettering: Minimum: 1-1/4 IN.
      b. Wording:
         1) First line: "CAUTION CAUTION CAUTION"
         2) Second line: "BURIED (Pipe Descriptor) LINE BELOW"
      c. Pipe Descriptors and color coding:
         1) Natural Gas or Propane: Black lettering on yellow background.
         2) Sewer or Waste: Black Lettering on Green Background.
         3) Water (potable): Black lettering on blue background.
         4) Water (nonpotable): Black lettering on Green background.

C. Equipment:
   1. Provide nameplate or stencil as warranted per Article 3.2.
   2. Label with equipment tag as shown on the Drawings.
      a. Black lettering on white background.
   3. Provide OSHA warning sign for equipment that starts automatically.
   4. Label all equipment control panels located remote from unit.
   5. Label all thermostats with self-adhesive markers with tag of equipment served.

END OF SECTION

SECTION 22 20 00
PLUMBING FIXTURES AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plumbing fixtures, trim, and equipment.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 61 03 - Equipment - Basic Requirements.
   4. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
      a. Accessibility Guidelines for Buildings and Facilities (ADAAG).
   2. American National Standards Institute (ANSI):
      a. Z358.1, Emergency Eyewash and Shower Equipment.
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. 90.1 [IP] [SI], Energy Standard for Buildings Except Low-Rise Residential Buildings.
   4. American Society of Mechanical Engineers (ASME):
      a. A112.19.3, Stainless Steel Plumbing Fixtures (Designed for Residential Use).
   5. American Society of Sanitation Engineers (ASSE):
      a. 1011, Performance Requirements for Hose Connection Vacuum Breaker.
   6. Canadian Standards Association (CSA).
   7. NSF International (NSF).
   8. Underwriters Laboratories, Inc. (UL).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 01 61 03 and Specification Section 40 05 00.
   3. Color selection charts for Owner color selection.
   4. Fabrication and/or layout drawings:
      a. Layout plan(s) showing dimensions, elevations, etc.
      b. Details showing connections, installation, rough-in locations, etc.
   5. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Chemical-resistance data.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Prefabricated trench drain system:

B.

2.2 MANUFACTURED UNITS

A. Sinks (S):
   1. Stainless steel sink:
      a. Type 304, 18-8 stainless steel.
      b. Self-rimming, drop-in mount.
      c. Fully coated underside.
      d. Drain punch centered in each bowl.
      e. Basket strainer and tailpiece.
      f. 3-faucet holes on 4 IN centers.
      g. ASME A112.19.3.
      h. Type: Single basin nominal 33 x 22 x 10 inch.
      i. Makers acceptable are Elkay, Just, Advance Tabco

B. Sink Fittings:
   1. Chicago Faucet 50-TABCP
   2. Chrome plated low lead solid brass mixing faucet.
   3. Single hole, double handle, quarter turn valves, ½" inlets
   4. Gooseneck swivel 5-1/4 inches.
   5. Aerator 2.2 gpm.
   6. Chrome plated brass strainer and 1-1/2 IN tail piece.
   7. Coupling nuts.

C. Reduced Pressure Backflow Preventer:
   1. Zurn Model 975XL2SE
   2. Lead free.
   3. Integral vertical 90 degree elbow inlet and vertical up 90 degree outlet all not more than 15" on center.
   4. Backflow preventers consist of two check valves, test cocks and relief valve, all assembled as an integral unit.
   5. Reduced pressure backflow preventers
   6. Backflow preventer to have threaded ends in sizes through 2 IN and pressure loss at that size at 70 gpm shall not exceed 13.5 psi
   7. Provide air gap funnel.

D. Prefabricated Trench Drain System:
   1. Acceptable makers include ACO Drain and Poly Drain
   2. Grating: Light duty fiberglass.
   3. Grating frames: Galvanized steel or frameless polymer concrete.

2.3 FABRICATION

A. Trench Sections:
   1. Pre-cast, pre-sloped, polymer concrete modular channel sections.
   2. Nominal Dimensions: 4 IN interior width, 1.0 PCT slope built into the bottom.
   3. Vertical side walls and a radiused bottom.
   4. 2 IN bolted lap joint.
   5. End caps: Same material as channel, design that allows the caps to interlock with channel sections and either close off the end of the channel or provide for drain pipe connection.
   6. Bottom outlet, oval to 6 IN round vertical:

a. Where shown on Drawings.
b. Same material as channel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cross Connection: Do not install any plumbing components that will provide a cross connection between potable and non-potable or drainage systems.

B. Fixtures:
1. Install fixtures at locations indicated on Drawings and in compliance with local Codes.
2. Connect plumbing supply, drain and vent line sizes as shown on Drawings.
3. Set proper grounds to form secure base for each fixture and rigid setting.
4. Install fixtures except water closets with water supply above rim and with Code approved backflow preventers.
5. Seal fixture joints abutting walls and floors with silicone sealant.
6. Connect exposed traps and supply pipes for fixtures and equipment to rough piping systems at wall, unless otherwise specified.

C. Drains:
1. Install drains at locations indicated on Drawings and in compliance with local Codes.
2. Trench drains:
a. Install in accordance with manufacturer's instructions and approved Shop Drawings.
b. Install trench sections with the top edges level and straight at elevations indicated.
1) Support channel sections in place while concrete is placed under and around sections as indicated.

D. Reduce Pressure Backflow Preventer: Install on water lines as required by Code.

3.2 FIELD QUALITY CONTROL

A. Test piping and fixtures for leaks per Specification Section 40 05 00.

END OF SECTION

SECTION 22 32 23
CARBON FILTER

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide carbon filters as shown in the Drawings.

B. Filters shall be capable of treating potable water from a municipal supply that contains residual chlorine used for disinfection and shall achieve the following treatment goals based on the influent loading:

Raw Water Design Data:

Chlorine	2.0	ppm max

Filter Effluent Design Quality:

Chlorine	less than	0.01	ppm

C. Package shall include pressure filtration system with granular activated carbon, Sch80 PVC piping, hoses, inlet distributor, underdrain system.

1.2 SUBMITTALS

A. Provide submittals in accordance with DIV 01.

B. Submittals shall be provided for items listed below:

1. 1. Manufacturers Product Data:
   a. Pressure Filters
   b. External piping to and including hoses.
   c. Internal piping.
   d. Filter media including material, gradation and depths.
2. 2. Shop Drawings:
   a. Each pressure filter assembly, materials, port sizes and locations, media, etc.
   b. Filter overall dimensions, filter arrangement, plan view elevation, side view.
   c. Equipment Layout.
3. 3. Operation and Maintenance Manuals shall be provided on:
   a. Each filter system.
   b. All mechanical equipment including valves, meters, pumps, etc. as supplied by filter manufacturer.

1.3 OPERATOR INSTRUCTIONS

A. Provide three copies of bound step-by-step operator start-up and operating instructions for the filter plant. Instructions for each of these units shall be typewritten on 8-1/2" x 11" paper.

1.4 PRODUCT DELIVERY AND STORAGE

A. Contractor shall not bring filtration equipment onto site until building is sufficiently complete to set the equipment in its designated space. Storage of un-protected equipment outdoors at the site for more than five (5) days will not be permitted. All equipment temporarily stored outside shall be protected with tarps tightly secured.

1.5 JOB CONDITIONS

A. Existing Conditions

1. If existing conditions prohibit proper installation or as shown on the Drawings or specifications herein, the Contractor shall notify the Engineer in writing requesting instruction.
2. The Contractor is responsible for the verification of new and existing dimensions, locations, elevations, and materials on site before that particular phase of installation begins.

1.6 REFERENCES

A. Industry standard references shall be noted, as applicable, in this specification and shall be considered a part of this specification.
   1. All Filter Media must be NSF approved and meet AWWA B100 standards

1.7 QUALITY ASSURANCE

A. A single supplier whose experience includes design, fabrication, and operation of water plants of a size and complexity similar to that specified herein shall furnish all major equipment and materials. Filter Supplier shall take complete responsibility for the operation of the new filtration equipment and the integration with the existing city water supply system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Filter Tech Systems, Inc. of Grand Junction, CO model AquaTech GAC24/3-3

B. Westech

2.2 GENERAL

A. The units shall be of the size and shape as shown in the plans and meeting the specified design criteria. The pressure filters shall be 24" diameter x 72" side shell. Filter media shall consist of 0.55 – 0.75 mm coal-based granular activated carbon (Calgon FiltraSorb 400 or equal) and support gravel.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

A.	Type of System	Granular Activated Carbon for Chlorine Removal	
B.	Design Flow	60 GPM	
C.	No. of Filters	Three	
D.	Type of Filter	Granular Activated Carbon	
E.	Surface Area	3.14	Square Feet per filter
F.	Filtration Rate	6.37	gpm/ft^2 per filter
G.	Backwash Rate	10	gpm/ft^2 per filter
H.	Backwash Flow	31.4	gpm maximum

2.4 FILTER TANKS

A. The filters shall be fiberglass/composite vessels with a diameter of 24" and an overall height (inclusive of stand) of 80.4" constructed of non-corrosive material according to the features and dimensions as shown on the drawings. The total vessel capacity shall be 119 gallons.

B. The pressure vessels shall have an operating pressure of 150 psi and designed with a 4:1 minimum for burst pressure.

C. The pressure vessel shall be designed to pass a 0 to rated operating pressure cycle test of 250,000 cycles without failure.

D. The pressure vessel shall be capable of withstanding negative pressure up to 5" Hg.

E. The pressure vessel inner shell shall be constructed of virgin PE material and shall be constructed in such a way as to isolate the fluid contents of the pressure vessel to eliminate corrosion, intrusion or reaction. The pressure vessel inner shell material will be the only material in contact with the contents.

F. The outer pressure vessel shall be constructed of continuous fiberglass roving.

G. Threaded pressure vessel openings shall be an UN thread specification with a positive O-ring seal.

H. The pressure vessel shall have a 4" opening in the center of the top dome and a 4" opening at the center of the bottom dome.

I. Connections to the pressure vessel and controller shall accommodate vertical expansion between top and bottom openings and between openings and hard piping.

J. The pressure vessel support base shall be a tripod design. Accessibility to the bottom of the pressure vessel is required for servicing and maintenance.

K. Clearance at the bottom of the pressure vessel shall be sufficient to service remove and replace the drain valve without moving the tank.

L. The pressure vessel shall be equipped with an adequate vacuum breaker installed between the pressure vessel inlet and any valve.

M. Tank bottom opening shall be fitted with an elbow and PVC True Union Ball Valve to be used as a filter drain and easily removed to be used for media removal

N. Tank top opening shall be used for filter influent and effluent piping.

O. Filtered water outlet shall be fitted with a bajonet-type high-flow underdrain.

P. The distributor tube to be held in place by an O-Ring seal.

Q. Filter influent and effluent piping shall be factory installed prior to shipping. Filter media will be installed in the field by the Contractor under direct supervision of the supplier's factory–direct field representative.

2.5 FILTER PIPING

A. All filter piping under pressure shall be solvent-welded Schedule 80 PVC. Flanges shall be provided at appropriate intervals to facilitate servicing.

B. All mounting hardware to be zinc-coated, stainless steel or aluminum.

C. All nuts, bolts, flat washers to be zinc-coated or stainless steel.

D. For the three filters, furnish one educator and hose as shown in the project Drawings for removal of media after multiple seasons of operation.

2.6 FILTER MEDIA

A. The filter manufacturer shall furnish dual media filter beds consisting of the following:

1. 36 inches of 0.55 – 0.75 mm Granular Activated Carbon.
   Uniformity coefficient shall not exceed 1.9
2. Bottom head to be filled with high-density support gravel in a sufficient amount to cover the upper-most portion of the underdrain with 3" of support gravel.

All Filter Media shall meet or exceed AWWA Standard B100 for filter Media.

The filter-plant manufacturer shall provide at least 5% additional media material, as compared to theoretical, to allow for unforeseen losses. The filter media shall be delivered to the jobsite in one cubic foot bags, palletized and stretch-wrapped with each individual bag tagged and marked with the size of its contents.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation, start-up and testing shall be conducted in accordance with DIVISION 01.

3.2 FILTER MEDIA INSTALLATION

A. The Installation Contractor shall install the media carefully, only under the technical direction of the factory-direct technical representative who shall be present during the installation and startup.

B. Starting with the support gravel, the contractor shall place the material in the filter to the depths indicated. The gravel shall be dumped from the top of the filter.

C. Contractor to install the underdrain in the lowest level of gravel taking care to pack the gravel under the header and laterals and to ensure that no gravel gets into the headers or laterals.

D. Following the above, the Contractor shall install the Granular Activated Carbon media per the manufacturer's specifications:

1. Fully submerge GAC bed in clean, contaminant free water for at least 16 hours (overnight)
2. Open backwash inlet and begin up-flow at 3 gpm/ft2 for 2 minutes
3. Increase flow to 5 gpm/ft2 and maintain for 2 minutes
4. Increase flow to 7 gpm/ft2 and maintain for 2 minutes
5. Increase flow to 8.5 gpm/ft2 and maintain for 30 minutes
6. Decrease flow to 7 gpm/ft2 and maintain for 2 minutes
7. Decrease flow to 5 gpm/ft2 and maintain for 2 minutes
8. Decrease flow to 3 gpm/ft2 and maintain for 2 minutes
9. Close backwash inlet and stop flow

3.3 TRAINING

A. Training shall be conducted in accordance with Division 01. The Contractor shall provide the factory-direct engineer from the treatment plant manufacturer for plant startup assistance and operator training to include placement directions of the filter media, plant equipment & control checkout, and operator instruction. The factory-direct engineer shall have had experience in training operators on at least five plants of the size and complexity similar to this project.

B. The factory-direct engineer shall include, as part of the operator training, discussions relating to chemical feed, filtration, effect of major variables on plant operation, use of various chemicals, factors influencing chlorine removal and filtration and the various components of system and their interrelationship.

C. Also to be presented during the training shall be the calculations relating to chemical feed, the use of constants to facilitate the calculations, and sample calculations to illustrate how the calculations are accomplished.

D. The operator training shall include discussions concerning the effect of pH on the process operation.

E. After going through the training sessions described above the plant operators will be expected to take over the new filter train operation with "over-the-shoulder" coaching from the factory direct engineer.

END OF SECTION

DIVISION 23

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 74 36
REFRIGERANT PIPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigeration piping system.
   2. Deductive Alternate No. 4 - Delete Chilled Water System and all work contained within this specification

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 23 00 – Alternates.
   4. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.
   5. Section 40 05 07 - Pipe Support Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. 15, Safety Code for Mechanical Refrigeration.
   2. ASTM International (ASTM):
      a. B280, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
   3. Federal Specification (FS):
      a. WW-T-799, Tube, Copper, Seamless, Water (For Use With Solder-Flared or Compression-Type Fittings).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Test reports:
      a. A dated declaration of the test of the refrigerant piping for each system shall be provided.
         1) The dated declaration shall include the information outlined in Article 12.3 of ASHRAE 15.
      b. Test reports of the refrigerant piping leak tests for all refrigerant piping systems installed.
      c. The test reports shall contain the following information:
         1) System refrigerant and high and low side pressure used.
         2) Listing of the necessary repairs made before the refrigerant piping system passed the leak test.
         3) Identification of specific system by referencing specific equipment identification numbers.
         4) Leak testing media used.
         5) Suction and discharge refrigerant gas pressures and temperatures taken after the refrigerant system has been charged.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.4 WARRANTY

A. The completed refrigerant piping system shall be guaranteed to be sufficiently free from leaks so that the loss of refrigerant for 18 months from the date of final payment shall not exceed 5 percent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Refrigerant piping specialties:
      a. Sporlan.
   2. Expansion valves:
      a. Sporlan.
      b. Alcoa.
   3. Silver solder - "Easy-Flow 45 IN:
      a. Harman.
   4. Moisture indicator - "SEE-ALL":
      a. Sporlan.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 REFRIGERANT PIPING AND FITTINGS

A. Refrigerant Piping:
   1. Copper tubing conforming to ASTM B280 and/or FS WW-T-799, dehydrated for refrigerant use, with high-temperature soldered joints and wrought copper (400 PSIG) fittings.
      a. For underground use: Type K.
      b. For aboveground use: Type L.

B. Piping Joints:
   1. Joints between copper tubing and fittings to be high temperature soldered (melting point not less than 1000 DEGF, but less than that of the metal being joined) with phos-copper alloys.
   2. Joints between copper and brass, steel, etc., shall be silver soldered only.
      a. Silver solder to be Handy Harmon "Easy-Flow 45."

C. Precharged Line Sets: Size per manufacturer's recommendations.

D. Field Assembled Units:
   1. Size refrigeration lines according to manufacturer's published tables using pressure or temperature drops as follows:
      a. Suction lines: 2 DEGF.
      b. Liquid lines: 1 DEGF or 2 PSI.
      c. Hot gas lines: 1 DEGF or 3.6 PSI.
      d. Size discharge and hot gas risers for positive oil return to compressors.

E. Hangers: As specified in Specification Section 40 05 07.

2.3 REFRIGERANT PIPING SPECIALTIES

A. Refrigerant Dryer:
   1. Sporlan material "CATCH-ALL" filter-drier with aluminum molded core:
   2. In each liquid line.
   3. A three-valve bypass around filter-drier.

4. Install so core can be removed without cutting or breaking any refrigerant line.

B. Moisture Indicator:
1. Show presence of moisture in system by change of color.
2. Install full size in the main liquid line adjacent to the filter-drier.
3. Use Sporlan "SEE-ALL."

C. Strainers:
1. Design to permit removing screen without removing strainer from piping system.
2. Screens not larger than 80 mesh.
3. Strainers on liquid line serving each thermostatic expansion valve and in suction line serving each refrigerant compressor not equipped with integral strainer.

D. Oil Traps: Provide in lines as indicated.

2.4 VALVES

A. All Valves:
1. All bronze.
2. 2 IN and less: Solder ends.
3. 3 IN and over: Four bolt union ends.

B. Shut-Off Valves:
1. Packed type with gas-tight cap seal and hard metal seats and shoulders which permit packing stuffing boxes wide open under pressure; or sealed diaphragm type.
2. Wheel, globe, angle or "T" handle.

C. Check Valves:
1. In liquid lines 5/8 IN and less: Lift check type.
2. In lines 3/4 to 2 IN: Swing check type.
3. In lines 3 IN and over: Wafer type swing check with bronze disc.

D. Expansion Valves:
1. Sized by manufacturer for refrigerant used.
2. Provide one in each circuit with liquid distributor connection immediately after.

E. Vent and Test Valves: Angle cap type with seal and outlet caps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Precharged Line Sets: Install per manufacturer's recommendations.

B. Field Assembled Lines:
1. Refrigerant piping:
a. In accordance with Specification Section 40 05 00.
b. Purge refrigerant piping of all air while connections of refrigerant piping are being made.
1) Shut-off valves.
2) Connect tank of dry nitrogen to line on back side of valve.
3) Introduce dry nitrogen into line as refrigerant piping joints are successively made up from valve to each condenser.
2. Testing:
a. Refrigerant piping systems: Follow general testing guidelines of ASHRAE 15, except as modified herein.
b. Pressurize the high and low pressure sides of the piping system after completion of the refrigerant piping.
1) Pressurize at the test pressures specified in ASHRAE 15 for the refrigerant type to be used in the system.

c. Repair any leaks and repeat tests until no further leaks are found and the system passes a static leak test at test pressure for a duration of 24 HRS.

3. Cleaning:
   a. Disconnect suction and discharge lines from compressor for clean up after complete system is tested.
   b. Valve or blank off system into three separate systems for purpose of cleanup.
      1) Suction side including cooling coils.
      2) Discharge side including air cooled condenser.
      3) Hot gas reheat side including heating DX coils.
   c. Thoroughly clean each system using pumped refrigerant until system is proven clean to satisfaction of refrigeration compressor serviceman.
   d. Notify Engineer for a visual inspection of both cleaning process and completely cleaned system.
4. Evacuation and Drying:
   a. After tests and cleaning have been completed and system proved tight, charge each circuit with dry clean refrigerant to gas pressure as recommended by the equipment manufacturer.
   b. Evacuate to 100 micron Hg and hold for 72 HRS.
      1) Use laboratory type vacuum pump capable of holding absolute pressure of 50 micron Hg.
      2) Check the vacuum with a suitable mercury column gage.
   c. Admit another drying charge of refrigerant and allow 4 to 6 HRS to absorb moisture and install dryer cores.
   d. Use second evacuation to remove all refrigerant and moisture.
   e. After second evacuation, charge system with refrigerant.
   f. Charge the system with refrigerant as required after final evacuation.

END OF SECTION

DIVISION 26

ELECTRICAL

SECTION 26 05 00
ELECTRICAL - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for electrical systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Division 03 - Concrete.
   4. Section 01 61 03 - Equipment - Basic Requirements.
   5. Section 03 15 19 - Anchorage to Concrete.
   6. Section 10 14 00 - Identification Devices.
   7. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
   8. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
      a. ADM, Aluminum Design Manual.
   2. American Institute of Steel Construction (AISC):
      a. Steel Construction Manual.
   3. American National Standards Institute (ANSI).
   4. ASTM International (ASTM):
      a. A36/A36M, Standard Specification for Carbon Structural Steel.
      b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C2, National Electrical Safety Code (NESC).
   6. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   7. National Electrical Manufacturers Association (NEMA):
   8. Underwriters Laboratories, Inc. (UL).

B. Products to be listed by a Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable product standards.
   1. Applicable product standards including, but not limited to, ANSI, FM, IEEE, NEMA and UL.
   2. NRTL includes, but is not limited to, CSA Group Testing and Certification (CS), FM Approvals LLC (FM), Intertek Testing Services NA, Inc. (ETL), and Underwriters Laboratories, Inc. (UL).

1.3 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
   1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
   2. Non-architecturally finished interior area: Hatchery room.

3. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of submittal process.
   2. See Specification Section 01 61 03 and individual specification sections for submittal requirements for products defined as equipment.
   3. General requirements:
      a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
      b. Include data sheets that include manufacturer's name and product model number.
         1) Clearly identify all optional accessories.
      c. Acknowledgement that products are NRTL listed or are constructed utilizing NRTL recognized components.
      d. Manufacturer's delivery, storage, handling and installation instructions.
      e. Product installation details.
      f. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.
      g. See individual specification sections for any additional requirements.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content process of Operation and Maintenance Manuals.

C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 01 65 50.

B. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
   1. Outdoor areas:
      a. Wet.
   2. Indoor areas:
      a. Dry.
      b. Also, wet near wells and water.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

C. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:

1. Manufacturers:
    a. Modular strut:
        1) Unistrut Building Systems.
        2) B-Line by Eaton.
        3) Globe Strut.
        4) Superstrut by Thomas & Betts.
2. Material requirements:
    a. Modular strut:
        1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.
        2) Stainless steel: AISI Type 316.
        3) PVC coated galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 MIL PVC coating.
        4) Aluminum: AA Type 6063-T6.
    b. Structural members (e.g., I beams, L and C channels):
        1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
        2) Aluminum: AA Type 6061-T6 or 6063-T6.
    c. Mounting plates:
        1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
        2) Aluminum: AA Type 6063-T6.
    d. Mounting hardware:
        1) Galvanized steel.
        2) Stainless steel.
    e. Anchorage per Specification Section 03 15 19.

B. Field touch-up of galvanized surfaces.
1. Zinc-rich primer.
    a. One coat, 3.0 MILS, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including pre-purchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

B. Install equipment in accordance with the requirements of:
1. NFPA 70.
2. IEEE C2.
3. The manufacturer's instructions.

C. In general, conduit routing is not shown on the Drawings.
1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.

D. When complete branch circuiting is not shown on the Drawings:
1. A homerun indicating panelboard name will be shown.
2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
4. See Specification Section 26 05 19 for combining multiple branch circuits in a common conduit.

E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.

F. Install equipment plumb, square and true with construction features and securely fastened.

G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.

H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.

I. Device Mounting Schedule:
   1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
      a. Receptacle on exterior wall of building (to center): 18 IN.
      b. Receptacle in non-architecturally finished areas (to center): 46 IN.
      c. Safety switch (to center of operating handle): 54 IN.
      d. Separately mounted motor starter (to center of operating handle): 54 IN.
      e. Pushbutton or selector switch control station (to center): 46 IN.
      f. Panelboard (to top): 72 IN.

J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
   1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 IN in equipment location with the Engineer's approval.

K. Provide electrical equipment support system per the following area designations:
   1. Dry areas:
      a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
   2. Wet areas:
      a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.

L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
   1. See Specification Section 03 15 19.
   2. Do not cut, or weld to, building structural members.
   3. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

M. Provide non-metallic corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.

N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.

O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.

P. Do not use materials that may cause the walls or roof of a building to discolor or rust.

Q. Identify electrical equipment and components in accordance with Specification Section 10 14 00.

R. Provide field markings and/or documentation of available short-circuit current (available fault current) and related information for equipment as required by the NFPA 70 and other applicable codes.

S. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
   1. Determine the SCCR rating by one of the following methods:
      a. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
      b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
      c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
   2. The source equipment is the panelboardwhere the equipment or control panel circuit originates.
   3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

3.2 FIELD QUALITY CONTROL

A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
   1. See Specification Section 01 73 20 for openings and penetrations in structures.

B. Replace equipment and systems found inoperative or defective and re-test.

C. Cleaning:
   1. See Specification Section 01 74 00.

D. The protective coating integrity of support structures and equipment enclosures shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
   4. Repair surfaces which will be inaccessible after installation prior to installation.
   5. See Specification Section 26 05 33 for requirements for conduits and associated accessories.

E. Replace nameplates damaged during installation.

3.3 DEMONSTRATION

A. Demonstrate equipment in accordance with Specification Section 01 75 00.

END OF SECTION

SECTION 26 05 19
WIRE AND CABLE - 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Building wire.
      b. Power cable.
      c. Control cable.
      d. Shielded VFD cable.
      e. Instrumentation cable.
      f. Wire connectors.
      g. Insulating tape.
      h. Pulling lubricant.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Insulated Cable Engineers Association (ICEA):
      a. S-58-679, Standard for Control Cable Conductor Identification.
   2. National Electrical Manufacturers Association (NEMA):
      a. ICS 4, Industrial Control and Systems: Terminal Blocks.
   3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
      a. WC 57/S-73-532, Standard for Control Cables.
      b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
      b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
   5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
      a. 568, Commercial Building Telecommunications Cabling Standard.
   6. Underwriters Laboratories, Inc. (UL):
      a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
      b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
      c. 467, Standard for Safety Grounding and Bonding Equipment.
      d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
      e. 486C, Standard for Safety Splicing Wire Connections.
      f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
      g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
      h. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
      i. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

B. Instrumentation Cable:
   1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
   2. The following are specific types of instrumentation cables:
      a. Analog signal cable:
         1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 VDC) signals, using No. 16 AWG and smaller conductors.
         2) Commonly used types are defined in the following:
            a) TSP: Twisted shielded pair.
            b) TST: Twisted shielded triad.
      b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.

C. Power Cable: Multi-conductor, insulated, with outer sheath containing building wire, No. 8 AWG and larger.

D. Shielded VFD Cable: Multi-conductor, insulated, with shield, drain wire and building wires, No. 12 and larger.

E. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.

F. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
         1) Wire connectors.
         2) Insulating tape.
         3) Cable lubricant.
      b. See Specification Section 26 05 00 for additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Building wire, power and control cable:
      a. Aetna Insulated Wire.
      b. Alphawire.
      c. Cerrowire.
      d. Encore Wire Corporation.
      e. General Cable.
      f. Okonite Company.
      g. Southwire Company.
   2. Shielded VFD cable:
      a. Belden Inc.

b. General Cable.
c. Okonite Company.
d. Olfex Wire and Cable, Inc.
e. Priority Wire and Cable (Prysmian).
f. Rockbestos-Surprenant Cable Corp.
g. Southwire Company.

3. Instrumentation cable:
   a. Analog cable:
      1) Alphawire.
      2) Belden Inc.
      3) General Cable.
4. Wire connectors:
   a. Burndy Corporation.
   b. Buchanan.
   c. Ideal.
   d. Ilsco.
   e. 3M Co.
   f. Teledyne Penn Union.
   g. Thomas and Betts.
   h. Phoenix Contact.
5. Insulating and color coding tape:
   a. 3M Co.
   b. Plymouth Bishop Tapes.
   c. Red Seal Electric Co.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MANUFACTURED UNITS

A. Building Wire:
1. Conductor shall be copper with 600 V rated insulation.
2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.
5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.

B. Control Cable:
1. Conductor shall be copper with 600 V rated insulation.
2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
4. Conform to NEMA/ICEA WC 57/S-73-532 and UL 44 and UL 1277 for type XHHW-2 insulation with an overall PVC jacket.
5. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
   a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
6. Individual conductor color coding:
   a. ICEA S-58-679, Method 1, Table E-2.
   b. See PART 3 of this Specification Section for additional requirements.
7. Conform to NFPA 70 Type TC [and IEEE 1202, CSA FT-4 or NFPA 262].

C. Electrical Equipment Control Wire:

1. Conductor shall be copper with 600 V rated insulation.
2. Conductors shall be stranded.
3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
4. Conform to UL 44 for Type SIS insulation.
5. Conform to UL 83 for Type MTW insulation.

D. Instrumentation Cable:
   1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   2. Analog cable:
      a. Tinned copper conductors.
      b. 300 V or 600 V PVC insulation with PVC jacket.
      c. Twisted with 100 PCT foil shield coverage with drain wire.
      d. Six (6) twists per foot minimum.
      e. Individual conductor color coding: ICEA S-58-679, Method 1, Table E-2.
      f. Conform to [IEEE 1202 or CSA FT-4 or NFPA 262,] UL 2250, UL 1581 and NFPA 70 Type ITC.
   3. Digital cable:
      a. As recommended by equipment (e.g., PLC, RTU) manufacturer.
      b. Horizontal voice and data cable:
         1) Category 6 per TIA/EIA/ANSI 568.
         2) Cable shall be label-verified.
         3) Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
         4) Conductors: No. 24 AWG solid untinned copper.
         5) Rated CMP per NFPA 70.
      c. Conform to NFPA 262 and NFPA 70 Type ITC.

E. Wire Connectors:
   1. Twist/screw on type:
      a. Insulated pressure or spring type solderless connector.
      b. 600 V rated.
      c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
      d. Phase and neutral conductors: Conform to UL 486C.
   2. Compression and mechanical screw type:
      a. 600 V rated.
      b. Ground conductors: Conform to UL 467.
      c. Phase and neutral conductors: Conform to UL 486A.
   3. Terminal block type:
      a. High density, screw-post barrier-type with white center marker strip.
      b. 600 V and ampere rating as required, for power circuits.
      c. 600 V, 20 ampere rated for control circuits.
      d. 300 V, 15 ampere rated for instrumentation circuits.
      e. Conform to NEMA ICS 4 and UL 486A.

F. Insulating and Color Coding Tape:
   1. Pressure sensitive vinyl.
   2. Premium grade.
   3. Heat, cold, moisture, and sunlight resistant.
   4. Thickness, depending on use conditions: 7, 8.5, or 10 MIL.
   5. For cold weather or outdoor location, tape must also be all-weather.
   6. Color:
      a. Insulating tape: Black.
      b. Color coding tape: Fade-resistant color as specified herein.
   7. Comply with UL 510.

G. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:
   1. Type XHHW-2:
      a. Building wire and power and control cable in architectural and non-architectural finished areas.
      b. Building wire and power and control cable in conduit in outdoor areas and below grade.
      c. Building wire and power and control cable in cable tray in outdoor areas.
   2. Type THHN/THWN and THHN/THWN-2:
      a. Building wire and power and control cable No. 8 AWG and smaller in architectural and non-architectural finished areas.
   3. Type SIS and MTW:
      a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.

B. Shielded VFD Cable:
   1. For wiring between a VFD and motor when routing in cable trays or conduit other than RGS or RAC.

C. Conductor Size Limitations:
   1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
   2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
   3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.

D. Color Code All Wiring as Follows:
   1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

* Orange when it is a high leg of a 120/240 V Delta system.

      a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
      b. Conductors larger than No. 6 AWG:
         1) Insulated phase and neutral conductors shall be identified by one of the following methods:
            a) Continuous colored outer finish along its entire length.
            b) 3 IN of colored tape applied at the termination.
         2) Insulated grounding conductor shall be identified by one of the following methods:
            a) Continuous green outer finish along its entire length.
            b) Stripping the insulation from the entire exposed length.
            c) Using green tape to cover the entire exposed length.

3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.

2. Power cables ICEA S-58-679, Method 4 with:
   a. Phase and neutral conductors identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
   b. Ground conductor: Bare.
3. Shielded VFD cable ICEA S-58-679, Method 4 with:
   a. Phase conductors identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
   b. Ground conductor: Green color insulation or bare.
4. Control cables ICEA S-58-679, Method 1, Table E-2:
   a. When a bare ground is not provided, one of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.
   b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.

E. Install all wiring in raceway unless otherwise indicated on the Drawings.

F. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
   1. Where specifically indicated on the Drawings.
   2. Where field conditions dictate and written permission is obtained from the Engineer.
   3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
      a. The combinations shall comply with the following:
         1) 12 VDC, 24 VDC and 48 VDC may be combined.
         2) 125 VDC shall be isolated from all other AC and DC circuits.
         3) AC control circuits shall be isolated from all DC circuits.
   4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
      a. The combinations shall comply with the following:
         1) Analog signal circuits may be combined.
         2) Digital signal circuits may be combined but isolated from analog signal circuits.
   5. Multiple branch circuits for similar loads may be combined in a common raceway, such as multiple lighting circuits or multiple receptacle circuits or other 120Vac circuits. Do not combine lighting and receptacle circuits.
      a. Do not combine control device circuits with lighting or receptacle circuits.
      b. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
         1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
         2) The neutral conductors may not be shared.
         3) Up sizing raceway size for the size and quantity of conductors.

G. Ground the drain wire of shielded instrumentation cables at one end only.
   1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).

H. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
   1. Feeder and branch power circuits:
      a. Device outlet boxes:
         1) Twist/screw on type connectors.
      b. Junction and pull boxes and wireways:

1) Twist/screw on type connectors for use on No. 8 and smaller wire.
2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.

c. Motor terminal boxes:
1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.

d. Manholes or handholes:
1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire.

2. Control circuits:
a. Junction and pull boxes: Terminal block type connector.
b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.
c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.

3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Engineer.
a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
b. Junction and pull boxes: Terminal block type connector.
c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.

4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

I. Insulating Tape Usage:
1. For insulating connections of No. 8 AWG wire and smaller: 7 MIL vinyl tape.
2. For insulating splices and taps of No. 6 AWG wire or larger: 10 MIL vinyl tape.
3. For insulating connections made in cold weather or in outdoor locations: 8.5 MIL, all weather vinyl tape.

J. Color Coding Tape Usage: For color coding of conductors.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for grounding and bonding system(s).

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 10 14 00 - Identification Devices.
   4. Section 26 05 00 - Electrical - Basic Requirements.
   5. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
   6. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   4. Underwriters Laboratories, Inc. (UL):
      a. 467, Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
         1) Grounding clamps, terminals and connectors.
         2) Exothermic welding system.
      b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Ground rods and bars and grounding clamps, connectors and terminals:
      a. ERICO by Pentair.
      b. Harger Lightning & Grounding.
      c. Heary Bros. Lightning Protection Co. Inc..
      d. Burndy by Hubbell.
      e. Robbins Lightning, Inc.

f. Blackburn by Thomas & Betts.
g. Thompson Lightning Protection, Inc.

2. Exothermic weld connections:
   a. ERICO by Pentair - Cadweld.
   b. Harger Lightning & Grounding - Ultraweld.
   c. Burndy by Hubbell - Thermoweld.
   d. FurseWELD by Thomas & Betts.

2.2 COMPONENTS

A. Wire and Cable:
   1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
   2. Insulated conductors: Color coded green, per Specification Section 26 05 19.

B. Conduit: As specified in Specification Section 26 05 33.

C. Grounding Clamps, Connectors and Terminals:
   1. Mechanical type:
      a. Standards: UL 467.
      b. High copper alloy content.
   2. Compression type for interior locations:
      a. Standards: UL 467.
      b. High copper alloy content.
      c. Non-reversible.
      d. Terminals for connection to bus bars shall have two bolt holes.
   3. Compression type suitable for direct burial in earth or concrete:
      a. Standards: UL 467, IEEE 837.
      b. High copper alloy content.
      c. Non-reversible.
      d. Factory filled with oxide inhibiting compound.

D. Exothermic Weld Connections:
   1. Copper oxide reduction by aluminum process.
   2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
   3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections. After connection, apply manufacturers approved touch-up paint to protect metallic surface from corrosion.
   4. Where ground conductors pass through floor slabs or building walls provide nonmetallic sleeves and install sleeve per Specification Section 01 73 20.
      a. Seal the sleeve interior to stop water penetration.
   5. Do not splice grounding electrode conductors except at ground rods.
   6. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Raceway Bonding/Grounding:
   1. Install all metallic raceway so that it is electrically continuous.
   2. Provide an equipment grounding conductor in all raceways with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
   3. NFPA 70 required grounding bushings shall be of the insulating type.
   4. Provide double locknuts at all panels.

5. Bond all conduits, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

C. Equipment Grounding:
   1. Ground all utilization equipment with an equipment grounding conductor.

3.2 FIELD QUALITY CONTROL

A. Leave grounding system uncovered until observed by Owner.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Conduits.
      b. Conduit fittings.
      c. Conduit supports.
      d. Wireways.
      e. Outlet boxes.
      f. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 26 05 00 - Electrical - Basic Requirements.
   4. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
   5. Section 26 27 26 - Wiring Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA).
   2. American Iron and Steel Institute (AISI).
   3. ASTM International (ASTM):
      a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      c. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
   4. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
      c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
      d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
      e. TC 14.AG, Aboveground Reinforced Thermosetting Resin Conduit and Fittings.
      f. TC 14.BG, Belowground Reinforced Thermosetting Resin Conduit and Fittings.
   5. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. C80.1, Electric Rigid Steel Conduit (ERSC).
      b. C80.3, Steel Electrical Metallic Tubing (EMT).
      c. C80.5, Electrical Aluminum Rigid Conduit (ERAC).
      d. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   6. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   7. Underwriters Laboratories, Inc. (UL):
      a. 1, Standard for Flexible Metal Conduit.
      b. 6, Electrical Rigid Metal Conduit - Steel.
      c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      d. 360, Standard for Liquid-Tight Flexible Metal Conduit.

e. 467, Grounding and Bonding Equipment.
f. 514A, Metallic Outlet Boxes.
g. 514B, Conduit, Tubing, and Cable Fittings.
h. 651, Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
i. 797, Electrical Metallic Tubing - Steel.
j. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
k.
l. 1203, Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.
m. 2420, Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
n. 2515, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data:
a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
1) Conduit fittings.
2) Support systems.
b. See Specification Section 26 05 00 for additional requirements.
3. Fabrication and/or layout drawings:
a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Rigid metal conduits and electrical metallic tubing:
a. Allied Tube and Conduit.
b. Western Tube and Conduit Corporation.
c. Wheatland Tube.
d. Patriot Aluminum Products, LLC.
2. Flexible conduit:
a. AFC Cable Systems.
b. Anamet, Inc.
c. Electri-Flex Company.
d. International Metal Hose Company.
e. Southwire Company, LLC.
3. Wireway:
a. Hoffman Engineering.
b. Wiegmann by Hubbell.
c. Square D by Schneider Electric.
4. Conduit fittings and accessories:
a. Appleton by Emerson Electric Co.
b. Carlon by Thomas & Betts.
c. Cantex, Inc.
d. Crouse-Hinds by Eaton.
e. Killark by Hubbell.
f. Osburn Associates, Inc.

g. O-Z/Gedney by Emerson Electric Co.
h. Raco by Hubbell.
i. Steel City by Thomas & Betts.
j. Thomas & Betts.

5. Support systems:
   a. Unistrut by Atkore International, Inc.
   b. B-Line by Eaton.
   c. Kindorf by Thomas & Betts.
   d. Minerallac Company.
   e. CADDY by Pentair.
   f. Superstrut by Thomas & Betts.
6. Outlet, pull and junction boxes:
   a. Appleton by Emerson Electric Co.
   b. Crouse-Hinds by Eaton
   c. Killark by Hubbell.
   d. O-Z/Gedney by Emerson Electric Co.
   e. Steel City by Thomas & Betts.
   f. Raco by Hubbell
   g. Bell by Hubbell.
   h. Hoffman Engineering.
   i. Wiegmann by Hubbell.
   j. B-Line by Eaton.
   k. Adalet.
   l. RITTAL North America LLC.
   m. Stahlin by Robroy Enclosures.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 RIGID METAL CONDUITS

A. Rigid Galvanized Steel Conduit (RGS):
   1. Mild steel with continuous welded seam.
   2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
   3. Threads galvanized after cutting.
   4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
   5. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6.

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Mild steel with continuous welded seam.

B. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.

C. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.

D. Standards: NFPA 70 Type EMT, NEMA/ANSI C80.3, UL 797.

2.4 RIGID NONMETALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):
   1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
   2. Rated for direct sunlight exposure.
   3. Fire retardant and low smoke emission.
   4. Shall be suitable for use with 90 DEGC wire and shall be marked "maximum 90 DEGC".
   5. Standards: NFPA 70 Type PVC, NEMA TC 2, UL 651.

2.5 FLEXIBLE CONDUIT

A. Flexible Galvanized Steel Conduit (FLEX):

1. Formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Standard: NFPA 70 Type FMC, UL 1.

2.6 WIREWAY

A. General:
   1. Suitable for lay-in conductors.
   2. Designed for continuous grounding.
   3. Covers:
      a. Hinged or removable in accessible areas.
      b. Non-removable when passing through partitions.
   4. Finish: Rust inhibiting primer and manufacturer's standard paint inside and out except for stainless steel type.
   5. Standards: UL 870, NEMA 250.

B. General Purpose (NEMA 1 rated) Wireway:
   1. 14 or 16 gage steel without knockouts.
   2. Cover: Solid, non-gasketed and held in place by captive screws.

C. Raintight (NEMA 3R) Wiring Trough:
   1. 14 or 16 GA galvanized steel without knockouts.
   2. Cover: Non-gasketed and held in place by captive screws.

D. Watertight (NEMA 4X rated) Wireway:
   1. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA stainless steel flanges.
   2. Cover: Fully gasketed and held in place with captive clamp type latches.
   3. Flanges: Fully gasketed and bolted.

2.7 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RGS:
   1. Locknuts:
      a. Threaded steel or malleable iron.
      b. Gasketed or non-gasketed.
      c. Grounding or non-grounding type.
   2. Bushings:
      a. Threaded, insulated metallic.
      b. Grounding or non-grounding type.
   3. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
   4. Couplings:
      a. Threaded straight type: Same material and finish as the conduit with which they are used on.
      b. Threadless type: Gland compression or self-threading type, concrete tight.
   5. Unions: Threaded galvanized steel or zinc plated malleable iron.
   6. Conduit bodies (ells and tees):
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
      b. Standard and mogul size.
      c. Cover:
         1) Clip-on type with stainless steel screws.
         2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
   7. Conduit bodies (round):
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
      b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
   8. Sealing fittings:
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.

b. Standard and mogul size.
c. With or without drain and breather.
d. Fiber and sealing compound: UL listed for use with the sealing fitting.

9. Expansion couplings:
   a. 2 IN nominal straight-line conduit movement in either direction.
   b. Galvanized steel with insulated bushing.
   c. Gasketed for wet locations.
   d. Internally or externally grounded.
10. Expansion/deflection couplings:
   a. 3/4 IN nominal straight-line conduit movement in either direction.
   b. 30 DEG nominal deflection from the normal in all directions.
   c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
   d. Internally or externally grounded.
   e. Watertight, raintight and concrete tight.
11. Standards: UL 467, UL 514B, UL 1203.

B. Fittings for Use with EMT:
1. Connectors:
   a. Straight, angle and offset types furnished with locknuts.
   b. Zinc plated steel.
   c. Insulated gland compression type.
   d. Concrete and raintight.
2. Couplings:
   a. Zinc plated steel.
   b. Gland compression type.
   c. Concrete and raintight.
3. Conduit bodies (ells and tees):
   a. Body: Copper free aluminum with threaded hubs.
   b. Standard and mogul size.
   c. Cover:
      1) Screw down type with steel screws.
      2) Gasketed or non-gasketed galvanized steel or copper free aluminum.
4. Standard: UL 514B.

C. Fittings for Use with FLEX:
1. Connector:
   a. Zinc plated malleable iron.
   b. Squeeze or clamp-type.
2. Standard: UL 514B.

D. Fittings for Use with FLEX-LT:
1. Connector:
   a. Straight or angle type.
   b. Metal construction, insulated and gasketed.
   c. Composed of locknut, grounding ferrule and gland compression nut.
   d. Liquid tight.
2. Standards: UL 467, UL 514B.

E. Fittings for Use with Rigid Nonmetallic PVC Conduit:
1. Coupling, adapters and conduit bodies:
   a. Same material, thickness, and construction as the conduits with which they are used.
   b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
   c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

F. Weather and Corrosion Protection Tape:
   1. PVC based tape, 10 mils thick.
   2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
   3. Used with appropriate pipe primer.

2.8 ALL RACEWAY AND FITTINGS

A. Mark Products:
   1. Identify the nominal trade size on the product.
   2. Stamp with the name or trademark of the manufacturer.

2.9 OUTLET BOXES

A. Metallic Outlet Boxes:
   1. Hot-dip galvanized steel.
   2. Conduit knockouts and grounding pigtail.
   3. Styles:
      a. 2 IN x 3 IN rectangle.
      b. 4 IN square.
      c. 4 IN octagon.
      d. Masonry/tile.
   4. Accessories:
      a. Flat blank cover plates.
      b. Barriers.
      c. Extension, plaster or tile rings.
      d. Box supporting brackets in stud walls.
      e. Adjustable bar hangers.
   5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:
   1. Zinc plated cast iron or die-cast copper free aluminum with manufacturer's standard finish.
   2. Threaded hubs and grounding screw.
   3. Styles:
      a. "FS" or "FD".
      b. "Bell".
      c. Single or multiple gang and tandem.
      d. "EDS" or "EFS" for hazardous locations.
   4. Accessories: 40 MIL PVC exterior coating and 2 MIL urethane interior coating.
   5. Standards: UL 514A, UL 1203.

C. See Specification Section 26 27 26 for wiring devices, wallplates and coverplates.

2.10 PULL AND JUNCTION BOXES

A. NEMA 1 Rated:
   1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   2. With or without concentric knockouts on four sides.
   3. Flat cover fastened with screws.

B. NEMA 3R Rated:
   1. Body and cover: 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   2. Drip shield top and seam-free sides, front and back.
   3. With or without concentric knockouts on bottom.
   4. Slip-on removable cover fastened on bottom edge with screws or continuous hinged cover fastened with screws.

C. NEMA 4 Rated:

1. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
6. Cover with oil resistant gasket.

D. NEMA 4X Rated (metallic):
1. Body and cover: 14 GA Type 304 or 316 stainless steel.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged door and stainless steel screws and clamps.
6. Door with oil-resistant gasket.

E. NEMA 4X Rated (Nonmetallic):
1. Body and cover: Ultraviolet light protected fiberglass-reinforced polyester boxes.
2. No knockouts.
3. External mounting flanges.
4. Hinged door with quick release latches and padlocking hasp.
5. Door with oil resistant gasket.

F. Miscellaneous Accessories:
1. Rigid handles for covers larger than 9 SQFT or heavier than 25 LBS.
2. Split covers when heavier than 25 LBS.
3. Weldnuts for mounting optional panels and terminal kits.
4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

G. Standards: NEMA 250, UL 50.

2.11 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
1. Material requirements.
a. Galvanized steel: ASTM A123/A123M or ASTM A153/A153M.
b. Stainless steel: AISI Type 316.
c. PVC coat galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 MIL PVC coating.

B. Single Conduit and Outlet Box Support Fasteners:
1. Material requirements:
a. Zinc plated steel.
b. Stainless steel.
c. Malleable iron.
d. PVC coat malleable iron or steel: 20 MIL PVC coating.
e. Steel protected with zinc phosphate and oil finish.

2.12 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

A. Sleeves, smoke and fire stop fitting through walls and floors:
1. See Specification Section 01 73 20.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:
1. NFPA 70.
2. Manufacturer instructions.

B. Size of Raceways:
   1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
   2. Unless specifically indicated otherwise, the minimum raceway size shall be:
      a. Conduit: 3/4 IN.
      b. Wireway: 2-1/2 IN x 2-1/2 IN.

C. Field Bending and Cutting of Conduits:
   1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
   2. Do not reduce the internal diameter of the conduit when making conduit bends.
   3. Prepare tools and equipment to prevent damage to the PVC coating.
   4. Degrease threads after threading and apply a zinc rich paint.
   5. Debur interior and exterior after cutting.

D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
      a. Total nominal thickness: 40 MIL.
   4. Repair surfaces which will be inaccessible after installation prior to installation.

F. Remove moisture and debris from conduit before wire is pulled into place.
   1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
   2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
   3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

I. Fill openings in walls, floors, and ceilings and finish flush with surface.
   1. See Specification Section 01 73 20.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.
   1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
   2. Run in straight lines parallel to or at right angles to building lines.
   3. Do not route conduits:
      a. Through areas of high ambient temperature or radiant heat.
      b. In suspended concrete slabs.
      c. In concrete members including slabs, slabs on grade, beams, walls, and columns unless specifically located and detailed on structural Drawings..
   4. Locate sleeves or conduits penetrating floors, walls, and beams so as not to significantly impair the strength of the construction. Do not place conduit penetrations in columns.

5. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
6. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 DEG of bends in the conduit run or in long straight runs to limit pulling tensions.

B. All conduits within a structure shall be installed exposed except as follows:
1. As indicated on the Drawings.
2. Concealed above gypsum wall board or acoustical tile suspended ceilings.
3. Conduits in architecturally finished areas shall be concealed.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:
1. Between instrumentation and telecommunication: 1 IN.
2. Between instrumentation and 125 V, 48 V and 24 VDC, 2 IN.
3. Between instrumentation and 600 V and less AC power or control: 6 IN.
4. Between instrumentation and greater than 600 VAC power: 12 IN.
5. Between telecommunication and 125 V, 48 V and 24 VDC, 2 IN.
6. Between telecommunication and 600 V and less AC power or control: 6 IN.
7. Between telecommunication and greater than 600 VAC power: 12 IN.
8. Between 125 V, 48 V and 24 VDC and 600 V and less AC power or control: 2 IN.
9. Between 125 V, 48 V and 24 VDC and greater than 600 VAC power: 2 IN.
10. Between 600 V and less AC and greater than 600 VAC: 2 IN.
11. Between process, gas, air and water pipes: 6 IN.

D. Conduits shall be installed to eliminate moisture pockets.
1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.
1. See Specification Section 01 73 20.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:
1. Power wire or cables: All raceway types.
2. Control wire or cables: All raceway types.
3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
4. Motor leads from a VFD: RGS, RAC or shielded VFD cables in all other raceways.
5. Telecommunication cables: All raceway types.

B. Permitted Raceway Types Per Area Designations:
1. Dry areas:
   a. RGS.
   b. RAC.
   c. EMT above 10 FT.
2. Wet areas:
   a. RGS.
   b. RAC.

C. Permitted Raceway Types Per Routing Locations:
1. In stud framed walls:
   a. EMT.
2. In concrete block or brick walls:
   a. PVC-40.

3. Above acoustical tile ceilings:
    a. EMT.
    b. NEMA 1 rated wireway.
4. Embedded in poured concrete walls and floors:
    a. PVC-40.
5. Beneath floor slab-on-grade:
    a. PVC-40.
6. Direct buried conduits and ductbanks:
    a. PVC-80.
    b. 90 DEG elbows for transitions to above grade:
        1) PVC-80.
    c. Long sweeping bends greater than 15 DEG:
        1) PVC-80

D. FLEX conduits shall be installed for connections to light fixtures, HVAC equipment and other similar devices above the ceilings.
1. The maximum length shall not exceed:
    a. 6 FT to light fixtures.
    b. 3 FT to all other equipment.

E. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
1. The maximum length shall not exceed:
    a. 6 FT to light fixtures.
    b. 3 FT to motors.
    c. 2 FT to all other equipment.

F. NEMA 1 Rated Wireway:
1. Surface mounted in electrical rooms.
2. Surface mounted above removable ceilings tiles of an architecturally finished area.

G. NEMA 3R Wiring Trough:
1. Surface mounted in exterior locations.

H. NEMA 4X Rated Wireway:
1. Surface mounted in areas designated as wet and or corrosive.

I. Underground Conduit: See Specification Section 26 05 43.

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

B. Install Expansion Fittings:
1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
2. Elsewhere as identified on the Drawings.

C. Install Expansion/Deflection Fittings:
1. Where conduits enter a structure.
    a. Except electrical manholes and handholes.
    b. Except where the ductbank is tied to the structure with rebar.
2. Where conduits span structural expansions joints.
3. Elsewhere as identified on the Drawings.

D. Threaded connections shall be made wrench-tight.

E. Conduit joints shall be watertight:
1. Where subjected to possible submersion.

2. In areas classified as wet.
3. Underground.

F. Terminate Conduits:
1. In metallic outlet boxes:
a. RGS and RAC:
1) Conduit hub and locknut.
2) Insulated bushing and two locknuts.
3) Use grounding type locknut or bushing when required by NFPA 70.
b. EMT: Compression type connector and locknut.
2. In NEMA 1 rated enclosures:
a. RGS and RAC:
1) Conduit hub and locknut.
2) Insulated bushing and two locknuts.
3) Use grounding type locknut or bushing when required by NFPA 70.
b. EMT: Compression type connector and locknut.
3. In NEMA 4 and NEMA 4X rated enclosures:
a. Watertight, insulated and gasketed hub and locknut.
4. When stubbed up through the floor into floor mount equipment:
a. With an insulated grounding bushing on metallic conduits.
b. With end bells on nonmetallic conduits.

G. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
1. Dry or wet and/or hazardous areas:
a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
b. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with stainless steel nuts and hardware.
2. Conduit type shall be compatible with the support system material.
a. Galvanized steel system may be used with RGS and EMT.
b. Stainless steel system may be used with RGS and RAC.

B. Permitted single conduit support fasteners per area designations and conduit types:
1. Architecturally finished areas:
a. Material: Zinc plated steel, or steel protected with zinc phosphate and oil finish.
b. Types of fasteners: Spring type hangers and clips, straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
c. Provide anti-rattle conduit supports when conduits are routed through metal studs.
2. Dry or wet and/or hazardous areas:
a. Material: Zinc plated steel, stainless steel and malleable iron.
b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
3. Conduit type shall be compatible with the support fastener material.
a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron fasteners may be used with RGS and EMT.
b. Stainless steel system may be used with RGS.
c. Nonmetallic fasteners may be used with PVC-40, PVC-80 and fiberglass.

C. Conduit Support General Requirements:
1. Maximum spacing between conduit supports per NFPA 70.
2. Support conduit from the building structure.

3. Do not support conduit from process, gas, air or water piping; or from other conduits.
4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
    a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
    b. Conduit hangers:
        1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
    c. Do not use suspended ceiling support systems to support raceways.
    d. Hangers in metal roof decks:
        1) Utilize fender washers.
        2) Not extend above top of ribs.
        3) Not interfere with vapor barrier, insulation, or roofing.
5. Conduit support system fasteners:
    a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
    b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:
1. Install products in accordance with manufacturer's instructions.
2. See Specification Section 26 05 00 and the Drawings for area classifications.
3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:
1. Permitted uses of metallic outlet boxes:
    a. Housing of wiring devices:
        1) Recessed in all stud framed walls and ceilings.
        2) Recessed in poured concrete, concrete block and brick walls of architecturally finished areas and exterior building walls.
    b. Pull or junction box:
        1) Above gypsum wall board or acoustical tile ceilings.
        2) Above 10 FT in an architecturally finished area where there is no ceiling.
2. Permitted uses of cast outlet boxes:
    a. Housing of wiring devices surface mounted in non-architecturally finished dry, wet, corrosive, highly corrosive and hazardous areas.
    b. Pull and junction box surface mounted in non-architecturally finished dry, wet, corrosive and highly corrosive areas.
3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 26 05 00.
4. Set device outlet boxes plumb and vertical to the floor.
5. Outlet boxes recessed in walls:
    a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they are flush with the face of the wall.
    b. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.
6. Place barriers between switches in boxes with 277 V switches on opposite phases.
7. Back-to-back are not permitted.
8. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.

C. Pull and Junction Boxes:
1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
    a. Make covers of boxes accessible.

2. Permitted uses of NEMA 1 enclosure:
    a. Pull or junction box surface mounted above removable ceiling tiles of an architecturally finished area.
3. Permitted uses of NEMA 4 enclosure:
    a. Pull or junction box surface mounted in areas designated as wet.
4. Permitted uses of NEMA 4X metallic enclosure:
    a. Pull or junction box surface mounted in areas designated as wet and/or corrosive.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Branch circuit panelboards.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 10 14 00 – Identification Devices.
   4. Section 26 05 00 - Electrical - Basic Requirements.
   5. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. PB 1, Panelboards.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      b. 67, Standard for Panelboards.

1.3 DEFINITIONS

A. Branch Circuit Panelboard: Bus rating of 400A and less or where labeled as Branch Circuit Panelboard on the Drawings.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.
   3. Fabrication and/or layout drawings:
      a. Panelboard layout with alphanumeric designation, branch circuit breakers size and type, as indicated in the panelboard schedules.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
   2. Panelboard schedules with as-built conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Eaton.
   2. ABB/GE.
   3. Square D by Schneider Electric.
   4. Siemens Corporation.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MANUFACTURED UNITS

A. Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. Ratings:
   1. Current, voltage, number of phases, number of wires as indicated on the Drawings.
   2. Short Circuit Current Rating (SCCR) and/or Ampere Interrupting Current (AIC) ratings equal to or greater than the interrupting rating indicated on the Drawings or in the schedule.
      a. Series rating is not acceptable.
      b. When fault current or minimum interrupting rating is not indicated, use rating of upstream equipment or infinite bus calculation of transformer secondary.

C. Construction:
   1. Interiors factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
   2. Main lugs: Solderless type approved for copper and aluminum wire.

D. Bus Bars:
   1. Main bus bars:
      a. Tin plated aluminum or tin plated copper sized to limit temperature rise to a maximum of 65 DEGC above an ambient of 40 DEGC.
      b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.
   2. Ground bus and isolated ground bus, when indicated on the Drawings: Solderless mechanical type connectors.
   3. Neutral bus bars: Insulated 100 PCT rated or 200 PCT rated, when indicated on the Drawings and with solderless mechanical type connectors.

E. Overcurrent and Short Circuit Protective Devices:
   1. Main overcurrent protective device:
      a. Molded case circuit breaker.
   2. Branch overcurrent protective devices:
      a. Bolt-on molded case circuit breaker.
   3. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
   4. Factory installed.

F. Enclosure:
   1. Boxes: Code gage galvanized steel, furnish without knockouts.
   2. Trim assembly: Code gage steel finished with rust inhibited primer and manufacturers standard paint inside and out.
   3. Branch circuit panelboard:
      a. Trims for surface mounted panelboards, same size as box.
      b. Nominal 20 IN wide and 5-3/4 IN deep with gutter space in accordance with NFPA 70.
      c. Clear plastic cover for directory card mounted on the inside of each door.
   4. Distribution panelboard:
      a. Trims cover all live parts with switching device handles accessible.

b. Minimum 8 IN deep and less than or equal to 12 IN deep with gutter space in accordance with NFPA 70.
c. Clear plastic cover for directory card mounted front of enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings, in accordance with the NFPA 70, and in accordance with manufacturer's instructions.

B. Support panelboard enclosures from wall studs or modular channels support structure, per Specification Section 26 05 00.

C. Provide NEMA rated enclosure as indicated on the Drawings. Where enclosure type is not indicated, provide enclosure rating suitable for the atmosphere where equipment is installed.

D. Field identification:
1. Provide all required tagging and markings per the NFPA 70 and Specification Section 10 14 00.

E. Provide each panelboard with a typed directory:
1. Identify all circuit locations in each panelboard with the load type and location served.
2. Use Owner-furnished mechanical equipment designation if different than designation indicated on the Drawings.
3. Use final building room names and numbers as identified by the Owner if different than designation indicated on the Drawings.
4. Identify spare overcurrent devices.

END OF SECTION

SECTION 26 24 19
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Separately mounted motor starters (including those supplied with equipment).

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 26 05 00 - Electrical - Basic Requirements.
   4. Section 26 24 16 - Panelboards.
   5. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. International Electrotechnical Commission (IEC).
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volt Maximum).
      b. ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.
      c. ICS 18, Motor Control Centers.
   3. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.

B. Miscellaneous:
   1. Verify motor horsepower loads, other equipment loads, and controls from approved shop drawings and notify Engineer of any discrepancies.
   2. Verify the required instrumentation and control wiring for a complete system and notify Engineer of any discrepancies.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.
   3. Fabrication and/or layout drawings:
      a. Separately mounted combination starters:
         1) Unit ladder logic wiring for each unit depicting electrical wiring and identification of terminals where field devices or remote control signals are to be terminated including industry standard symbology of the field devices as indicated on the Drawings, specification and/or loop descriptions. Drawings indicate basic control functionality, provide diagrams for the manufacturer's product(s) meeting the required functionality.
         2) Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

b. Fabrication and/or layout drawings updated with as-built conditions.

C. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Service equipment marking and documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Allen-Bradley by Rockwell Automation, Inc.
2. c3controls.
3. Eaton.
4. General Electric.
5. Square D by Schneider Electric.
6. Siemens Corporation.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 SEPARATELY MOUNTED COMBINATION STARTERS

A. Standards:
1. NEMA 250, NEMA ICS 2.
2. UL 508.

B. Enclosure:
1. NEMA 1 rated

C. Operating Handle:
1. With the door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
2. Circuit breaker and MCP operators includes a separate TRIPPED position.
3. Mechanical interlock to prevent to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism for use by authorized personnel.
4. Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism for use by authorized personnel.
5. Padlockable in the OFF position.

D. Control Devices:
1. Provide control devices as indicated on the Drawings.
2. Devices will be accessible with the door closed.

E. Control Power Transformer:
1. 120V secondary.
2. Fused on primary and secondary side.
3. Sized for 140 PCT of required load.

F. Fault Current Withstand Rating: Equal to the rating of the electrical gear from which it is fed.

G. Motor Starters: See requirements within this Specification Section.

H. Disconnect Switch, Overcurrent and Short Circuit Protective Devices:
1. Class RK1 fuse.
2. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
3. Factory installed.

2.3 MOTOR STARTERS

A. Standards:
   1. NEMA ICS 2.
   2. UL 508.

B. Full Voltage Non-Reversing (FVNR) Magnetic Starters:
   1. NEMA full size rated contactor.
      a. NEMA half sizes and IEC contactors are not permitted.
   2. Double-break silver alloy contacts.
   3. Overload relays:
      a. Ambient insensitive, adjustable solid state type with phase loss protection, phase imbalance protection and manual reset.
   4. Interlock and auxiliary contacts, wired to terminal blocks:
      a. Holding circuit contact, normally open.
      b. Overload alarm contact, normally open.
      c. Normally open auxiliary contact, for remote run status.
      d. Additional field replaceable auxiliary contacts as required per the Sequence of Operation.
      e. Two additional normally open spare field replaceable auxiliary contacts.

C. Variable Frequency Drives: See Specification Section 26 29 23.

2.4 CONTROL PANELS

A. Where control panels are indicated in the project Drawings, they shall include:
   a. NEMA 1 enclosure.
   b. UL 508 listed industrial control panel.
   c. Thermal magnetic circuit breaker for each pump with cover mounted disconnect operator for each pump.
   d. IEC rated full voltage non-reversing motor starter with solid state ambient compensated thermal overload relay for each pump.
   e. Hand-off-auto selector switches for each pump.
   f. Green RUN indicator lights, push-to-test type.
   g. Red flashing HIGH LEVEL ALARM indicator light, push-to-test type.
   h. Fuse for protection of 120 VAC control circuit.
   i. 600 volt rated terminals for field wiring of panel.
   j. One non-resetable elapsed time meter for each pump.
   k. One through the inner door overload reset pushbutton per pump shall be provided. Pushbutton shall allow the operator to reset the overload relay without opening the inner deadfront door.
   l. Duplex alternator including selector switch to change alternation of pumps from AUTO to PUMP 1 LEADS or PUMP 2 LEADS.
   m. One set of unpowered “form c” contact for pumps shall be provided to indicate cumulative alarms.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings and in accordance with manufacturer's recommendations and instructions.

B. Mounting height for surface mounted equipment: See Specification Section 26 05 00.

C. Provide separately mounted combination starters with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
   1. Determine the SCCR rating by one of the following methods:

a. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.

2. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the equipment or control panel circuit originates.
3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

D. Overload Heaters:
1. Size for actual motor full load current of the connected motor.
2. For motors with power factor correction capacitors, size to compensate for the capacitors effect on load current.

E. Combination and Manual Starter Enclosures:
1. Permitted uses of NEMA 1 enclosure:
a. Surface or flush mounted in architecturally finished areas.
b. Surface mounted above 10 FT in areas designated as dry in architecturally and non-architecturally finished areas.
2. Permitted uses of NEMA 4X enclosure:
a. Surface mounted in areas designated as wet and/or corrosive.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: See Specification Section 26 08 13.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Receptacles.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 26 05 00 - Electrical - Basic Requirements.
   4. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. WD 1, General Color Requirements for Wiring Devices.
      c. WD 6, Wiring Devices - Dimensional Requirements.
   2. Underwriters Laboratories, Inc. (UL):
      a. 498, Standard for Attachment Plugs and Receptacles.
      b. 514A, Metallic Outlet Boxes.
      c. 943, Ground-Fault Circuit-Interrupters.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Wall switches and receptacles:
      a. Bryant Electric.
      b. Cooper Wiring Devices by Eaton.
      c. Hubbell Incorporated Wiring Device-Kellems.
      d. Leviton Manufacturing Company.
      e. Legrand/Pass & Seymour.
      f. Eaton Crouse-Hinds.
      g. Appleton Electric Co.
      h. Hubbell Killark.

2.2 RECEPTACLES

A. Basic requirements unless modified in specific requirements paragraph of receptacles and per designated areas:
   1. Industrial Specification Grade.
   2. Straight blade.
   3. Brass triple wipe line contacts.
   4. One-piece grounding system with double wipe brass grounding contacts and self-grounding strap with grounding terminal.
   5. Back and side wired.
   6. Rating: 20 A, 125 VAC.
   7. High impact nylon body.
   8. Receptacle body color:
      a. Normal power: Gray.
   9. Duplex or simplex as indicated on the Drawings.
   10. Configuration: NEMA 5-20R.
   11. Standards: UL 498, UL 514A, NEMA WD 1, NEMA WD 6.

B. Receptacle Type Specific Requirements:
   1. Basic receptacles:
      a. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
         1) Identification: Letters "WR" on face of receptacle.
   2. Ground Fault Circuit Interrupter (GFCI):
      a. Specification Grade.
      b. Class A protection.
      c. Feed through type.
      d. Test and reset buttons.
      e. Self-testing.
      f. Visual indicator light.
      g. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
         1) Identification: Letters "WR" on face of receptacle.
      h. Additional standards: UL 943.
   3. Plug load (PL) control receptacle.
      a. Commercial Specification Grade.
      b. Dual controlled (PLD) or half controlled (PLH) as indicated on the Drawings.
      c. Identification: NEMA approved controlled receptacle marking on face of receptacle.

C. Damp Non-Architecturally Finished Areas Specific Requirements:
   1. Coverplate:
      a. Cast iron alloy, gasketed, self-closing cover, stainless steel hardware, galvanized and factory painted finish.
      b. Cast aluminum, gasketed, self-closing cover, stainless steel hardware, natural, lacquer or factory painted finish.
      c. Weatherproof when receptacle is covered.
      d. Single or multiple gang as required.

D. Wet Non-architecturally Finished Areas Specific Requirements:
   1. Coverplate:
      a. Extra-duty rated, weatherproof (NEMA 3R) while in use, gasketed, stainless steel hardware, copper-free aluminum, 3.2 IN minimum cover depth for #12 AWG cords.

E. Exterior Locations Specific Requirements:
   1. Coverplate:
      a. Extra-duty rated, weatherproof (NEMA 3R) while in use, gasketed, stainless steel hardware, copper-free aluminum, 3.2 IN minimum cover depth for #12 AWG cord.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 26 05 00.

C. See Specification Section 26 05 33 for device outlet box requirements.

D. Where more than one receptacle is installed in a room, they shall be symmetrically arranged.

E. Provide blank plates for empty outlets.

END OF SECTION

SECTION 26 28 00
OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Low voltage circuit breakers.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C37.13, Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
      b. C37.16, Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations.
      c. C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      a. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
      b. 943, Standard for Safety for Ground-Fault Circuit-Interrupters.
      c. 1066, Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Reports:
      a. As-left condition of all circuit breakers that have adjustable settings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Circuit breakers:
      a. Eaton.
      b. General Electric Company.
      c. Square D Company.
      d. Siemens.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 CIRCUIT BREAKERS

A. Molded Case Type:
   1. General:
      a. Standards: UL 489.
      b. Unit construction.
      c. Over-center, toggle handle operated.
      d. Quick-make, quick-break, independent of toggle handle operation.
      e. Manual and automatic operation.
      f. All poles open and close simultaneously.
      g. Three position handle: On, off and tripped.
      h. Molded-in ON and OFF markings on breaker cover.
      i. One-, two- or three-pole as indicated on the Drawings.
      j. Current and interrupting ratings as indicated on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Current and interrupting ratings as indicated on the Drawings.

B. Series rated systems not acceptable.

C. Devices shall be ambient temperature compensated.

D. Circuit Breakers:
   1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:
      a. Frame sizes 400 amp and less with trip setting less than 400A shall be thermal magnetic type.

3.2 FIELD QUALITY CONTROL

END OF SECTION

SECTION 26 28 16
SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Safety switches.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 26 05 00 - Electrical - Basic Requirements.
   4. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. KS 1, Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
   2. Underwriters Laboratories, Inc. (UL):
      a. 98, Enclosed and Dead-Front Switches.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following safety switch manufacturers are acceptable:
   1. Eaton.
   2. General Electric.
   3. Square D by Schneider Electric.
   4. Siemens Corporation.
   5. Appleton by Emerson Electric Co.
   6. Crouse-Hinds by Eaton.
   7. Killark by Hubbell.

2.2 SAFETY SWITCHES

A. General:
   1. Non-fusible or fusible as indicated on the Drawings.
   2. Suitable for service entrance when required.
   3. NEMA Type HD heavy-duty construction.
   4. Switch blades will be fully visible in the OFF position with the enclosure door open.
   5. Quick-make/quick-break operating mechanism.
   6. Deionizating arc chutes.

7. Manufacture double-break rotary action shaft and switchblade as one common component.
8. Clear line shields to prevent accidental contact with line terminals.
9. Operating handle (except NEMA 7 and NEMA 9 rated enclosures):
    a. Red and easily recognizable.
    b. Padlockable in the OFF position.
    c. Interlocked to prevent door from opening when the switch is in the ON position with a defeater mechanism.

B. Ratings:
1. Horsepower rated of connected motor.
2. Voltage and amperage: As indicated on the Drawings.
3. Short circuit withstand:
    a. Non-fused: 10,000A.
    b. Fused: 200,000A.

C. Accessories, when indicated in PART 3 of this Specification Section or on the Drawings:
1. Neutral kits.
2. Ground lug kits.
3. Auxiliary contact kits:
    a. Opens before main switch.
    b. Rated 10A at 125/250 VAC.
    c. One N.O. and one N.C. contact.

D. Enclosures:
1. NEMA 1 rated:
    a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
    b. With or without knockouts, hinged and lockable door.
2. NEMA 3R rated:
    a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
    b. With or without knockouts, hinged and lockable door.
3. NEMA 4X rated (metallic):
    a. Body and cover: Type 304 or 316 stainless steel.
    b. No knockouts, external mounting flanges, hinged and gasketed door.

E. Overcurrent and short circuit protective devices:
1. Fuses.
2. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.

F. Standards: NEMA KS 1, UL 98.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's instructions and recommendations.

B. Install switches adjacent to the equipment they are intended to serve unless otherwise indicated on the Drawings.

C. Provide auxiliary contact kit on local safety switches for motors being controlled by a variable frequency drive.
1. The VFD is to be disabled when the switch is in the open position.

D. Permitted uses of NEMA 1 enclosure:
1. Surface or flush mounted in areas designated dry in architecturally finished areas.

E. Permitted uses of NEMA 3R enclosure:
   1. Surface mounted in exterior location for HVAC equipment only.

F. Permitted uses of NEMA 4X metallic enclosure:
   1. Surface mounted in areas designated as wet and/or corrosive.

END OF SECTION

SECTION 26 29 23
VARIABLE FREQUENCY DRIVES - LOW VOLTAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Variable frequency drives (VFDs) for operation of inverter duty motors.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 10 14 00 - Identification Devices.
   4. Section 26 05 00 - Electrical - Basic Requirements.
   5. Section 01 61 03 - Equipment - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI).
   2. ETL Testing Laboratories (ETL).
   3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
      b. 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
      c. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
   4. National Electrical Manufacturer's Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. MG 1, Motors and Generators.
   5. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 430, Motors Motor Circuits, and Controllers..
   6. Occupational Safety and Health Administration (OSHA).
   7. Underwriters Laboratory, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.
      b. 508A, Standard for Industrial Control Panels.

B. Qualifications:
   1. Provide drives that are listed and labeled by UL, ETL, or other Nationally Recognized Testing Laboratory (NRTL) as defined by OSHA regulations, or that have been inspected and subsequent field-labeled by such NRTL.
   2. Where listed drives and other components are installed in a common enclosure, the assembly shall be listed and labeled per UL 508 and UL 508A or equivalent NRTL standard.
      a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" or equivalent NRTL label prior to shipment to the jobsite.
   3. VFD Supplier shall maintain an authorized service organization within [100] [300] miles of the Project Site.

C. Coordination:
   1. The intent of this Specification Section is to allow the VFD manufacturer to provide the best solution for the harmonic and motor protection outlined herein.
      a. This solution shall include, but not be limited to, all aspects of the distribution system including standby generation, motor feeder cable type and available floor space.
   2. Motor and VFD coordination: See Specification Section 01 61 03.

3. VFD shall be supplied complete with all required control components.
    a. Provide control as indicated:
        1) On the electrical drawings.
        2) As specified in this Specification Section.
    b. VFD manufacturer shall review the application and provide, at no additional cost to the Owner, the hardware and software necessary to allow the VFD to control the driven equipment motor over its required operating range.
        1) These may include, but are not limited to, analog and digital interface modules, communication interface modules, switches, lights and other devices.
    c. Coordinate control devices with devices furnished with driven equipment such as vibration switches, thermal sensors, leak detectors, etc.
4. Verify plan dimensions with equipment space requirements as indicated on the Drawings.
    a. Equipment which exceeds the allotted maximum dimensions may not be acceptable.
    b. Equipment which reduces clear work space below the minimums established by the NFPA 70 will not be acceptable.

1.3 DEFINITIONS

A. Variable Torque (VT):
1. Defines a load characteristic in which the torque delivered from the motor to the load is reduced as speed is reduced below full rated.
2. This type of load permits the VFD and the motor to operate at reduced output current at reduced speed.

B. Constant Torque (CT):
1. Defines a load characteristic in which the torque delivered from the motor to the load remains constant as speed is varied.
2. This type of load requires the VFD to be able to continuously deliver rated output current over the entire speed range.

C. Constant Horsepower:
1. Defines a load characteristic in which the torque delivered from the motor to the load is reduced as the speed is increased.
2. This characteristic is required for operation of the VFD and motor above rated frequency to maintain output current within the rated value.

D. Inverter Duty Motor: An AC induction motor complying with all requirements of NEMA MG 1 Part 31 for definite-purpose inverter-fed motors.

E. Standard Motor: An AC induction motor that fails to comply with one or more requirements of NEMA MG 1 Part 31.

F. Low Voltage: 600 VAC or less.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Provide a schedule for each VFD including the following information:
    a. Equipment Tag Number.
    b. VFD Complete Catalog Number.
    c. VFD Amp Frame Size.
    d. Variable or Constant Torque Rating Basis.
    e. Rated Input Current.
    f. Rated Continuous Output Current.
    g. Rated Short Circuit Current.
    h. VFD cable type specified (shielded or non-shielded).
    i. VFD Maximum Motor Lead Length for the type of cable used.
    j. Motor Manufacturer.

k. Motor Frame Size.
l. Motor Full Load Amps.
m. Motor Service Factor.
n. As installed motor Lead Length.
o. VFD options provided to meet harmonic or motor protection specifications.

3. Submit VFD Shop Drawings concurrently with driven equipment and motor Shop Drawings.
4. Product technical data:
   a. Complete electrical ratings and performance specifications confirming compliance with specified ratings and performance.
   b. Maximum rate of heat rejection from VFD and all related components and associated cooling requirements.
   c. Manufacturer's installation instructions.
   d. Manufacturer's programming and operating instructions.
   e. See Specification Section 26 05 00 for additional requirements.
5. Fabrication and/or layout drawings:
   a. Top, front and side exterior views, with details showing maximum overall dimensions of enclosure, mounting provisions and conduit/cable entry provisions.
   b. Identify minimum clearances from other VFDs or electrical equipment required for proper cooling at top, bottom, side and back of enclosure.
   c. Three-line diagrams showing AC schematic of VFD, input, output and bypass devices including device ratings.
   d. Interior layout drawings showing location of all components within enclosure, field wiring terminal boards, and power and grounding connections.
   e. Field wiring diagrams showing locations and sizes of all electrical connections, ground terminations, and requirements for shielded wire usage or any other special installation considerations.
   f. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.
6. Certifications:
   a. Submit with Shop Drawings:
      1) Identification and location of closest authorized service organization.
      2) Harmonic analysis at each PCC per Harmonic Protection Requirements Article.
   b. Submit prior to shipment:
      1) Certified factory test reports confirming compliance with specified requirements.
   c. Submit after installation:
      1) Certified field service reports showing:
         a) Each VFD is operational.
         b) Each VFD and its driven equipment motor are compatible.
         c) Each VFD responds correctly to the input control signals.
         d) Critical frequencies of the drive system and that the VFD has been set to lockout these frequencies.
         e) Measured harmonic levels per Harmonic Protection Requirements Article.
         f) Measured motor terminal peak voltages per Motor Protection Requirements Article.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
   2. Approved copy of VFD schedule per Submittals Article.
   3. Manufacturer's instruction manuals.
   4. Troubleshooting procedures with a cross-reference between symptoms and corrective recommendations.
   5. Connection data to permit removal and installation of recommended smallest field-replaceable parts.

6. Recommended spare parts list.
7. Commissioning sheets showing “as-left” values of all user-programmable or adjustable drive parameters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Allen Bradley.
   2. ASEA Brown Bovari (ABB).
   3. Eaton.
   4. Danfoss.
   5. General Electric Company.
   6. Siemens/Robicon.
   7. Siemens.
   8. Square D Company.
   9. Toshiba.
   10. Yaskawa.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 GENERAL

A. VFDs shall consist of a rectifier-DC bus-inverter combination producing a sine-coded pulse-width-modulated (PWM) output voltage waveform.

B. VFDs, whether installed in motor control center (MCC) construction or separately-mounted, shall constitute a complete combination motor controller per NFPA 70, Article 430 and shall provide the following per the requirements of that article without the addition of any external components or devices.
   1. Motor control.
   2. Motor overload protection.
   3. Motor and motor branch circuit short circuit and ground fault protection.
   4. Motor and controller disconnecting means.

C. It is the intent of this Specification that VFDs shall be an “engineered” or “configured” drive package in which the VFD chassis, all input, output and bypass power devices, VFD accessories, ancillary switches, contactors, relays, and related control devices are selected, furnished, factory-assembled and -tested by the VFD manufacturer in a single enclosure requiring only connection of the power supply circuit, motor branch circuit, and external control wiring in the field.

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

A. Application:
   1. VFD(s) shall be of sufficient capacity and shall provide a quality of output waveform for stepless motor control from 10 to 100 PCT of base speed of the driven equipment.
   2. VFDs shall be compatible with:
      a. Inverter duty induction motors.
   3. VFDs shall be suitable for Constant Torque (CT) or Variable Torque (VT) applications.
      a. VFD manufacturer shall coordinate with the manufacturer of the driven equipment to identify CT and VT applications.
   4. VFDs shall be designed to operate successfully under the following site conditions:
      a. Ambient:
         1) Coordinate environmental requirements with the VFD installed location. Provide all necessary environmental controls to maintain VFD temperature.
         2) Temperature: 0-40 DEGC.
         3) 95 PCT non-condensing relative humidity.

b. Elevation: Less than 3,300 FT above MSL.
c. Power supply characteristics:
1) 208Vac, 3 PH, 60 Hz, 3 wire, (±10 PCT).
2) Effectively grounded.

B. Ratings and Performance Specifications:
1. Voltage rating:
a. Nominal: 208VAC, 3 PH, 60 Hz.
b. Range for continuous full load operation: ±10 PCT of nominal.
c. Voltage imbalance tolerance for full load operation: 3 PCT minimum.
2. Current ratings:
a. Continuous:
1) Equal to or greater than the motor nameplate full load.
b. Short-term overload:
1) VT: 110 PCT for 1 minute.
2) CT: 150 PCT for 1 minute.
3) Permissible for 1 minute every 10 minutes continuously.
c. Short circuit:
1) 10,000 A RMS SYM, minimum As indicated on the Drawings.
2) Where a short circuit rating is not indicated or specified for individual VFDs, each VFD shall have a rating not less than indicated on the Drawings for the MCC, switchboard or panelboard the VFD is supplied from.
3) Where specified short circuit rating indicates additional input impedance is required to protect semiconductors, provide input AC line reactors, whether required to meet harmonic performance specifications or not.
3. Efficiency:
a. 97 PCT, minimum, at full speed and full load.
b. 93 PCT, minimum at 1/2 speed and full load.
4. Displacement power factor:
a. 95 PCT, minimum from 50 PCT to 100 PCT speed and load.
5. Efficiency and power factor criteria apply from the input terminals to the output terminals of the VFD alone, excluding losses of input and output power circuit accessories.
6. Frequency drift:
a. +0.5 PCT of set frequency.
7. Speed regulation (motor dependent): 3 PCT.
8. Speed range: 10:1.
9. Control type:
a. Volts/Hertz ratio; constant over the entire operating range of the VFD except:
1) When operating under voltage boost.
2) At frequencies over 60 Hz.

C. Operational Features:
1. Insensitive to input phase sequence.
2. Continued operation with momentary voltage dips of 25 PCT of rated voltage, or single phase condition: 4 SEC, minimum.
3. Controls power loss ride-through: 500 MSEC, minimum.
4. Electronic reversing.
5. DC injection braking.
6. Anti-windmilling: Synchronization of VFD starting frequency with spinning or coasting load, forward or reverse.
7. Critical frequency band lockout:
a. Minimum of three settings.
b. Adjustable bandwidth, 1 - 5 Hz.
8. Capable of operating without the motor connected for start-up and troubleshooting.

D. The VFD shall be provided with the following minimum user-programmable parameters:
1. Carrier frequency.

2. Independent maximum and minimum speeds for forward and reverse operation.
3. Start frequency and hold time.
4. Independent linear acceleration and deceleration time.
5. Preset “jog” speed.
6. Three critical frequency bands.
7. One preset speed selectable by logic input.
8. Volts/Hertz ratio.
9. Voltage boost, magnitude and frequency range.
10. Process controller gain, offset and bias.
11. Current limit.
12. Overcurrent pickup.
13. Overcurrent delay.
14. Ground fault pickup.
15. DC injection level and time.

E. The VFD shall be designed such that the power circuit components are fully protected from line side disturbances and load side faults:
   1. General:
      a. Shutdown conditions associated with supply circuit conditions which can be corrected external to the VFD-motor system shall be provided with automatic reset, with shutdown cause logged in memory:
         1) Input under voltage.
         2) Input over voltage.
         3) Input under frequency.
         4) Input over frequency.
         5) Input Phase loss.
         6) DC Bus under voltage.
      b. Shutdown conditions which indicate overload or fault within the VFD, the output circuit, or the motor shall require local manual reset at the VFD, requiring operator intervention.
         1) Over temperature.
         2) Blown fuse.
         3) Component failure.
         4) Overload.
         5) Short circuit.
         6) Ground fault.
         7) DC Bus over voltage.
         8) External safety input (e.g., motor thermal protection).
         9) Logic fault.
      c. When automatic shutdown occurs, VFD shall restart immediately upon reset, whether automatic or manual.
      d. VFD shall hold cause of trip data for a minimum of four shutdowns in memory.
         1) Data to be accessible through the keypad, local communication link and remotely.
   2. Input protection:
      a. Input circuit breaker or current-limiting fuses with externally operable disconnect.
         1) Fault current interrupting rating equal to or greater than the specified withstand rating of the VFD.
         2) Handle padlockable in the OFF position.
      b. Provide full protection for semiconductors integral to the VFD; units requiring current-limiting fuses or circuit breakers in the supply circuit are not acceptable.
      c. Incoming line transient suppression.
         1) 6000V peak per IEEE C62.41.
         2) Phase-to-phase and phase-to-ground protection.
      d. Sustained over voltage trip.
   3. Internal protection:
      a. Surge suppression and power device snubbers.

b. Power devices rated at 2.5 times line voltage.
c. Instantaneous over current trip.
d. DC bus over voltage trip.
e. Power device over temperature trip.
f. Control logic circuit malfunction trip.

4. Output protection:
   a. Inverse-time overload trip:
      1) UL Class 10 characteristic.
   b. Over voltage trip.
   c. Over frequency trip.
   d. Short circuit trip.
      1) Line to line and line to ground.
   e. Ground fault trip.

2.4 OPERATOR AND REMOTE CONTROL INTERFACE

A. Drive controls shall be microprocessor-based with on-board human machine interface and both local communications capability.
   1. All monitoring and control functions, other than those shutdowns specified to be manual reset only, shall be available both locally and remotely.
   2. VFD speed control shall be available remotely from a wall-mounted potentiometer. Refer to Drawings.

B. Control circuits shall be 120 VAC.
   1. 120 VAC supplied by CPT in the VFD.
      a. CPT shall have minimum additional capacity of 60 VA greater than that required by control devices.
      b. CPT shall have two fuses on the primary side and one fuse on the secondary side.
      c. CPT shall have surge protection on the primary side independent of any other surge protection in the VFD.

C. Operator Interface:
   1. Door mounted sealed keypad, membrane type with LED or LCD display.
      a. Messages shall be in English and engineering units.
      b. Drive operating parameters shall be programmable.
      c. Menu driven.
      d. Password security.
      e. Display fault and diagnostic data.
      f. Operating parameters, fault and diagnostic data maintained in non-volatile memory with historic log of fault and diagnostic data.
      g. Gold plated plug-in contacts.
   2. Provide indication and control interface, integral in the keypad, as required in the sequence of operation and Drawings.
      a. Minimum indications:
         1) Run.
         2) Stop.
         3) Ready.
         4) Alarm.
         5) Fault.
         6) Local control.
         7) Remote control.
         8) Control source local.
         9) Control source remote.
         10) Speed indication.
      b. Minimum control functions:
         1) On/Off Selector switch.
         2) Reset button.

3) Speed control potentiometer.
4) Cover mounted run time meter (separate from HMI display)
5) Pilot lights as indicated on the drawings.

3. Diagnostic indicators located externally on the face of the drive shall show the type of fault responsible for drive warning, shutdown or failure.
   a. On occurrence of more than one condition, each shall be recorded or indicated by the diagnostics.

D. Remote Control Interface:
1. Local portable computer interface via RS232/RS242 serial communications port:
   a. Capability to:
      1) Start-Stop VFD.
      2) Control VFD Speed.
      3) Access fault and diagnostic data.
2. Analog and discrete inputs:
   a. Speed reference (setpoint) signal 4-20 mA DC.
   b. Isolated process PID controller with user-programmable setpoint, gain, rate, reset and span for accepting a remote 4-20 mA DC process variable signal.
3. Analog and discrete outputs:
   a. [4-20 mA] [0-10 V] DC output for remote speed indication, as a function of frequency, calibrated 0 to 100 PCT.
   b. Drive FAULT contacts.
   c. Drive RUNNING contacts.
4. Contacts:
   a. Contacts shall be rated 2 A inductive at 120 VAC.
   b. All contacts shall be wired to field wiring terminal boards.
5. Drive shutdown on external fault input:
   a. Provide isolated input for dry contact from external motor or system safety devices to cause immediate shutdown of VFD.
   b. Safety shutdown to be operable in all operating modes of drive, including local operation from keypad.
   c. Local safety switch, to driven equipment, auxiliary contact to lock-out VFD from running when safety switch is open.

2.5 MOTOR PROTECTION REQUIREMENTS

A. The VFD shall produce a quality of output waveform adequate to allow the motor to produce rated torque at rated RPM continuously without exceeding the temperature rise given in NEMA MG 1 Table 31-2.

B. Provide motor overload, short circuit and ground fault protection integral to drive electronics.

C. The VFD shall not produce voltage spikes in excess of the following values at the motor terminals when operated with the feeder types shown on the Drawings and the actual installed feeder lengths.
1. If unmitigated voltage peaks exceed the specified limits, provide output line reactors, filters, or other devices as required to meet the specified limits:
   a. Inverter duty motors: 1280 V.
   b. Rise time shall be greater than or equal to 0.1 microsecond.
   c. Motor lead length and data shall be determined by the Contractor based on the actual routing of the conductors.

D. Following start-up, provide measurement of peak voltage at the terminals of each motor, unless the lead lengths are 10 PCT shorter than the manufacturers published literature for maximum lead length for the type of cable installed.
1. Values in excess of specified limits require correction by contractor and re-measurement.
2. Provide certification of compliant measurements as part of Field Service Engineer's final report.

2.6 EQUIPMENT CONSTRUCTION

A. Fabrication and Assembly:
   1. Each VFD system shall be factory-assembled in an enclosure for remote mounting, and shall utilize interchangeable plug-in printed circuit boards and power conversion components wherever possible.
      a. Factory assembly shall be performed by the VFD manufacturer or authorized agent.
      b. Systems fabricated or assembled in whole or in part by parties other than the VFD manufacturer or authorized agent will not be acceptable.
   2. Reactors and/or filters, where required, shall be mounted within or in an ancillary enclosure adjacent to the drive enclosure, or with the Engineer's permission may be mounted in a separate enclosure.
   3. Cooling fans, as required, shall be provided to run when drive is running.
   4. Enclosures for separately mounted VFD's:
      a. NEMA Type 1 for installation in Electrical Rooms.
      b. NEMA Type 4X stainless steel for installations in wet, damp or outdoor areas.
         1) Provide enclosure cooling required to not exceed drive temperature ratings.

B. Wiring:
   1. The wiring in the VFD shall be neatly installed in wire ways or with wire ties where wire ways are not practical.
      a. Where wire ties are used, the wire bundles are to be held at the back panel with a screw-mounted wire tie mounting base.
      b. Bases with a self-sticking back will not be allowed.
   2. All plug-in contacts shall be gold-plated.
   3. Provide terminal boards for all field wiring and inter-unit connections, including analog signals.
      a. Provide terminals for shield continuity where required.
   4. Terminal blocks shall be complete with marking strip, covers and pressure connectors.
      a. Non-brittle, interlocking, track-mounted type.
      b. Screw terminals will not be allowed.
      c. A terminal for each conductor of external circuits plus one ground for each shielded cable.
      d. For free-standing panels, 8 IN of clearance shall be provided between terminals and the panel base for conduit and wiring space.
      e. Not less than 25 PCT spare terminals shall be provided.
      f. Terminals shall be labeled to agree with identification indicated on the suppliers submittal drawings.
      g. Individually fuse each control loop or system and all fuses or circuit breakers shall be clearly labeled and located for easy maintenance.
   5. All grounding wires shall be attached to the enclosure sheet metal with a ring tongue terminal.
      a. The surface of the sheet metal shall be prepared to assure good conductivity and corrosion protection.
   6. Wiring shall not be kinked or spliced and shall have markings on both ends or be color coded.
      a. Markings or color code shall match the manufacturer's drawings.
   7. With the exception of electronic circuits, all interconnecting wiring and wiring to terminals for external connection shall be stranded copper, type MTW or SIS, insulated for not less than 600 V, with a moisture-resistant and flame-retardant covering rated for not less than 90 DegC.

C. Nameplates:
   1. All devices mounted on the face of the drive shall be provided with a suitable nameplate as specified in Specification Section 10 14 00.
   2. Push buttons, selector switches, and pilot lights shall have the device manufacturer's standard legend plate.

3. Relays, terminals and special devices inside the control enclosure shall have permanent markings to match identification used on manufacturer's wiring diagrams.

D. Painting: Enclosure, after being phosphate washed, shall be thoroughly cleaned and given at least one (1) coat of rust-inhibiting primer on all inner surfaces prior to fabrication.

2.7 COMPONENTS AND ACCESSORIES

A. Reactors:
1. Impedance: 3 PCT.
2. Continuous current: Not less than drive rating.
3. Current overload: 150 PCT for 1 minute.
4. Insulation temperature rating: 180 DEGC.
5. Copper windings.
6. Saturation current rating: 3.5 to 5 times rated current.
7. Hi-potential rating: 2500 VAC line to ground and line to line, for 1 minute.
8. Noise reduction features:
   a. Epoxy over cast coil.
   b. Extra dips and bakes of varnish over continuous wound coil.

2.8 MAINTENANCE MATERIALS

A. Provide manufacturer's recommended renewable spare parts (e.g., power and control fuses).

B. Spare parts utilized during pre-start-up or start-up and demonstration testing shall be immediately restocked, at no cost to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and as indicated on the Drawings.

B. Verify the installed motor nameplate electrical requirements do not exceed the VFD capacity.

C. Provide services of manufacturer's representative to perform start-up services.

D. The selection of input and output harmonic and voltage spike protection shall also be made on the available physical space.
1. The space available on the Drawings shall not be exceeded.

3.2 START UP

A. Pre-start-up Services:
1. Manufacturer’s Field Services - After the Contractor confirms that equipment has been installed, the Contractor shall arrange to have a factory-authorized field technician to the project site for the purpose of confirming installation of the equipment and initial equipment start-up/calibration and troubleshooting. See also Section 01440.
   a. Confirm that all equipment connections are properly made.
   b. Check that equipment operates within manufacturer’s tolerances.
   c. Confirm that components are fully operational.
   d. Contractor to provide a written report outlining who was present and a brief summary of work completed.
2. The technician shall train the Contractor how to operate the equipment so that the Contractor can demonstrate operation to the A/E during the Component Verification visit. Training shall include proper operation and maintenance procedures and follow what is included in the O&M manual.
3. This trip shall be separate from the Owner Training that will occur in the future.
4. Shall be completed a minimum of 30 days prior to the Component Verification.
5. Shall consist of:
   a. Physical and electrical installation check.

b. Final adjustments and calibration of drive parameters.
c. VFD operation from simulated input signals.

6. Shall be complete when VFD(s) are fully operational.
7. VFDs shall be programmed to automatically restart after a power failure without operator intervention if the VFD was enabled to run and was running before the power outage.

B. Field Quality Control:
1. Perform field measurement of harmonics at each PCC per Harmonic Protection Requirements Article.
   a. For each individual VFD.
   b. For the maximum number of VFDs that will be operational at the same time.
   c. When all loads are at 75 PCT load minimum.
   d. Duration: 1 HR minimum.
2. Perform field measurement of the maximum voltage peak at the terminals of each motor fed from a VFD per Motor Protection Requirements Article.
   a. Use a high speed oscilloscope to produce a plot of Voltage (Y axis) versus Time (X axis).
      1) Time shall be measured in microseconds.
   b. Tests shall be performed at full:
      1) Full voltage and speed.
      2) Loaded to 75 PCT minimum.
      3) Duration: 1 HR minimum.
3. Record all data necessary for the preparation of required test reports.

C. Start-up and Demonstration Services:
1. Have factory trained technician available on site to make adjustments to drive setting and program features during the system component verification and the system verification.
2. Supervise start-up of all units including recheck of settings made during the pre-start-up tests.
   a. Perform all work in the presence of the Owner's designated representatives.
3. Setup all VFDs with carrier frequency at minimum value consistent with proper operation; inform Engineer of carrier frequencies set in excess of 5 kHz and reason for setting.
4. Simulate operation of the VFD and its associated control and instrumentation system in both the manual and automatic modes.
   a. Ensure compatibility of VFD with associated control and instrumentation signals.
5. Simulate power outage and drive restart feature.
6. Simulate VFD failures and demonstrate troubleshooting aids.

D. Instruct Owner's designated personnel:
1. Minimum of 8 HRS at the jobsite.
2. Include both field and classroom instruction.
3. Instructions shall include proper operation and maintenance procedures including, but not limited to:
   a. Lubrication.
   b. Troubleshooting.
   c. Repair and replacement.
   d. Parts inventory.
   e. Maintenance records.

E. This trip shall be separate from the trip related to Field Quality Control.

F. Owner Training will occur after the System Verification has been completed and prior to Final Inspection to ensure that all components and systems are fully functional.

END OF SECTION

SECTION 26 43 13
LOW VOLTAGE SURGE PROTECTION DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type 3 SPD - Medium exposure locations (switchboard, panelboard and motor control center), integrally mounted.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
      b. C62.41.1, Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits.
      c. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
      d. C62.45, Recommended Practice on Surge Testing For Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
   2. Military Standard:
      a. MIL-STD-220B, Method of Insertion Loss Measurement.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL):
      a. 1283, Standard for Electromagnetic Interference Filters.
      b. 1449, Standard for Surge Protective Devices.

B. Qualifications:
   1. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
      a. Upon request, suppliers or manufacturers shall provide a list of not less than three customer references showing satisfactory operation.

1.3 DEFINITIONS

A. Clamping Voltage:
   1. The applied surge shall be induced at the 90 DEG phase angle of the applied system frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge.

B. Let-Through Voltage:
   1. The applied surge shall be induced at the 90 DEG phase angle of the applied system frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge.

C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.

D. Maximum Surge Current:
   1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 PCT deviation of clamping voltage at a specified surge current.
   2. Listed by mode, since number and type of components in any SPD may very by mode.

E. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).

F. Surge Current per Phase:
   1. The per phase rating is the total surge current capacity connected to a given phase conductor.
      a. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
      b. The N-G mode is not included in the per phase calculation.

G. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 480/277 V system the L-L peak voltage is 679V and the L-N peak voltage is 392 V).

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Manufacturer's qualifications.
      b. Standard catalog cut sheet.
      c. Electrical and mechanical drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
      d. Testing procedures and testing equipment data.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of submittal process.
      b. The content of the Operation and Maintenance Manuals.
   2. Warranty.

1.5 WARRANTY

A. Minimum of a five year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Standards: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, MIL-STD 220B, UL 1283, UL 1449.

2.2 TYPE 3 SPD

A. Product:
   1. Integrally mounted in a panelboard.
   2. Hybrid solid state high performance suppression system.
      a. Do not use gas tubes, spark gaps or other components in suppression system which might short or crowbar the line resulting in interruption of normal power flow to connected loads.

3. Do not connect multiple SPD modules in series to achieve the specified performance.
4. Designed for parallel connection.
5. Field connection: Use mechanical or compression lugs for each phase, neutral and ground that will accept bus bar or #10 through #1/0 conductors.
6. Device monitor:
    a. Long-life, solid state, externally visible indicators and Form C contact(s) that monitor the on-line status of each mode of the units suppression filter system or power loss in any of the phases.
    b. A fuse status only monitor system is not acceptable.

B. Operating Voltage: The nominal unit operating voltage and configuration as indicated on the Drawings.

C. Modes of Protection: All modes.
1. Three phase (delta): L-L, L-G.
2. Three phase (wye): L-N, L-L, L-G and N-G.
3. Single phase (2 pole): L-L, L-N, L-G and N-G.
4. Single phase: L-N, L-G and N-G.

D. Maximum Continuous Operating Voltage: Less than 130 PCT of system peak voltage.

E. Operating Frequency: 45 to 65 Hz.

F. Short Circuit Rating: Equal to or greater than rating of equipment SPD is connected to.

G. Maximum Surge Current: 160,000 A per phase, 80,000 A per mode minimum.

H. Minimum Repetitive Surge Current Capacity: 4000 IEEE C High or B combination waveform impulses with no degradation of more than 10 PCT deviation of the clamping voltage.

I. SPD Protection:
1. Integral unit level and/or component level overcurrent fuses and sustained overvoltage thermal cutout device.
2. An IEEE B combination wave shall not cause the fuse to open and render the SPD inoperable.

J. Maximum Clamping Voltages: Dynamic test at the 90 DEG phase angle including 6 IN lead length and measured from the zero voltage reference:

System Voltage	Test Mode	IEEE C62.41		UL 1449
		B Comb. Wave	B3 Ring Wave	
L-L < 250 V **L-N < 150 V**	L-L	1000 V	700 V	800 V
	L-N	600 V	400 V	500 V
	L-G	800 V	550 V	600 V
	N-G	800 V	550 V	600 V
L-L > 250 V **L-N > 150 V**	L-L	2000 V	1400 V	1800 V
	L-N	1150 V	800 V	1000 V
	L-G	1550 V	1000 V	1200 V
	N-G	1550 V	1000 V	1200 V

K. EMI-RFI Noise Rejection: Attenuation greater than 30 dB for frequencies between 100 kHz and 100 MHz.

2.3 SOURCE QUALITY CONTROL

A. SPD approvals and ratings shall be obtained by manufacturers from nationally recognized testing laboratories.

B. The SPD are to be tested as a complete SPD system including:
   1. Integral unit level and/or component level fusing.
   2. Neutral and ground shall not be bonded during testing.
   3. 6 IN lead lengths.
   4. Integral disconnect switch when provided.

C. The “as installed” SPD system including the manufacturers recommended circuit breaker, the SPD is connected to, will not open when tested with a IEEE C3 combination waveform.

D. Tests to be performed in accordance with IEEE C62.45:
   1. Clamping voltage performance testing using IEEE C62.41 Category waveforms.
   2. Single pulse surge current capacity test.
   3. Repetitive surge current capacity testing.
   4. Spectrum analysis for EMI-RFI noise rejection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Type 1 and 3 SPD:
   1. Connected in parallel to the equipment.
   2. Install in dedicated electrical equipment compartment, bucket or panelboard box at the factory before shipment.
   3. Provide leads that are as short and straight as possible.
   4. Maximum lead length: 12 IN.
   5. Minimum lead size: #2 stranded AWG or bus bar.
   6. Connect leads to the equipment to be protected by one of the following means:
      a. Through a circuit breaker or molded case switch mounted in the equipment.
      b. Use manufacturer recommended circuit breaker size.
      c. Circuit breaker or switch to be operable from the equipment exterior or from behind a hinged door.

END OF SECTION

DIVISION 31

EARTHWORK

SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Dewatering system.
   2. Surface water control system.
   3. Monitoring wells.
   4. System operation and maintenance.
   5. Water disposal.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
   4. Section 31 25 00 - Soil Erosion and Sediment Control.

1.2 QUALITY ASSURANCE

A. Obtain permit from EPA under National Pollutant Discharge Elimination System (NPDES) for storm-water discharge from construction sites.

B. Permits:
   1. Obtain and pay respective fees for all local, state, and federal permits required for the withdrawal, treatment and disposal/discharge of water from the dewatering operation, prior to start of work.

1.3 DEFINITIONS

A. Dewatering:
   1. Lowering of groundwater table and intercepting horizontal water seepage to prevent groundwater from entering excavations, trenches and shafts.
   2. Disposing of removed water.

B. Surface Water Control:
   1. Removal of surface water within open excavations.

C. Foundations:
   1. Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.
   2. Geotechnical Engineer:
      a. Independent geotechnical specialist providing field quality control for the Project.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Dewatering plan design data and Drawings including the following:
      a. Proposed type of dewatering system with complete description of equipment and instrumentation to be used.
      b. Arrangement, locations, and depths of system components.
      c. Pipe sizes and capacities.
      d. Filter types and sizes.
      e. Water disposal method and location.
      f. Surface water control devices.

g. System operation, monitoring, and maintenance procedures.
h. Method of monitoring water quality.
i. Signed and sealed by professional engineer.

3. Product technical data including:
   a. Dewatering pump data including the following:
      1) Size, capacity, and means of operation of engine and motor.
   b. Pumping equipment for control of surface water within excavation.

1.5 PROJECT CONDITIONS

A. Site Information:
1. Data in subsurface investigation reports was used for the basis of the design.
   a. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings.
   b. The Owner or Engineer will not be responsible for interpretations or conclusions drawn from this data by Contractor.
2. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
3. Site data provided is not contractual and shall be considered "for information only".

PART 2 - PRODUCTS

2.1 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:
1. See Specification Section 31 25 00.
2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
   a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
2. Protect and maintain bench marks, monuments or other established reference points and property corners.
   a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
3. Verify location of utilities.
   a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
   b. Obtain and examine local utility records for location data.
   c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
      1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
      2) Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
      3) Obtain Owner's approval prior to disconnecting any utility service.

d. Repair damages to utility items at own expense.
e. In case of damage, notify Engineer at once so required protective measures may be taken.

4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
   a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
   b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
   c. All repairs to be made and paid for by Contractor.
5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

3.2 DEWATERING

A. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.

B. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
   1. Employ dewatering specialist for selecting and operating dewatering system.
   2. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.
   3. Install groundwater monitoring wells as necessary.
   4. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.

C. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
   1. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
   2. Discharge water into existing storm sewer system, drainage channels and settling basins.

3.3 SURFACE WATER CONTROL SYSTEMS

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Specification Section 31 25 00.

B. Divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels, storm drains and settling basins in accordance with requirements of the agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

END OF SECTION

SECTION 31 23 33
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation, trenching, backfilling and compacting for all underground utilities and all piping.
      a. Wastewater piping.
      b. Overflow piping.
      c. Storm piping
      d. Process Water piping.
      e. Sewers and drain piping.
      f. Water piping (potable, plant, process and nonpotable).
      g. Surface drainage conduits and piping.
      h. Electrical ductbanks, conduits, and direct burial cables.
      i. All related utility and process appurtenances.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Division 26 - Electrical.
   4. Section 31 23 00 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
      c. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
      d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
      e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

B. Pipe Embedment or Carefully Compacted Backfill or Pipe Embedment: soils required from 4” under pipes to 12” over pipes.

C. Final Backfill material: soils required from 12” over pipes to roadway surfaces, pavements or topsoil.

D. Cohesive soils - GC, SC, ML, CL, MH, CH per ASTM D2321

E. Cohesionless soils – GW, GP, SW, SP per ASTM D2321

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
   4. Submit sieve analysis reports on all granular materials.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Trench shield (trench box) certification if employed:
      a. Specific to Project conditions.
      b. Re-certified if members become distressed.
      c. Certification by registered professional structural engineer, registered in the state where the Project is located.
      d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
   1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.

D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Common Backfill (Final Backfill) Material:
   1. Where under structures or sidewalks provide per Section 31 23 00 Earthwork or provide Granular Borrow in lifts not exceeding 12” compacted to 90% standard Proctor.
   2. Where not under structures, sidewalks or roads provide Cohesive soils - GC, SC, ML, CL, MH, CH per ASTM D2321 or Cohesionless soils – GW, GP, SW, SP per ASTM D2321.
      a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
      b. Moisture content at time of placement: 3 percent plus/minus of optimum moisture content as specified in accordance with ASTM D698.
      c. See also Section 31 23 00.

B. Subgrade Stabilization Materials: Where subgrade is not stable provide Mirifi 600x or equal over the native material and then start the pipe embedment zone.

C. Carefully Compacted Backfill (Pipe Embedment):
   1. Provide Granular Borrow with NO rocks larger than 2” meeting Class II per ASTM D2321 compacted in lifts not exceeding 12” to 90% standard Proctor density. Flowable fill is also acceptable. ASTM D2321 Class IB (dense-graded, clean manufactured, processed aggregates) wrapped in geotextile is also acceptable.

2. Granular Borrow:
   a. Uniformly graded bank-run gravel which can be compacted to the required density, free of debris, roots, topsoil, vegetable matter, frozen material, and any other deleterious material. The portion that passes a 3" sieve shall meet the following gradation requirements:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3 inch	100
¼ inch	25 - 70
#40	0 - 30
#200	0 - 7

   b. Maximum size stone passes 6" sieve.
   c. If native material can be shown to be the same as described in a and b, then native material qualifies as Granular Borrow.

3. Flowable fill:
   a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
   b. Material characteristics:
      1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
         a) Cement (Type I or II): 50 LBS.
         b) Fly ash: 200 LBS.
         c) Fine sand: 2,700 LBS.
         d) Water: 420 LBS.
         e) Air content: 10 percent.
      2) Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
      3) Approximate compressive strength should be 85 to 175 psi.
      4) Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.
      5) Mixing and handling of the material shall be in accordance with Specification Division 03.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials off site unless DNR agrees to on site disposal.

3.2 EXCAVATION

A. Unclassified Excavation: Rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone are unsuitable materials unless they meet the specification of another material.

B. Excavation for Appurtenances:
   1. 12 IN (minimum) clear distance between outer surface and embankment.
   2. See Specification Section 31 23 00 for applicable requirements.
   3. See Specification Section 33 05 16 for applicable requirements.

C. Groundwater Dewatering:
   1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow subgrade stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
   2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.
   3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
      a. Employ dewatering specialist for selecting and operating dewatering system.
   4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
   5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
   6. Install groundwater monitoring wells as necessary.
   7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

D. Trench Excavation:
   1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
      a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
         1) Stabilize excavation to prevent undermining of existing utility and yard piping.
   2. Open trench outside buildings, units, and structures:
      a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
      b. Field adjust limitations as weather conditions dictate.
   3. Trenching within buildings, units, or structures:
      a. No more than 100 LF at any one time.
   4. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
      a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
   5. Observe following trenching criteria:
      a. Trench size:
         1) Excavate width to accommodate free working space.
         2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN
more than 33 IN	24 IN

         3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
         4) Keep trenches free of surface water runoff.
            a) Include cost in Bid.
            b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:

1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
2. Modify for electrical installations as follows:
    a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
    b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
    c. Do not over excavate trench.
    d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
    e. See Division 26 for additional requirements.

F. Flowable Fill:
1. Flowable fill shall be:
    a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
    b. Placed in 4 FT maximum lifts to the elevations indicated.
        1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
        2) Contractor shall place flowable fill lifts in such a manner as to prevent flotation of the pipe.
2. Flowable fill shall not be placed on frozen ground.
3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
4. Conform to appropriate requirements of Specification Section 31 23 00.
5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DegF and rising.
6. At the time of placement, flowable fill must have a temperature of at least 40 DegF.
7. Mixing and placing shall stop when the air temperature is 38 DegF or less and falling.
8. Each filling stage shall be as continuous an operation as is practicable.
9. Contractor shall prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
10. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of the preceding Groundwater Dewatering paragraph in PART 3 of this Specification Section.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:
1. Backfill and compact to 90 percent of maximum dry density per ASTM D698.
2. Backfill with granular bedding material as option.

B. Rock Excavation:
1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
2. Backfill to grade with suitable earth or granular material.
3. Form bell holes in trench bottom.

C. Subgrade Stabilization:
1. Stabilize the subgrade when directed by the Owner.
2. Observe the following requirements when unstable trench bottom materials are encountered.
    a. Notify Owner when unstable materials are encountered.
        1) Define by drawing station locations and limits.
    b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
        1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.

B. Carefully Compacted Backfill (Pipe Embedment):
   1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
   2. Comply with the following:
      a. Place backfill in lifts not exceeding 8 IN (loose thickness).
      b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
      c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
      d. Compact each lift to specified requirements.

C. Common Trench Backfill:
   1. Perform in accordance with the following:
      a. Place backfill in lift thicknesses capable of being compacted to densities specified.
      b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
      c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

D. Water flushing for consolidation is not permitted.

E. Backfilling for Electrical Installations:
   1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.
   2. Modify for electrical installation as follows:
      a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.5 COMPACTION

A. General:
   1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
   2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:
   1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.

      a. Carefully compacted backfill (Pipe Embedment): See Part 2.

      b. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	98 percent of maximum dry density by ASTM D698
	Cohesionless soils	98 percent of maximum dry density by ASTM D698
Under turfed, sodded, plant seeded, nontraffic areas	Cohesive soils	890 percent of maximum dry density by ASTM D698
	Cohesionless soils	90 percent of maximum dry density by ASTM D698

3.6 FIELD QUALITY CONTROL

A. Testing:
   1. Perform in-place moisture-density tests as directed by the Geotechnical Engineer.
   2. Perform tests through recognized testing laboratory approved by Owner.
   3. Costs of “Passing” and “Failing” tests paid by Contractor.
   4. Perform additional tests as directed until compaction meets or exceeds requirements.
   5. Reference to Engineer in this Specification Section will imply Geotechnical Engineer and directed by Engineer to undertake necessary inspections as approvals as necessary.
   6. Assure Testing Agency has immediate access for testing of all soils related work.
   7. Ensure excavations are safe for testing personnel.

END OF SECTION

SECTION 31 25 00
SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil erosion and sediment control.
   2. Deductive Alternates 1 & 2 – Delete all soil erosion and sediment control associated with the Storage Building and Deep Well.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 23 00 – Alternates.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Erosion control standards: 1994 PA 451, PART 91, AS AMENDED, MCL 324.9101 ET SEQ

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw bales, twine tied.

B. Silt Fence and 2 IN by 2 IN posts

C. Stone for Stone Filter: 2-4 IN graded gravel or crushed stone.

D. Grass Seed: Oats, Barley, Sudangrass, Rye, Wheat.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to General Stripping Topsoil and Excavating:
   1. Install perimeter dikes and swales.
   2. Excavate and shape sediment basins and traps.
   3. Construct pipe spillways and install stone filter where required.
   4. Machine compact all berms, dikes and embankments for basins and traps.
   5. Install straw bales where indicated.
      a. Provide two stakes per bale.
      b. First stake angled toward previously installed bale to keep ends tight against each other.

B. Construct sediment traps where indicated on Drawings during rough grading as grading progresses.

C. Temporarily seed basin slopes and topsoil stockpiles:
   1. Rate: 1/2 LB/1000 SQFT.
   2. Reseed as required until good stand of grass is achieved.

3.2 DURING CONSTRUCTION PERIOD

A. Maintain Basins, Dikes, Traps, Stone Filters, Straw Bales, etc.:
   1. Inspect regularly especially after rainstorms.
   2. Repair or replace damaged or missing items.

B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.

C. Construct inlets as soon as possible.
   1. Excavate and tightly secure straw bales completely around inlets as detailed on Drawings.

D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.

E. Do not disturb existing vegetation (grass and trees).

F. Excavate sediment out of basins and traps when capacity has been reduced by 50 PCT.
   1. Remove sediment from behind bales to prevent overtopping.

G. Topsoil and Fine Grade Slopes and Swales, etc.: Seed and mulch as soon as areas become ready.

3.3 NEAR COMPLETION OF CONSTRUCTION

A. Eliminate basins, dikes, traps, etc.

B. Grade to finished or existing grades.

C. Fine grade all remaining earth areas, then seed and mulch.

END OF SECTION

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 16 23
CONCRETE SIDEWALK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete sidewalk and steps.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 03 31 30 - Concrete, Materials and Proportioning.
   4. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
   5. Section 03 05 05 - Testing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M153, Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
      b. M171, Sheet Materials for Curing Concrete.
      c. M182, Burlap Cloth Made from Jute or Kenaf.
      d. M213, Preformed Expansion Joint Fillers for Concrete Paving and Structure Construction (Nonextruding and Resilient Bituminous Types).
      e. M224, Use of Protective Sealers for Portland Cement Concrete.
      f. M233, Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
   2. American Concrete Institute (ACI):
      a. 305R, Hot Weather Concreting.
      b. 306R, Cold Weather Concreting.
   3. ASTM International (ASTM):
      a. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
      b. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      c. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
      d. C33, Standard Specification for Concrete Aggregates.
      e. C150, Standard Specification for Portland Cement.
      f. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      g. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-lbf/ft^3).
      h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
      i. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   4. Federal Specification (FS):
      a. SS-S-1614, Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied for Portland Cement and Tar Concrete Pavements.
      b. TT-S 00227 E(3), Sealing Compound: Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
   3. Mix design(s) in accordance with Specification Section 03 31 30 and Specification Section 03 05 05.
   4. Qualifications of concrete installer.
   5. Drawings detailing all reinforcing.
   6. Concrete cylinder test results from field quality control.

B. Samples:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Samples of fabricated jointing materials and devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Chemical admixtures:
      a. Sika Chemical Corporation.
      b. BASF Admixtures, Inc.
      c. Protex Industries.
      d. W. R. Grace and Company.

B. Submit request for substitution in accordance with Specification Section 00700, Paragraph 5.2.

2.2 MATERIALS

A. Portland Cement:
   1. ASTM C150, Type I or II.

B. Aggregates:
   1. ASTM C33, gradation size #67, 3/4 IN to #4.

C. Water:
   1. Potable quality.

D. Admixtures:
   1. Comply with Specification Section 03 31 30.

E. Reinforcing Bars:
   1. ASTM A615, Grade 60.

F. Welded Wire Reinforcement:
   1. ASTM A185 or ASTM A1064.
   2. Flat.
   3. Clean, free from dirt, scale, rust.

G. Preformed Joint Filler:
   1. Nonextruding cork, self-expanding cork, sponge rubber or cork rubber.
   2. Meet AASHTO M153 or AASHTO M213.

H. Hot-Poured Joint Sealing Material:
   1. FS SS-S-1614.

I. Sidewalk Joint Sealant:
   1. Two compound, polyurethane sealant.
   2. Class A, Type 1.
   3. Self-leveling.
   4. Nontracking.
   5. FS TT-S 00227 E(3).

J. Membrane Curing Compound:
   1. ASTM C309.

K. Cover Materials for Curing:
   1. Burlap:
      a. AASHTO M182.
      b. Minimum Class 2, 8 OZ material (1 YD x 42 IN).
   2. Polyethylene film:
      a. AASHTO M171.

L. Paper Subgrade Cover:
   1. Polyethylene film, AASHTO M171.

M. Concrete Treatment:
   1. Boiled linseed oil mixture.
   2. Meets AASHTO M233.

N. Forms:
   1. Steel or wood.
   2. Size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment.
   3. Free of distortion and defects.
   4. Full depth.
   5. Metal Side Forms:
      a. Minimum 7/32 IN thick.
      b. Depth equal to edge thickness of concrete.
      c. Flat or rounded top minimum 1-3/4 IN wide.
      d. Base 8 IN wide or equal to height, whichever is less.
      e. Maximum deflection 1/8 IN under center load of 1700 LBS.
      f. Use flexible spring steel forms or laminated boards to form radius bends.

2.3 MIXES

A. Mix design to provide 4,000 PSI 28-day compressive strength, 1-1/2 IN +1 IN slump, 6 PCT air.

B. Comply with Specification Section 03 31 30 and Specification Section 03 31 31.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade Preparation:
   1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevation and section.
   2. Scarify and recompact top 6 IN of fills and embankments which will be sidewalk and step areas.
   3. Remove soft or spongy areas.
      a. Replace with aggregate material, or Class II material as directed by engineer.
   4. Compact to the following densities:
      a. Cohesive soils: 95 percent per ASTM D698.
      b. Noncohesive soils: 75 percent relative per ASTM D4253 and ASTM D4254.
   5. Assure moisture content is within limits prescribed to achieve required compaction density.
   6. Following compaction, trim and roll to exact cross section.

a. Check with approved grading template.
7. Perform density tests on subgrade to determine that subgrade complies with the specification.

B. Aggregate Course:
1. Place material in not more than 6 IN thick layers.
2. Spread, shape, and compact all material deposited on the subgrade during the same day.
3. Compact to 75 percent relative per ASTM D4253 and ASTM D4254.

C. Loose and Foreign Material:
1. Remove loose and foreign material immediately before application of paving.

D. Appurtenance Preparation:
1. Block out or box out curb inlets and curb returns.
2. Provide for joint construction as detailed and dimensioned on Drawings.
3. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade.
a. Secure to elevation with concrete.
b. Place concrete up to 5 IN below design grade.
4. Clean and oil forms.

3.2 ERECTION, INSTALLATION AND APPLICATION

A. Concrete Production:
1. Comply with Specification Section 03 31 31.

B. Forms:
1. Form support:
a. Compact soil foundation and cut to grade to support forms.
b. Use bearing stakes driven flush with bottom of form to supplement support as necessary.
c. Do not use earth pedestals.
2. Staking forms:
a. Joint forms neatly and tightly.
b. Stake and pin securely with at least three (3) pins for each 10 FT section.
3. Clean and oil forms prior to placement of concrete.
4. Set forms sufficiently in advance of work (minimum 2 HRS) to permit proper inspection.
5. Previously finished pavement or curb and gutter contiguous with new work may serve as side form when specifically approved.

C. Reinforcing:
1. Lap mats one (1) full space.
2. Tie end transverse member of upper mat securely to prevent curling.
3. Lap nonwelded bars 12 IN minimum.
4. Support:
a. Place bars securely on chairs at called-for height.
b. Place other fabric on the first of a two-course pour and cover promptly with final pour, or place fabric by a fabric-placer if procedure is reviewed and approved by Engineer.

D. Joints:
1. Hold locations and alignment to within + 1/4 IN.
2. Finish concrete surface adjacent to previous section to within + 1/8 IN, with tooled radius of 1/4 IN.
3. Metal keyway joints:
a. Form by installing metal joint strip, left in place.
b. Stake and support like side form.
c. Provide dowels or tie bars.

4. Weakened plane joints:
a. Locate at 6 FT intervals.

b. Tool groove in freshly placed concrete with tooling device.
c. Groove dimensions shall be 3/8 IN at surface and 1/4 IN at root.

5. Install construction joints at end of day's work or wherever concreting must be interrupted for 30 minutes or more.
6. Expansion joints:
   a. Locate at 48 FT intervals and at all intersection curb returns.
   b. Stake in place load transfer device consisting of dowels.
   c. Supporting and spacing means and premolded joint filler as per Drawing details.
   d. Provide preformed joint filler at all junctions with existing sidewalks, steps, or other structures.
7. Thoroughly clean and fill joints with joint sealing material as specified.
8. Upper surface of filled joint to be flush to 1/8 IN below finish surface.

E. Place Concrete:
1. Comply with Specification Section 03 31 31.
2. Construct driveway openings and other features as per Drawing details.

F. Cold and Hot Weather Concreting:
1. Cold weather:
   a. Cease concrete placing when descending air temperature in shade falls below 40 DEGF.
   b. Do not resume until ambient temperature has risen to 40 DEGF.
   c. If placing is authorized below 40 DEGF by Engineer, maintain temperature of mix between 60 and 80 DEGF.
   d. Heat aggregates or water or both.
   e. Water temperature may not exceed 175 DEGF.
   f. Aggregate temperature may not exceed 150 DEGF.
   g. Remove and replace frost damaged concrete.
   h. Salt or other antifreeze is not permitted.
   i. Comply with ACI 306R.
2. Hot weather:
   a. Cease concrete placing when plastic mix temperature cannot be maintained under 90 DEGF.
   b. Aggregates or water or both may be cooled.
   c. Cool water with crushed ice.
   d. Cool aggregates by evaporation or water spray.
   e. Never batch cement hotter than 160 DEGF.
   f. Comply with ACI 305R.

G. Finishing:
1. As soon as placed, strike off and screed to crown and cross section, slightly above grade, so that consolidation and finishing will bring to final Drawing elevations.
2. Maintain uniform ridge full width with first pass of first screed.
3. Test with 6 FT straightedges equipped with long handles and operated from sidewalk.
4. Draw excess water and laitance off from surface.
5. Float finish so as to leave no disfiguring marks but to produce a uniform granular or sandy texture.
6. Broom finish after floating.
7. Tool edges with suitable edger.
8. Provide exposed aggregate surfaces in areas indicated on the Drawings.
9. Provide method such as abrasive blasting, bush hammering, or surface retarder acceptable to the Engineer.

H. Curing:
1. Apply membrane curing compound complying with ASTM C309, and in accordance with manufacturer's directions but at a rate of minimum 200 SQFT per gallon.

2. Apply curing compound within 4 HRS after finishing or as soon as surface moisture has dissipated.
3. Cure for minimum of seven (7) days.
4. When average daily temperature is below 50 DEGF, provide insulative protection of 12 IN minimum thickness loose dry straw, or equivalent, for 10 days.
5. Linseed oil sealant:
    a. For concrete sidewalk and step, seal surface with linseed oil.
    b. Apply linseed oil to clean surface as per AASHTO M224 after concrete has cured for 1 month.
    c. Apply first application at rate of 67 SQYD per gallon.
    d. Apply second application to a dry surface at rate of 40 SQYD per gallon.

I. Protection of Concrete:
1. Protect new sidewalk, steps, and their appurtenances from traffic for a minimum of 14 days.
2. Repair or replace parts of sidewalk and steps damaged by traffic, or other causes, prior to final acceptance.

J. Opening to Traffic:
1. After 14 days, area may, at Owner's discretion, be opened to traffic if job cured cylinders have attained a compressive strength of 3000 LBS per square inch when tested in accordance with ASTM standard methods.
2. Prior to opening to traffic, clean and refill joints as required with specified filler material.

K. Clean Up:
1. Assure clean-up work is completed within two (2) weeks after sidewalk has been opened to traffic.
2. No new work will begin until clean-up work has been completed, or is maintained within 2 weeks after sidewalk has been opened to traffic.

L. Handrails:
1. Provide handrails where required and as per Drawing details.

3.3 FIELD QUALITY CONTROL

A. Provide test cylinders in accordance with Specification Section 03 05 05 for each __5___CY of placed concrete.

END OF SECTION

DIVISION 33

UTILITIES

SECTION 33 05 16
PRECAST CONCRETE MANHOLE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast manholes and accessories to serve as Esocid Reuse Pump Station as shown in the drawings.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A48/A48M, Standard Specification for Gray Iron Castings.
      b. A536, Standard Specification for Ductile Iron Castings.
      c. C150/C150M, Standard Specification for Portland Cement.
      d. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
      e. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
      f. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
      g. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Fabrication and/or layout drawings:
      a. Include detailed diagrams of manholes showing typical components and dimensions, reinforcements and other details.
      b. Itemize, on separate schedule, sectional breakdown of each manhole structure with all components and refer to drawing identification number or notation.
      c. Indicate knockout elevations for all piping entering each manhole.
   4. Buoyancy uplift and structural calculations.
   5. Drawings shall be signed and sealed by a Professional Engineer registered in state corresponding to the project location.

B. Submit product data, drawings and IO&M manuals for roof hatches.

C. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

1.4 SITE CONDITIONS

A. For this project, the established high groundwater elevation is 3.5 feet below preconstruction ground.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Manhole rings, covers and frames:
      a. Neenah Foundry and Neenah Enterprises, Inc.
      b. East Jordan.
   2. Manhole steps: M.A. Industries, Inc.
   3. Black mastic joint compound:
      a. Kalktite 340.
      b. Tufflex.
      c. Plastico.
   4. Premolded joint compound:
      a. RAM-NEK.
      b. Kent Seal.
   5. Emulsified fibrated asphalt compound:
      a. Sonneborn Hydrocide 700B.

2.2 MANHOLE STRUCTURE COMPONENTS

A. Manhole Components:
   1. Reinforcement: ASTM C478.
   2. Minimum wall thickness: 5 IN.
   3. Minimum base thickness: 12 IN.
   4. Provide the following components for each manhole structure:
      a. Base (precast) with integral bottom section or (cast-in-place).
      b. Precast bottom section(s).
      c. Precast barrel section(s).
      d. Precast eccentric transition section except where a round hatch the full diameter of the manhole is indicated in the Drawings.
      e. Precast adjuster ring(s) except where a round hatch the full diameter of the manhole is indicated in the Drawings.
      f. Precast flat top except where a round hatch the full diameter of the manhole is indicated in the Drawings.
   5. Unless dimensioned or specifically noted on Drawings, provide manhole section with minimum 48 IN inside dimensions.

B. Provide plastic encapsulated manhole rungs. Where indicated in the Drawings, they shall be designed by the manufacturer to protrude 7 inches.

C. Except where Drawings specifically describe other, seal all pipe penetrations 4 inch diameter and larger in manhole with replaceable rubber boot seals with stainless steel clamps and stainless steel mechanically expanding bands such s Press-Seal PSX Direct Drive or Kor-N-Seal. Seals for 1-1/2 and 2” pipe shall be equal to A-Lok X-Cel 9091 Series.

D. Hatch fabricated of aluminum and stainless steel for at least 150 psf load, made by USF Fabrication or Bilco.

E. Exposed Structures: Concrete mix shall have air content appropriate for structures that will be exposed.

F. Special Coatings and Joint Treatment:
   1. Joints of precast sections:
      a. Black mastic compound: ASTM D4586.
   2. Vertical wall surfaces:
      a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type II for all exterior surfaces that will be below grade. Coatings shall be shop applied.

PART 3 - EXECUTION

3.1 MANHOLE CONSTRUCTION

A. General:
   1. Construct cast-in-place concrete base slabs.
   2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent sewer sections.
   3. Shape inverts accurately and steel trowel finish.
      a. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert using as large a radius as manhole inside diameter will permit.
      b. Pour base slab integral with bottom barrel section.

B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.

C. All horizontal mating surfaces between concrete and concrete or concrete and metal, above established high groundwater elevation shown trowel apply to clean surface black mastic joint compound to a minimum wet thickness of 1/4 IN immediately prior to mating the surfaces.

END OF SECTION

DIVISION 40

PROCESS INTERCONNECTIONS

SECTION 40 05 00
PIPE AND PIPE FITTINGS - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Process piping systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 01 - General Requirements.
   2. Section 09 96 00 - High Performance Industrial Coatings
   3. ection 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
   4. Section 40 05 07 - Pipe Support Systems.
   5. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Iron and Steel Institute (AISI).
   2. American Society of Mechanical Engineers (ASME):
      a. B16.3, Malleable Iron Threaded Fittings.
      b. B16.5, Pipe Flanges and Flanged Fittings.
   3. ASTM International (ASTM):
      a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
      d. A536, Standard Specification for Ductile Iron Castings.
      e. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
      f. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
      g. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
      h. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
      i. D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.
      j. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
      k. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
   4. American Water Works Association (AWWA):
      a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
      b. C606, Standard for Grooved and Shouldered Joints.
      c. C651, Standard for Disinfecting Water Mains.
      d. C800, Standard for Underground Service Line Valves and Fittings.
   5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
      a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.

b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.

6. International Plumbing Code (IPC).
7. Underwriters Laboratories, Inc. (UL).

B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 SYSTEM DESCRIPTION

A. Piping Systems Organization and Definition:
1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
2. See PIPING SPECIFICATION SCHEDULES in PART 3.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
1) Attach technical product data on gaskets, pipe, fittings, and other components.
3. Fabrication and/or layout drawings:
a. Exterior yard piping drawings (minimum scale 1 IN equals 10 FT) with information including:
1) Dimensions of piping lengths.
2) Invert or centerline elevations of piping crossings.
3) Acknowledgement of bury depth requirements.
4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
6) Line slopes and vents.
b. Interior piping drawings (minimum scale 1/8 IN equals 1 FT) with information including:
1) Dimensions of piping from column lines or wall surfaces.
2) Invert dimensions of piping.
3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
4) Location and type of pipe supports and anchors.
5) Locations of valves and valve actuator type.
6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
7) Acknowledgement of valve, equipment and instrument tag numbers.
8) Provisions for expansion and contraction.
9) Line slopes and air release vents.
c. Schedule of interconnections to existing piping and method of connection.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 77 00 and 01 33 00 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer.
   1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit.
   1. Repair abrasions, scars, and blemishes.
   2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Compression sleeve couplings:
      a. Romac.
      b. Ford.
      c. JCM.
      d. Krausz
   2. Transition coupling:
      a. Ford
      b. Romac
      c. JCM
      d. Krausz
   3. a. Sigma
   4. c. Star

2.2 PIPING SPECIFICATION SCHEDULES

A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Specification Section.

2.3 COMPONENTS AND ACCESSORIES

A. Reducers:
   1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
   2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

B. Underground Warning Tape:

C. Valves:
   1. See Drawings for valves used in each system.
   2. See Specification Section 40 05 51.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

A. Unless otherwise shown on the Drawings, provide a minimum of 4 FT earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing except where specifically indicated otherwise in the Drawings.

B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals specified in Specification Section 01 73 20 and as shown on Drawings.

C. Install expansion devices as necessary to allow expansion and contraction movement.

D. Laying Pipe In Trench:
   1. Excavate and backfill trench in accordance with Specification Section 31 23 33.
   2. Clean each pipe length thoroughly and inspect for compliance to specifications.
   3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
   4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
   5. Except for first two (2) joints, before making final connections of joints, install two (2) full sections of pipe with earth tamped along side of pipe or final with bedding material placed.
   6. Lay pipe in only suitable weather with good trench conditions.
      a. Never lay pipe in water except where approved by Engineer.
   7. Seal open end of line with watertight plug if pipe laying stopped.
   8. Remove water in trench before removal of plug.

E. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded. Anchorage and Blocking:
   1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
   2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
      a. Concrete blocks shall not cover pipe joints.
   3. Provide bearing area of concrete in accordance with drawing detail.

F. Install underground hazard warning tape.

G. Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

B. Alignment of piping smaller than 4 IN may not be shown; however, install according to Drawing intent and with clearance and allowance for:
   1. Expansion and contraction.
   2. Operation and access to equipment, doors, windows, hoists, moving equipment.
   3. Headroom and walking space for working areas and aisles.
   4. System drainage and air removal.

C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified in Specification Section 01 73 20 and as shown on the Drawings.

D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

E. Pipe Support:
   1. Use methods of piping support as shown on Drawings and as required in Specification Section 40 05 07.
   2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
      a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
   3. Size pipe supports with consideration to specific gravity of liquid being piped.

F. Locate and size sleeves and castings required for piping system.
   1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.

G. Use reducing fittings throughout piping systems.
   1. Bushings will not be allowed unless specifically approved.

H. Equipment Drainage and Miscellaneous Piping:
   1. Provide drip pans and piping at equipment where condensation may occur.
   2. Hard pipe stuffing box leakage to nearest floor drain.
   3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
      a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
      b. Hard pipe drainage to nearest floor drain.
   4. Collect system condensate at drip pockets, traps and blowoff valves.
   5. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.
   6. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
      a. Size to handle application with 3/4 IN being minimum size provided.

I. Provide full face gaskets on all systems.

J. Equipment Pipe Connections:
   1. Equipment - General:
      a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
      b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
      c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
         1) Provide tightening torque in accordance with manufacturer's recommendations.
      d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
      e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
      f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
      g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
      h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
         1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
         2) Realign as necessary, install flange bolts and make equipment connection.
      i. Provide utility connections to equipment shown on Drawings, scheduled or specified.

K. Provide insulating components where dissimilar metals are joined together.

3.3 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.

C. Undertake connections in fashion which will disturb system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

F. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.

G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.4 FIELD QUALITY CONTROL-NO LEAKGE IS ALLOWED. TEST DURATIONS SHALL BE 4 HRS.

A. Pipe Testing - General:
   1. Test piping systems as follows:
      a. Test exposed, non-insulated piping systems upon completion of system.
      b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.
      c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.
      d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.
   2. Utilize pressures, media and pressure test durations as specified in the PIPING SPECIFICATION SCHEDULES.
   3. Isolate equipment which may be damaged by the specified pressure test conditions.
   4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
      a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
      b. Notify the Engineer 24 HRS prior to each test.
   5. Completely assemble and test new piping systems prior to connection to existing pipe systems.
   6. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
   7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

B. Pressure Testing:
   1. Testing medium: Unless otherwise specified in the PIPING SPECIFICATION SCHEDULES, utilize the following test media.
      a. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 48 IN	Gravity	10 ft	Water
All sizes	Pumped	85 psig	Water

   2. Hydrostatic pressure testing methodology:
      a. General:
         1) All joints, including welds, are to be left exposed for examination during the test.
         2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
         3) Provide temporary restraints for expansion joints for additional pressure load under test.
         4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
         5) Do not paint or insulate exposed piping until successful performance of pressure test.
      b. Soil, waste, drain and vent systems:

1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.
2) Eliminate leaks before proceeding with work or concealing piping.
3) Minimum test heights shall be 10 FT above highest stack inlet.

3. Compressed air systems shall be tested with air at 65 psi.

3.5 CLEANING, DISINFECTION AND PURGING

A. Cleaning:
1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.
   a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
   b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.
6. After erection of piping and tubing, but prior to installation of service outlet valves, blow natural gas and liquefied petroleum gas and digester gas systems clear of free moisture and foreign matter by means of air, nitrogen or carbon dioxide.
   a. Oxygen shall never be used.
7. Clean chlorine piping in accordance with CI Pamphlet 6.
8. Purge all neat liquid polymer tubing or piping between the neat polymer storage tank or tote and the polymer blending units with mineral oil to remove residual water prior to introducing neat polymer. Following purging, drain as much of the mineral oil out of the system as possible. Dispose of purged fluids and waste mineral oil in accordance with local environmental regulations.

3.6 LOCATION OF BURIED OBSTACLES

A. Furnish exact location and description of buried utilities encountered and thrust block placement.

B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.

C. Include such information as location, elevation, coverage, supports and additional pertinent information.

D. Incorporate information on "As-Recorded" Drawings.

3.7 SCHEDULES: EXCEPT WHERE SPECIAL FITTINGS OR PIPES ARE SPECIFICALLY NOTED IN THE DRAWINGS, SCH 80 PVC FOR PUMPED REUSE WATER (PR), SCH 40 PVC FOR GRAVITY REUSE WATER (GR) AND OVERFLOW PIPING AND DRAINS (OW) AND COPPER FOR COMPRESSED AIR

and PVC Duct for 12” diameter oxygenation columns.

END OF SECTION

SECTION 40 05 07
PIPE SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe support and anchor systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 05 50 00 - Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B31.1, Power Piping.
      b. B31.3, Process Piping.
   2. ANVIL International (ANVIL).
   3. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A276, Standard Specification for Stainless Steel Bars and Shapes.
      c. A510, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
      d. A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
      e. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
      f. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   4. American Welding Society (AWS):
      a. D1.1, Structural Welding Code - Steel.
   5. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
      b. SP-69, Pipe Hangers and Supports - Selection and Application.

B. Responsibility:
   1. Contractor shall design support systems for 12 IN DIA piping and smaller, and for larger diameter piping where supports are not shown on the Drawings.
   2. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to design, furnish and install the system of hangers, supports, guidance, anchorage and appurtenances.
   3. General piping support details may be indicated on the Drawings in certain locations for pipe smaller than 12 IN DIA.
   4. Contractor shall incorporate those details with requirements of this Specification Section to provide the piping support system.

C. Each type of pipe hanger or support shall be the product of one manufacturer.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
    c. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
    d. Scaled drawings showing location, installation, material, loads and forces, and deflection of all hangers and supports.
    e. Analyze each pipe system for all loads and forces on hangers and supports and their reaction forces to the structure to which they are fastened.
    f. Support systems for piping systems over 12 IN DIA, systems operating over 100 psig or systems operating over 200 DegF designed by the Contractor: Submit detail design calculations and scaled drawings prepared and signed by a registered Professional Engineer in the State of Georgia, showing the requirements of paragraphs d. and e. above.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 MANUFACTURED UNITS

A. General:
    1. Supports shall be reinforced plastic, stainless steel, aluminum, galvanized or FRP with stainless steel fasteners unless noted otherwise in the Drawings.

    2. Outdoor supports not addressed in previous paragraph shall be galvanized or stainless, aluminum, FRP or polymer with stainless or galvanized fasteners.

    3. Galvanized components:
        a. Electro-galvanized components:
            1) Bar, forged or cast fabrications: ASTM B633, SC4.
            2) Rolled sheet fabrications: ASTM A917 and ASTM A918, 50N50NU.
        b. Hot-dipped galvanized components: See Specification Section 05 50 00.
    4. Dissimilar metals protection:
        a. Galvanized-to-galvanized and galvanized-to-aluminum: No protection required.
        b. All other galvanized-to-dissimilar metal connections: Neoprene or nylon pads, shims, grommets, etc.

B. Channel Strut and Channel Strut accessories such as high post bases and gussets:
    1. Cooper/B-Line or Unistrut

C. Parallel Pipe Clamps:
    1. Hangerlok or Clic

D. Hanger Rods:
    1. Material:
        a. ASTM A36.
        b. ASTM A575, Grade M1020.
        c. ASTM A576, Grade 1020.
        d. Minimum allowable tensile stress of 12,000 psi at 650 DegF per MSS SP-58.
    2. Continuously threaded.
    3. Electro-galvanized or cadmium plated after threads are cut.

4. Load limit:

NOMINAL ROD DIAMETER	MAXIMUM SAFE LOAD, (LBS)
3/8 IN DIA (min)	610
1/2 IN DIA	1,130

E. Hangers:
1. Hangers for use directly on copper pipe: Copper or cadmium plated.
2. Hangers for use other than directly on copper pipe: Stainless or or galvanized.
3. Hanger type schedule:

APPLICATION	PIPE SIZE	HANGER TYPE
All except noted	4 IN and less	ANVIL Figure 108 with Figure 114
All except noted	Over 4 IN	ANVIL Figure 590

F. Concrete Inserts for Hanger Rods:
1. Continuous slots: Unistrut #P1000.
2. Individual inserts: ANVIL Figure 281.

G. Vertical Pipe Supports:
1. At base of riser.
2. Lateral movement:
   a. Clamps or brackets:

H. Expanding Pipe Supports:
1. Spring hanger type.
2. MSS SP-58.

I. Pipe Support Saddle:
1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings.
2. ANVIL Figure 264.

J. Pipe Support Risers:
1. Schedule 40 pipe.
2. Galvanized.
3. Size: As recommended by saddle manufacturer.

K. Pipe Support Base Plate:
1. 4 IN larger than support.
2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
4. Collar welded to floor plate.
5. Edges ground smooth.
6. Assembly hot-dipped galvanized after fabrication.

L. Wall Brackets:
1. For pipe located near walls and 8 FT or more above floor elevation or as otherwise indicated on the Drawings.
2. ANVIL Figure 199.

M. Pipe Anchors:
1. For locations shown on the Drawings.
2. 1/4 IN steel plate construction.
3. Hot-dipped galvanized after fabrication.

4. Designed to prevent movement of pipe at point of attachment.

2.3 DESIGN REQUIREMENTS

A. Supports capable of supporting the pipe for all service and testing conditions.
   1. Provide 5 to 1 safety factor.

B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

C. Design supports and hangers to allow for proper pitch of pipes.

D. For chemical and waste piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
   1. ASME B31.3.
   2. MSS SP-58 and MSS SP-69.
   3. Except where modified by this Specification.

E. For steam and hot and cold water piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
   1. ASME B31.1.
   2. MSS SP-58 and MSS SP-69.

F. Check all physical clearances between piping, support system and structure.
   1. Provide for vertical adjustment after erection.

G. Support vertical pipe runs in pipe chases at base of riser.
   1. Support pipes for lateral movement with clamps or brackets.

H. Place hangers are to be installed on outside of pipe insulation.
   1. Use a pipe covering protection saddle for insulated pipe at support point.
   2. Insulated piping 1-1/2 IN and less:
      a. Provide a 9 IN length of high density perlite or high density calcium silicate at saddle.
   3. Insulated piping over 1-1/2 IN: Provide a 12 IN length of high density perlite or high density calcium silicate at saddle.

I. Provide 20 GA galvanized steel pipe saddle for fiberglass and plastic support points to ensure minimum contact width of 4 IN.

J. Pipe Support Spacing:
   1. General:
      a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.
      b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.
      c. Provide at least one (1) support for each length of pipe at each change of direction and at each valve.
   2. Steel, stainless steel, cast-iron pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

1. PVC pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/4 and less	3
1-1/2 thru 3	4
4 and greater	5

* Maximum fluid temperature of 120 DegF.

2. Support each length and every fitting:
   a. Bell and spigot piping:
      1) At least one (1) hanger.
      2) Applied at bell.
   b. Mechanical coupling joints:
      1) Place hanger within 2 FT of each side of fittings to keep pipes in alignment.
3. Space supports for soil and waste pipe and other piping systems not included above every 5 FT.
4. Provide continuous support for nylon tubing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
   1. Included in this requirement are movements from:
      a. Trap discharge.
      b. Water hammer.
      c. Similar internal forces.

B. Weld Supports:
   1. AWS D1.1.
   2. Weld anchors to pipe in accordance with ASME B31.3.

C. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

D. Inspect hangers for:
   1. Design offset.
   2. Adequacy of clearance for piping and supports in the hot and cold positions.
   3. Guides to permit movement without binding.
   4. Adequacy of anchors.

E. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.

F. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
   1. Install concrete inserts as concrete forms are installed.

G. Welding:
   1. Welding rods: ASTM and AWS standards.
   2. Integral attachments:
      a. Include welded-on ears, shoes, plates and angle clips.
      b. Ensure material for integral attachments is of good weldable quality.

   Preheating, welding and postheat treating: ASME B31.3, Chapter V.

END OF SECTION

SECTION 40 05 17
PIPE - COPPER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Copper piping, fittings, and appurtenances for oxygen supply piping

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
   4. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.
   5. Section 40 05 07 - Pipe Support Systems.

C. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
      b. B16.23, Cast Bronze Solder Joint Drainage Fittings - DWV.
      c. B16.26, Cast Bronze Alloy Fittings for Flared Copper Tubes.
   2. ASTM International (ASTM):
      a. B32, Standard Specification for Solder Metal.
      b. B42, Standard Specification for Seamless Copper Pipe, Standard Sizes.
      c. B88, Standard Specification for Seamless Copper Water Tube.
      d. B306, Standard Specification for Copper Drainage Tube (DWV).
   3. American Welding Society (AWS):
      a. A5.8M/A5.8, Specification for Filler Metals for Brazing and Braze Welding.

1.2 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. See Specification Section 40 05 00.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Copper Tubing:
   1. ASTM B88, Type L hard.

B. Fittings:
   1. Pressure non-buried: ASME B16.22.
   2. Pressure buried: ASME B16.22 or ASME B16.26.
   3. Viega press fitted copper suitable for oxygen

C. Brazing:
   a. Use brazing alloy with melting temperature above 1000 DEGF and suitable flux.

D. See Piping Schedules in Specification Section 40 05 00.

E. Unions:
   1. Pipe sizes 2 IN and smaller: Copper, ground joint.
   2. Pipe sizes 2-1/2 IN and larger: Brass flanged unions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with Specification Section 40 05 00.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Specification Section 40 05 00.

B. Utilize only annealed (soft) type tubing where flared joints are used and drawn temper (hard) type tubing where soldered or brazed joints are used.

C. Support exposed piping in accordance with Specification Section 40 05 00 and Specification Section 40 05 07.

D. Install buried piping in accordance with Specification Section 31 23 33 and Specification Section 40 05 00.

END OF SECTION

SECTION 40 05 31
PIPE: PLASTIC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic pipe.
   2. Deductive Alternate No. 4 – Delete all plastic pipe associated with the Chilled Water System.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 23 00 – Alternates.
   4. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. See Specification Section 40 05 00.

B. Referenced Standards:
   1. ASTM International (ASTM):
      a. PVC (polyvinyl chloride) materials:
         1) D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
         2) D1785, Standard Specification for Poly (Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.
         3) D2467, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
         4) D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
         5) D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
         6) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
         7) F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
         8) F679, Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
      b. Installation:
         1) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   2. American Water Works Association (AWWA):
      a. PVC (polyvinyl chloride) materials:
         1) C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN Through 12 IN, for Water Distribution.
         2) C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.
   3. NSF International (NSF).

1.3 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. See Specification Section 40 05 00.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPING (EXPOSED)

A. General:
   1. Provide Schedule 40 pipe with Schedule 40 fittings and appurtenances to locations shown on Drawings.
   2. Furnish materials in full compliance to following material specifications:
      a. Manufacture pipe, fittings and appurtenances from polyvinyl chloride (PVC) compound which meets the requirements of Type 1, Grade 1 (12454-B) Polyvinyl Chloride as outlined in ASTM D1784.
      b. Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the NSF.

B. Pipe:
   1. Furnish pipe meeting requirements of ASTM D1785.
   2. Pipe 4 IN and less to be solvent welded.
   3. Pipe larger than 2 IN may be either flanged or solvent welded unless shown otherwise on Drawings.

C. Fittings: Provide ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe. Provide bolt-on PVC saddles where Drawings indicate. They shall have 316 stainless steel bolts and resilient seals. Flanges/Unions:
   1. Furnish flanges and unions at locations shown on Drawings.
   2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
   3. Use flat, full faced natural rubber gaskets at flanged connections.
      a. Furnish heavy hex head bolts, each with one (1) heavy hex nut, ASTM F593 Type 316 stainless steel.
   4. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

D. Installation:
   1. Field threading PVC will not be permitted.
      a. Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.
      b. Female adapters are not acceptable unless specially called for on the Drawings.
   2. Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.
      a. Continuously support PVC piping at liquid operating temperatures in excess of 100 DegF.
      b. For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.
      c. Support riser clamps on spring hangers.
      d. Do not clamp PVC tightly or restrict movement for expansion and contraction.

2.2 PRESSURE PIPING (UNDERGROUND)

A. Materials: Furnish materials in full compliance with following requirements:
   1. ¾ - 3 IN: SCH 40 PVC with solvent cemented joints.
   2. 4 & 6-12 IN: DR 25 AWWA C900 PVC rated 165 psi except where Drawings specifically indicate otherwise.
   3. 14-42 IN: AWWA C905 PVC DR-25.
   4. Joints for AWWA PVC pipe shall be the elastomeric-gasket type with a pressure rating not less than pipe pressure rating meeting performance requirements of ASTM D3139.

B. Installation:
   1. Field threading of PVC pipe will not be permitted.
   2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

2.3 PVC DRAINAGE, SEWER PIPING AND UNDERGROUND AIR DUCTS

A. Materials:
   1. Furnish materials in full compliance to the following material specification.
   2. PVC pipe shall be rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454-B or 12454-C as described in specification ASTM D1784.
   3. The requirements of this Specification are intended to provide for pipe and fittings suitable for non-pressure drainage of wastewater and surface water.
   4. Joining systems shall consist of an elastomeric gasket joint meeting requirements of ASTM D3212.
   5. Supply to the Engineer all information and sample of joining method for his evaluation.
      a. Only jointing methods acceptable to the Engineer will be permitted.
   6. Provide pipe and fittings meeting or exceeding the following requirements:
      a. 4-42 IN DIA: ASTM D3034 and ASTM F679, SDR 35 (PS 46) or SDR 26 (PS 115) or SCH 40 DWV PVC.
   7. Ensure impact strengths and pipe stiffnesses in full compliance to these Specifications.

B. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
   1. Provide for a maximum deflection of not more than 5 percent.

C. Infiltration and Exfiltration:
   1. The maximum allowable infiltration measured by test shall not exceed 100 GAL per inch of pipe diameter per mile per 24 HRS.
   2. For exfiltration, all the pipe and fittings shall exceed performance requirements by an air test procedure as specified in Section 40 05 00.
   3. Observe full instructions of the Engineer for carrying of testing procedures.
      a. Perform tests only during presence of the Engineer or his authorized representative.
   4. Should any test on any section of pipe line disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.

D. Deflection:
   1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
   2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 percent.
   3. Any repaired pipe shall be retested.

2.4 PVC TUBING

A. General: Provide nylon tubing with fittings and appurtenances as shown on Drawings.

B. Materials:
   1. Furnish clear outer braided tubing with braid outside the walls.
   2. Have tubing manufactured of nylon with working temperatures from 5 to 180 DegF.
   3. Design tubing with a minimum safety factor of 4 to 1 ratio of burst pressure to working pressure at maximum temperature.
   4. Provide tubing with working pressure of 75 psi at 180 DegF.
   5. Ensure that tubing is self-extinguishing and fire resistant.

C. Fittings:

1. Install tubing with nylon fittings and connectors.
2. Use barbed type adapters with stainless steel clamps.
3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
4. Ensure fittings have the same pressure and temperature rating as the tubing.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less.
   1. Include manufacturer's name and trademark.
   2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications and NSF approvals when applicable.

3.2 PRESSURE PIPING (UNDERGROUND)

A. Installation:
   1. Field threading of PVC pipe will not be permitted.
   2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

3.3 PVC DRAINAGE, SEWER PIPING AND UNDERGROUND AIR DUCTS

A. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
   1. Provide for a maximum deflection of not more than 5 percent.

B. Infiltration and Exfiltration:
   1. The maximum allowable infiltration measured by test shall not exceed 100 GAL per inch of pipe diameter per mile per 24 HRS.
   2. For exfiltration, all the pipe and fittings shall exceed performance requirements by an air test procedure as specified in Section 40 05 00.
   3. Observe full instructions of the Engineer for carrying of testing procedures.
      a. Perform tests only during presence of the Engineer or his authorized representative.
   4. Should any test on any section of pipe line disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.

C. Deflection:
   1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
   2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 percent.
   3. Any repaired pipe shall be retested.

3.4 PVC TUBING

A. Fittings:
   1. Install tubing with nylon fittings and connectors.
   2. Use barbed type adapters with stainless steel clamps.
   3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
   4. Ensure fittings have the same pressure and temperature rating as the tubing.

END OF SECTION

SECTION 40 05 51
VALVES: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. In this and other Division 40 specifications, where "water" is used to describe an application it includes lake water, well water, aerated water, raw water and treated water and "wastewater" includes sanitary waste, drains, storm sewer, effluent and overflow water.

B. Section Includes:
   1. Valving, actuators, and valving appurtenances.

C. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.20.1, Pipe Threads, General Purpose.
      b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
      c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASTM International (ASTM):
      a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
      c. D638, Standard Test Method for Tensile Properties of Plastics.
      d. D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
      e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
      f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
   3. American Water Works Association (AWWA):
      a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 through 144 IN.
      b. C606, Standard for Grooved and Shouldered Joints.
   4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
      a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

1.3 DEFINITIONS

A. The following are definitions of abbreviations used in this Specification Section or one (1) of the individual valve sections:
   1. CWP: Cold water working pressure.
   2. WOG: Water, oil, gas working pressure.
   3. WWP: Water working pressure.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Valve pressure and temperature rating.
      d. Valve material of construction.
      e. Special linings.
      f. Valve dimensions and weight.
      g. Valve flow coefficient.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 00 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

2.2 MATERIALS

A. Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

A. Valve Actuators - General:
   1. Provide actuators as shown on Drawings or specified.
   2. Counter clockwise opening as viewed from the top.
   3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
   4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or 300 foot-pounds torque on the operating nut.
   5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
   6. Extension stem:
      a. Install where shown or specified.
      b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
      c. Pin all stem connections.
      d. Center in valve box or grating opening band with guide bushing.

B. Exposed Valve Manual Actuators:
   1. Provide for all exposed valves not having electric or cylinder actuators.
   2. Provide handwheels for gate and globe valves.
      a. Size handwheels for valves in accordance with AWWA C500.
   3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
      a. Lever actuators for butterfly valves shall have a minimum of 8 intermediate lock positions between full open and full close.

2.4 FABRICATION

A. End Connections:
   1. Provide the type of end connections for valves as required in the Piping Schedules presented in Specification Section 40 05 00 or as shown on the Drawings.
   2. Comply with the following standards:
      a. Threaded: ASME B1.20.1.
      b. Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.
      c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
      d. Soldered: ASME B16.18.
      e. Grooved: Rigid joints per Table 5 of AWWA C606.

B. Refer to individual valve Specification Sections for specifications of each type of valve used on Project.

C. Nuts, Bolts, and Washers:
   1. Wetted or internal to be bronze or stainless steel.
      a. Exposed to be zinc or cadmium plated.

D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

C. For threaded valves, provide union on one (1) side within 2 FT of valve to allow valve removal.

D. Install valves accessible for operation, inspection, and maintenance.

END OF SECTION

SECTION 40 05 52
MISCELLANEOUS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Float-operated valves (2 IN and smaller).
   2. Male Threaded Aluminum Check Valves

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 40 05 51 - Valves - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. American Water Works Association (AWWA):
      a. C512, Standard for Air-Release, Air-Vacuum, and Combination Air Valves for Waterworks Service.
      b. C550, Standard for Protective Interior Coatings for Valves and Hydrants.
   3. Canadian Standards Association (CSA).
   4. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 51.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 FLOAT-OPERATED VALVES (2 IN AND SMALLER)

A. Suppliers:
   1. Control Devices, LLC. Robert Manufacturing R1370-1-5
   2. McMaster-Carr Part 4634K41

B. Materials:
   1. Stainless steel body, rod and float
   2. Metal components of 316 stainless steel.
   3. Viton disc seal with Teflon cup seal.

C. Design Requirements:
   1. Rated to at least 85 psi where flow rating shall be at least 50 gpm for valve with inlet for 1" dia. pipe.
   2. Direct float connected and mechanically actuated.
   3. Float for valve with 1" dia. inlet shall not exceed 8" dia.
   4. Overall length of valve, float rod and float shall not exceed 25 inches.
   5. Overall height of bare valve shall not exceed 2-1/2 inches.

2.3 MALE THREADED ALUMINUM CHECK VALVE

A. Suppliers:
   1. US Valve/Techno Holdings, LLC — Style 5002
   2. Process Development & Control — Series 801

B. Materials:
   1. Aluminum or 316 stainless steel body.
   2. Resilient seals

C. Design Requirements
   1. Rated at least 50 psi.
   2. Full bore.
   3. Valve for connection to 3" dia. pipe shall be not more than 5.5 inches long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: See Specification Section 01 61 03 and Specification Section 40 05 51.

B. Air Release, Vacuum Relief, and Pressure Relief Valves:
   1. Pipe exhaust to a suitable disposal point.
   2. Where exhausted to a trapped floor drain, terminate exhaust line 6 IN minimum above floor.

C. Float-Operated Valves: Install baffle around float to minimize turbulence adjacent to float.

3.2 FIELD QUALITY CONTROL

A. Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.

B. Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

END OF SECTION

SECTION 40 05 63
BALL VALVES

PART 1 - GENERAL

1.1 SUMMARY – SAME AS BALL VALVES IN SECTION 22 05 23 GENERAL DUTY VALVES FOR PLUMBING PIPING

END OF SECTION

SECTION40 05 64

BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Butterfly valves.
B. Related Sections include but are not necessarily limited to:
   1. Division 01 - General Requirements.
   2. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.
   3. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.5, Pipe Flanges and Flanged Fittings - NPS 1/2 Through NPS 24.
   2. ASTM International (ASTM):
      a. A48, Standard Specification for Gray Iron Castings.
      b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A276, Standard Specification for Stainless Steel Bars and Shapes.
      d. A395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
      e. A436, Standard Specification for Austenitic Gray Iron Castings.
      f. A536, Standard Specification for Ductile Iron Castings.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 51.
B. Operation and Maintenance Manuals:
   1. See Specification 01 33 00 for requirements for:
      a. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. ASAHI/America
   2. Hayward Industrial
   3. Georg Fisher

2.2 PVC BUTTERFLY VALVES:

A. PVC or reinforced PP lever that latches in 19 or more positions.
B. PVC or reinforced PP body, lugged with 316 stainless inserts to mate to ANSI 150 flanges, suitable for dead end service without downstream flange.
C. Stem extension of 316 ss and ss or factory epoxy coated carbon steel neck extension where Drawings indicate stem and neck extension.
D. Stem of 316 ss. PVC or PP disc. EPDM seal.
E. Rated 150 psi, bidirectional.

F. Acceptable makes & models include Georg Fisher 578, ASAHI/America 57IL, Hayward BYV (except not in extended applications unless provided with gear).

2.3 ACCESSORIES

A. Refer to Drawings and/or valve schedule for type of actuators.
   1. Furnish actuator integral with valve.
B. Refer to Section 40 05 51 for actuator requirements.]

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 40 05 51.

END OF SECTION

SECTION 40 05 65
GLOBE VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Angle globe valves or angle valves.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 40 05 51 - Valves - Basic Requirements.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 51.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.

2.2 VALVES: ANGLE VALVE OR ANGLE GLOBE VALVE

A. Class 150.

B. Comply with MSS SP-80.

C. Manufacturers:
   1. Chemtrol Figure No. T45AC-V
   2. Hayward Industrial AV Series

D. Materials:
   1. Body, bonnet: PVC
   2. O-Rings: FPM or FKM

E. Design Requirements:
   1. 150 PSI minimum rating.
   2. Valves for ½" pipe shall be rated not less than 5 gpm at 1 psid.
   3. End of inlet to centerline of outlet shall not exceed 1.5 inches.
   4. FPT inlet and outlet and 90 degree body.
   5. Designed for throttling and on/off control.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 40 05 51.

B. Install globe valves with stem in horizontal position wherever possible.

END OF SECTION

SECTION 40 42 00
PIPE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulation:
      a. Piping insulation.
   2. Adhesives, mastics, caulkings, and finishes.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 40 05 07 - Pipe Support Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded-Hot-Plate Apparatus.
      b. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
      c. C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
      d. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
      e. E96, Standard Test Methods for Water Vapor Transmission of Materials.
      f. F25, Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas.
      g. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
      h. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
      i. E 119 Standard Method of Fire Tests of Building Construction, 2 Hour Wall Panel Test, 2 Hour External Total Engulfment Test, hose stream evaluation.
      j. E-136, Combustion Characteristics of Building Materials in a Vertical Tube Furnace.
      k. E 162, Surface Flammability of Materials.
      l. E 814, Through-Penetration, 2-Hour Firestop Test.
   2. ISO 6944-1985, Method of Determining Fire Resistance of Ventilation Ducts.
   3. National Fire Protection Association (NFPA):
      a. 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
   4. Underwriters Laboratories, Inc. (UL):
      a. 723, Standard for Test for Surface Burning Characteristics of Building Materials.
   5. National Commercial and Industrial Insulation Standards (2013 seventh edition).
      a. Published by Midwest Insulation Contractors Association (MICA).
      b. Endorsed by National Insulation Association (NIA).
      c. MICA plate numbers listed in this specification reference this document.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.

c. Submit complete specification of insulation materials, adhesives, cement, together with manufacturer's recommended methods of application and coverage for coatings and adhesives.

3. Submit itemized schedule by building of proposed insulation systems showing density, thermal conductivity, thickness, adhesive, jackets and vapor barriers.
4. Certifications: Products will meet the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Elastomeric insulation:
      a. Rubatex.
      b. Armstrong.
   2. Cellular Glass:
      a. Pittsburgh Corning.
      b. Johns Manville.
      c. Owens Corning.
      d. Knauf.
   3. High density perlite:
      a. Johns Manville.
      b. Industrial Insulation Group (LIC).
   4. High density calcium silicate:
      a. Industrial Insulation Group (LIC).
   5. Adhesives, mastics, caulking, and finishes:
      a. Foster Products.
      b. Childers.
      c. Dow Corning.
      d. Johns Manville.
      e. Knauf.

B. Submit request for substitution in accordance with Specification Section 01 25 00.

2.2 PIPING INSULATION - ELASTOMERIC

A. General:
   1. Insulation fire and smoke hazard ratings for composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation), as tested by procedure ASTM E84, NFPA 255 and UL 723, not exceeding:
      a. Flame spread: 25.
      b. Smoke developed: 50.
   2. Accessories (adhesives, mastics, cements, and tapes: Same component ratings as listed above.
   3. Indicate on product labels or their shipping cartons: Flame and smoke ratings do not exceed above requirements.
   4. Permanent treatment of jackets or facings to impart flame and smoke safety is required.
      a. Water-soluble treatments are prohibited.
   5. Insulated shields at pipe support points.

B. Pipe, Fitting, and Valve Insulation:
   1. Flexible elastomeric closed cell pipe insulation.
      a. Average thermal conductivity not to exceed 0.27 (Btu-IN)/(HR-FT^2-DegF) at mean temperature of 75 DegF, temperature range -40 to 220 DegF; permeability not to exceed 0.20 by ASTM E96; water absorption 3 percent by ASTM D1056 and ozone resistance.

2. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.

2.3 BURIED PIPING INSULATION – CELLULAR GLASS

A. Per ASTM C 552. Preformed.

2.4 PIPE INSULATION INSERTS AT HANGERS

A. High Density Perlite:
   1. Pre-formed.
   2. Fire hazard rating:
      a. UL 723, ASTM E84, NFPA 255.
      b. Flame spread: Zero (0).
      c. Smoke developed: Zero (0).
   3. Average density: 13 LBS/CF.
   4. Compressive strength: 80 psi to produce 5 percent compression.
   5. Maximum surface temperature: 1,200 DegF.

B. High Density Calcium Silicate:
   1. Pre-formed.
   2. Fire hazard rating:
      a. UL 723, ASTM E84, NFPA 255.
      b. Flame spread: Zero (0).
      c. Smoke developed: Zero (0).
   3. Average density: 14 LBS/CF.
   4. Compressive strength: 100 psi to produce 5 percent compression.
   5. Maximum surface temperature: 1,200 DegF.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:
   1. Insulated buried piping shall have jacket designed to be buried such as PittWrap.
   2. Consider ductwork, piping and equipment as exposed, except as otherwise indicated.
   3. Consider ductwork, piping and equipment in walls, partitions, floors, pipe chases, pipe shafts and duct shafts as concealed.
      a. Consider ductwork, piping and equipment above ceilings as concealed.
   4. Provide release for insulation application after installation and testing is complete.
      a. Apply insulation on clean, dry surfaces after inspection.
   5. Provide insulation continuous through wall, roof and ceiling openings, pipe hangers, supports and sleeves.
   6. Provide insulation with vapor barrier for piping, ductwork and equipment where surfaces may be cooler than surrounding air temperatures.
      a. Provide vapor barrier (0.17 perm-IN; ASTM C553) continuous and unbroken.
      b. Hangers, supports, anchors, and related items that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.
   7. Apply specified adhesives, mastics and coatings at the manufacturer's recommended coverage per unit volume.

C. Piping Insulation - Elastomeric:
   1. Do not insulate until satisfactory completion of required pressure testing.
   2. Apply insulation to clean, dry surfaces.
   3. Slip insulation on pipe prior to connection.
      a. Whenever the slip-on technique is not possible provide insulation neatly slit and snapped over the pipe.

4. Fabricate and install fitting cover insulation according to manufacturer's recommendations.
5. Seal joints, slits, miter-cuts and other exposed edges of insulation with adhesive, recommended by the insulation manufacturer, to ensure complete vapor barrier.

D. Piping Insulation – Cellular Glass:
   1. Apply over clean dry pipe.
      a. Butt all joints together firmly.
   2. Seal joints, slits, miter-cuts and other exposed edges of insulation as recommended by the insulation manufacturer.

3.2 SCHEDULES

A. Buried refrigerant lines
   1. Cellular glass thermal insulation.
   2. Thickness 1½" on suction and liquid lines.
   3. Jacket designed to be buried.

B. Exposed Refrigeration Lines (35-60 DegF):
   1. Elastomeric.
   2. 1/2 IN thickness for lines 1 IN and smaller.

END OF SECTION

SECTION 40 66 16
CLOSED-VESSEL LOW-PRESSURE/HIGH-INTENSITY ULTRAVIOLET EQUIPMENT - ADD 1

PART 1 - GENERAL

1.1 SCOPE

A. All labor, materials, equipment and appurtenances required for the enclosed vessel, pressurized flow, amalgam lamp based, ultraviolet (UV) systems illustrated and scheduled on the Drawings and as specified in this specification. The UV systems are to be complete and operational with all control equipment and accessories as shown and specified.

1.2 RELATED REQUIREMENTS

A. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 79 02 – Component and System Verification.
   4. Division 22: Plumbing.
   5. Division 26: Electrical.

1.3 SUBMITTALS

A. All submittals are to comply with submission and content requirements specified within Specification Section 01 33 00.

B. The Contractor shall submit shop drawings and product literature including all pertinent information for the proposed equipment such as dimensions, manufacturer, capacity, type, curves, certifications, accessories, physical and performance data, finishes, materials, location, layouts and wiring diagrams, etc.

C. The Contractor shall submit Installation, Operation, and Maintenance Manuals weeks before training. These manuals shall contain complete wiring diagrams and schematics, parts lists, system operational data, dosage tables (based upon the range of field conditions, i.e., % transmissions and water flow rates), and drawings for the UV disinfection equipment supplied. The shop drawings and product literature may satisfy some of the requirements for the manuals, but it is the Contractor's responsibility to provide complete manuals.

1.4 QUALITY ASSURANCE

A. The UV systems shall be from a manufacturer that has had similar systems in the same vessel configuration with the same lamps pre-validated by a third party per USEPA UVDGM or NWRI protocol. Documentation shall be submitted.

1.5 WARRANTEES

A. The Contractor shall provide a Manufacturer’s written warranty that provides:
   1. For full replacement of all defective lamps within the first 8,760 hours of operation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UV systems complete with UV reactor(s), control panel(s), UV intensity monitoring system(s), and all accessories herein specified and indicated in the Drawings.

B. To be acceptable, the UV system must operate in enclosed vessels and use amalgam UV lamps. The UV system must be designed to fit within the piping configuration shown on the Drawings, without compromise of clearances or hydraulic performance criteria.

C. UV lamp ballasts shall be tested for no more than 10% total harmonic distortion and UV system shall generate no more than 10% total harmonic distortion. Contractor shall have total harmonic distortion measured to demonstrate compliance.

D. Given 60 deg. F water with 81% UVT, dose shall be 40 mJ/sq cm validated (pre-validated per US EPA UVDGM or DVGW or Onorm or NWRI) or 60 mJ/sq cm (non-validated; but, calculated per US EPA UVDGM or DVGW or Onorm or NWRI). The associated flow rate for packages tagged UV-1 thru 3 shall be 115 us gpm and 1,000 watts max. and for UV-4 shall be 30 gpm and 500 watts max. UV vessels shall be suitable for installation with lamps vertical and vessels and manufacturer recommended maintenance space and inlet field piping shall not be more than 10'-6" altogether. Input voltage will be 208 volt single phase.

E. System shall be rated to give 40 mJ/sq cm calculated wall dose or Reduction Equivalent Dose to 160 gpm water flow at 80% UVT. System shall be suitable for operation given 208 volt 3 phase power. Input power requirement shall not exceed 2,500 watts.

2.2 DESIGN, CONSTRUCTION, AND MATERIALS

A. General
1. All components in contact with the process water shall be Type 316L stainless steel which has been passivated, mechanically polished and electro-polished.
2. All material exposed to UV light shall be Type 316L stainless steel, Type 219 quartz or a suitably UV resistant material. Type 214 quartz also allowed.
3. The system shall be designed for complete immersion of the UV lamps including electrode with the full length of the lamp in the water. All lamp electrical connections shall be at one end of the UV lamp. The major axis of the UV lamps shall be parallel to the direction of flow in the reactor.
4. System shall have manual lamp sleeve wipers.

B. UV Reactor
1. Each UV reactor shall be manufactured from seamless stainless steel tubing.
2. Each UV reactor shall have a drain port fixed to its outer wall.
3. Each UV reactor shall accept its respective UV lamps and quartz sleeves through only one end of the vessel. This end of the UV reactor shall allow for complete reactor entry so internal inspection and/or service can be accomplished.
4. The service side of the UV reactor and the UV lamp sleeve seals shall be made using suitable O-ring materials.
5. UV reactors shall be able to operate safely at a maximum inlet pressure of 150 psi and tested to 225 psi. Inlet pressure 145 psi and test pressure 188 psi also allowed.
6. Each UV reactor shall have a UV intensity sensor that can be removed and cleaned.

C. UV Lamps
1. The filament shall be significantly rugged to withstand shock and vibration.
2. Lamp bases shall be resistant to UV and ozone.
3. All electrical connections to the UV lamp shall be terminated at one end.
4. UV lamps shall have a lamp base design that prevents arcing between electrical pins.
5. UV lamps shall have a monochromatic spectral output, with the emissions peaking at 254 nanometers.
6. The type of quartz used for lamp manufacture shall be compatible with wavelength emission.
7. The mercury contained in the lamps shall be mixed with a base metal and fixed to the inside wall of the UV lamp quartz.

D. Lamp End Seal and Lamp Holder
1. The open end of the UV lamp sleeves shall be sealed to the sleeve guide by a suitable compression O-ring.
2. O-ring compression shall be made by a sleeve nut, which shall require no special tools for installation or removal.

3. Each UV lamp electrical connection shall incorporate a sealing boot which is held firmly in place by the sleeve nut to prevent emission of ultraviolet rays. Twist lock connections also allowed.

E. UV Lamp Sleeves
   1. Clear fused quartz tubing, closed at one end shall be used. Type 219 quartz shall be used for disinfection and ozone destruction applications. Type 214 quartz also allowed.

F. Electronic Power Supplies
   1. Each pair of UV lamps shall be powered by one electronic power supply. One power supply per lamp also acceptable.
   2. The electronic power supply shall not be frequency dependent.
   3. Each lamp within the pair shall operate on its own circuit within the power supply so as to prevent consecutive lamp failures should one lamp fail.

G. Electrical
   1. Each UV reactor shall be powered from a remote mountable System Control Center by means of a waterproof cable interfacing with a watertight strain relief.
   2. The System Control Center shall be of painted steel construction.
   3. System Control Center shall be stainless steel or epoxy coated steel with electrical rating NEMA 12 or IP54 or better.
   4. Provide transformers from the UV manufacturer if system requires voltage other than the site voltage scheduled on the Drawings.

H. Control and Instrumentation
   1. System control shall be microprocessor based. Operator interface is to be display type only and be located indoors.
   2. The local displays main screen shall allow the operator to view current system operating statuses; providing information inclusive of: UV intensity, UV dose, system operating hours, total number of lamps operating, power level of ballasts, and any alarm conditions. Display shall allow the operator to further view alarm conditions and history, system configuration/settings, and operation.
   3. Controller shall be capable of taking in a 4-20 mA input proportional to flow in gallons per minute. Controller shall calculate dose given flow and its own intensity and shall display dose and controller shall allow user to set a low dose alarm. Controller shall have 4-20 mA output proportional to dose. Controller shall also allow the User to key in flow rate instead of the controller using analog input.
   4. Alarm Conditions:
      a. The microprocessor based local display shall allow the operator to access and view the following alarm conditions:
         1) Individual lamp failure – failed lamps shall be indicated by specific address (i.e. lamp #). Position in the reactor shall be indicated via lamp numbers fixed to the lamp wiring at the service end of the UV reactor.
         2) UV dose and Low UV dose Alarm – Intensity to be monitored by a silicon carbide diode with UV dose displayed in mWs/cm^2. A low UV alarm will occur once minimum design UV dose has been exceeded. Units mJ/cm^2 also acceptable.
         3) Lamp life status – at the end of UV lamp(s) lifetime (8,500 hours) the elapsed time meter will flash continually for the next 240 hours to alert the operator that all lamps in the reactor require change out. A lamp life status indicator light that changes from green to orange or red for operator attention is also acceptable.
   5. Alarm Signals:
      a. System shall have a normally open contact so that an alarm condition can be remotely sensed.

2.3 SAFETY EQUIPMENT

A. Two (2) Face Shield(s), able to block UV light wavelengths between 200 and 400nm

2.4 ACCEPTABLE MANUFACTURERS

A. Drawings are based on first manufacturer listed. It is believed that the others listed have products close enough to equal to be accepted. Any changes necessary to accommodate them are the Contractor's responsibility.
   1. UltraAqua UV (represented by Innovasea, Baton Rouge) models MR3-220SS and MR1-220SS.
   2. Trojan/Aquafine models Logic 04AS20 and SwiftSC B03.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall install the UV Systems per the Equipment Manufacturer's directions and the project Drawings. The Contractor will provide all required supports and anchoring required to install the UV units. The plumbing and electrical connections shall be provided as detailed on the Drawings and specifications. The Equipment Manufacturer will provide adequate crating and protection of the UV Systems for shipment to the project site. Installation instructions will be provided that specifically outline installation of the UV system. Lifting instructions will be provided to assist the Contractor in placing the units in the mechanical room.

3.2 START-UP AND COMPONENT VERIFICATION

A. Prior to startup the Contractor shall have attained complete Operation and Maintenance Manuals from the supplier and submitted at least one copy to the Architect/Engineer's corporate home office. Another copy shall be kept at the site and made accessible to the Architect/Engineer. Other copies shall be per Division 1.

B. After the Contractor confirms that scheduled flowing water will be available to pass through the UV units, the Contractor shall arrange to have a factory-authorized field technician to the project site for the purpose of verification of installation of the equipment and initial equipment start-up and trouble-shooting. The technician shall also train the Contractor how to operate the UV equipment so that the Contractor can demonstrate operation to the A/E during the Component Verification visit. This shall occur weeks prior to agency training and last 4 hours duration.

3.3 AGENCY TRAINING

A. The Contractor shall have a factory authorized field technician review the installation, operate the UV equipment using hatchery water and give 4 hrs hands-on training to the using Agency staff on how to operate and maintain the equipment. The Contractor shall coordinate the scheduling of this visit with the hatchery manager and the UV equipment maker's authorized representative. This shall not be during the same week as Start-Up or Component Verification.

B. The Contractor shall make a factory-authorized field technician make one visit between 3 and 9 months after Agency Training at a time agreed upon by the hatchery manager for a period of four (4) working hours each trip for the purpose of inspection of the equipment and training the facility personnel on proper operation and maintenance procedures.

END OF SECTION

SECTION 40 70 00

WATER FLOW METERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flow components.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 91 03 – Component and System Commissioning.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Iron and Steel Institute (AISI).
   2. American National Standards Institute (ANSI).
   3. American Society of Mechanical Engineers (ASME):
      a. B16.5, Pipe Flanges and Flanged Fittings.
      b. B31.1, Power Piping.
      c. PTC 19.3, Instruments and Apparatus, Part 3 Temperature Measurement.
      d. PTC 19.5, Application of Fluid Meters, Part 2.
      e. Section II, Part A SA-182, Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
      f. Section II, Part A SA-479, Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
   4. ASTM International (ASTM):
      a. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
      b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A182, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
      d. A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
      e. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   5. Federal Communications Commission (FCC)
      a. 47 CFR 15, Radio Frequency Devices.
   6. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for:
      a. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 WATER FLOW METER SCHEDULE:

A. WM-1 2” dia., 6-99 gpm or broader, eye level cold water main to north walleye sump

B. WM-2 2” dia., 6-99 gpm or broader, eye level cold water main to middle walleye sump

C. WM-3 2” dia., 6-99 gpm or broader, eye level cold water main to south walleye sump

D. WM-4 1” dia., 2.3-50 gpm or broader, eye level cold water to Esocid sump

E. WM-5 3” dia., 14-150 gpm or broader, eye level leaving north walleye reuse pumps

F. WM-6 3” dia., 14-150 gpm or broader, eye level leaving middle walleye reuse pumps

G. WM-7 3” dia., 14-150 gpm or broader, eye level leaving south walleye reuse pumps

H. WM-8 2” dia., 6-99 gpm or broader, eye level at drop to Discfilter DCF-4

I. WM-9 2” dia., 6-99 gpm or broader, east end of north Walleye Jar Rack

J. WM-10 2” dia., 6.99 gpm or broader, east end of central Walleye Jar Rack

K. WM-11 2” dia., 6.99 gpm or broader, east end of south Walleye Jar Rack

L. WM-12 1” dia., 2.3-50 gpm or broader, east end Esocid Jar Rack

2.2 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.

2.3 FLOW COMPONENTS

A. Meters shall be battery powered and shall have thread adapter end connections or adapters to such or flanges and glass filled polypropylene body. They shall be provided with replaceable batteries supplied by the meter manufacturer with an estimated life of not less than 2 years.

B. Acceptable manufacturer and model series:

   1. Seametrics WMP Series

   2. Application to short pipes: Only meters with manufacturer pre-published literature supporting that the meters will be accurate with as little as two diameters of straight pipe upstream and one diameter of straight pipe downstream will be accepted.

   3. Design and fabrication:
      a. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
      b. Operating pressure: 150 psi.
      c. Full bore.
      d. Pulsed DC magnetic field excitation.
      e. NEMA 3X rated.
      f. Accuracy shall be +/-3 percent of rates earlier scheduled.

g. Meter operable as specified in liquids with conductivity as low as 20.0 microSiemens/cm.

h. Display readable for vertical flow up or down.

i. Materials: Electrodes of 316 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions, including but not limited to grounding.

B. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment.

C. Keep foreign matter out of the system.

D. Remove all oil on piping and tubing with solvent before piping and tubing installation.

E. Plug all open ends and connections to keep out contaminants.

F. Threaded Connection Seals:
   1. Use Tite-Seal or acceptable alternate.
   2. Use of lead base pipe dope or Teflon tape is not acceptable.
   3. Do not apply Tite-Seal to tubing threads of compression fittings.

3.2 TRAINING

A. Provide on-site training in accordance with Specification Section 01 79 23.

END OF SECTION

SECTION 40 72 00
LEVEL INSTRUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Level Switches:
      a. Float-Tilt Type Level Switch.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.5, Pipe Flanges and Flanged Fittings.
   2. ASTM International (ASTM):
      a. A106, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service.
   3. American National Standards Institute (ANSI).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.4 SYSTEM DESCRIPTION

A. The instruments specified in this Specification Section are the primary element components for the submersible pump control, and process alarms.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 LEVEL TRANSMITTERS

2.3 LEVEL SWITCHES

A. Float-Tilt Type Level Switch:
   1. Acceptable manufacturers:
      a. SJE Rhombus, Milliampmaster control switch.
      b. Flygt, NNM-10 level regulator.
      c. Or approved equal.

2. Materials:
    a. Float material: Polypropylene or Teflon coated type 316 stainless steel.
    b. Cable jacket: PVC, neoprene.
    c. Cable clamp: Polypropylene or 316 stainless steel.
3. Design and fabrication:
    a. Mechanically-activated control switch designed to activate low current control panels and alarms. Sealed gold cross-point contacts designed for low current (non-sparking) operation.
    b. Provide switch complete with flexible electrical cables of length as noted or as necessary per mounting requirements.
    c. Cable type SJOW, nitrile PVC jacket, 2-No. 18 AWG.
    d. Float: 2.74 inch diameter x 4.83 inch long, high-impact, corrosion resistant housing.
    e. Mounting Device: cable weight or mounting clamp as shown in the schedule.
    f. Fail-safe contacts:
        1) High level applications – normally closed:
            a) The contact switch turns on (closes) when the switch drops below horizontal signaling a not at high level condition, and turns off (opens) when the switch tips above horizontal.
        2) Low level applications – normally open.
            a) The contact switch turns on (closes) when the switch tips above horizontal signaling a not at low level condition, and turns off (opens) when the switch drops below horizontal.
    g. Contacts shall activate/deactivate at 1.5 IN above and below horizontal with a 3.5 IN tether.
    h. The float operation shall not be sensitive to rotation.
    i. Maximum water depth: 30 FT.
    j. Terminate cables in junction box.
    k. Process temperature: 60 DegF.
    l. Pipe-mounted, corrosion-proof cable clamp for 1 IN pipe.
    m. Fiberglass connection junction box sized to allow the connection of up to five floats.
    n. UL Listed.

2.4 ACCESSORIES

A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
    1. Materials, unless otherwise specified, shall be as follows:
        a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
        b. Mounting brackets: galvanized steel.
            1) Standard: 316 stainless steel.
        c. Mounting plates, angles: galvanized steel.
            1) Standard: Carbon steel.

B. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install instrument mounting pipe stands level and plumb.

C. Instrument Valves:
    1. Orient stems for proper operation.
    2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.

3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line.
    a. When cool, reassemble the valves.
5. Support each valve individually.
    a. The tubing system does not qualify as support for the valve.

D. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment.

E. Keep foreign matter out of the system.

F. Remove all oil on piping and tubing with solvent before piping and tubing installation.

G. Plug all open ends and connections to keep out contaminants.

H. Threaded Connection Seals:
1. Use Tite-Seal or acceptable alternate.
2. Use of lead base pipe dope or Teflon tape is not acceptable.
3. Do not apply Tite-Seal to tubing threads of compression fittings.

I. Instrument Mounting:
1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
3. Mount instruments level, plumb, and support rigidly.
4. Mount to provide:
    a. Protect from heat, shock, and vibrations.
    b. Provide accessibility for maintenance.
    c. Free from interference with piping, conduit and equipment.

3.2 TRAINING

A. Provide on-site training in accordance with Specification Section 01 75 00.

END OF SECTION

DIVISION 42

PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

SECTION 42 22 29
INCUBATION, HEATING AND CHILLING SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Base Bid:
   1. Provide incubation chilling systems and incidental equipment required to make aquaculture chilling and heating systems complete and fully operational.
   2. Provide thermostats, sensors, and wiring.

1.2 RELATED WORK ITEMS

A. Specified Elsewhere:
   1. Section 01 23 00 – Alternates
   2. Section 23 74 36 – Refrigerant Piping System
   3. Division 26 – Electrical

1.3 SUBMITTALS

A. Submit Product Literature on all items listed under "Products Included" earlier in this section.

B. Submit Product Literature and Shop Drawings on:
   1. Incubation chilling systems.

C. Submit manufacturer's testing, adjustment, and start-up instructions.

D. Submit manufacturer's operating and maintenance instructions.

1.4 WARRANTY

A. Provide manufacturer's warranty against heat pump system defects and workmanship for a period of eighteen (18) months from delivery or twelve (12) months from start-up, whichever is less.

PART 2 - PRODUCTS

2.1 INCUBATION CHILLING SYSTEM

A. Four separate split incubation heating & chilling systems are required, three nominal 5 hp each, 60,000 Btu/Hr tagged in the Drawings as Heat Pumps HP-1 to HP-3 and Heat Exchangers tagged HX-1 to HX-3 and one system that is at least 2.5 nominal Hp, 30,000 Btu/Hr. They shall be 208 volt 3 phase. Each evaporator/heat exchanger shall be vertical and shall be no wider than 19 IN and no longer than 24 IN, inclusive of stand, controller and factory attached piping.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Aqua Logic, Inc.
      b. Delta Hydronics

B. Provide low ambient controls for operation down to 0 degree F ambient air.

C. Each package shall be made up of two major split components: the condensing unit with compressor and the heat exchanger. To ensure compatibility, the condensing unit, heat exchanger and all parts must come from the same supplier as well as the stainless steel frame

that the heat exchanger shall be mounted on and factory controller and wiring and PVC unions and a loose shipped flow switch for field installation.

D. Packages shall be equipped with digital temperature controller enclosed in a NEMA4X enclosure with easy 3 push button programming.

E. Install as indicated on Drawings and following manufacturer's instructions.

F. Water piping connections shall be 2 IN diameter.

G. Compressor
   1. Scroll type compression to provide inherently low vibration.
   2. Compressor to be suction cooled, direct drive, 3600 RPM hermetic motors.
   3. Scroll compressor to include a centrifugal oil pump to provide positive lubrication to all moving parts.
   4. Unit shall have two direct-drive hermetic compressors with centrifugal oil pump, oil level sight glass and an oil charging valve
   5. Compressor shall have voltage utilization range of plus or minus 10 percent of nameplate voltage
   6. Crankcase heater, internal temperature and current – sensitive motor overloads to be included for maximum protection
   7. External high and low pressure cut out devises shall be provided

H. Condensing Unit (Heat Pump/Chiller):
   1. The chiller is a refrigerant system providing single stage cooling.
   2. Unit shall have an outdoor rated air-tempered condenser. Unit shall operate with process water leaving temperatures at least as low as 40˚F.
   3. Condensing units are to be factory assembled and wired.
   4. Unit frames constructed from 14 gauge welded galvanized steel with 14 to 16 gauge galvanized steel panels and access doors.
   5. The unit surface is phosphatized and finished with an air-dry paint.
   6. Provide certified ratings in accordance with ANSI/ARI 520.

I. Heat Exchanger (Evaporator):
   1. Heat Exchange Shell:
      a. Constructed from non-toxic, non-corrosive titanium tubing and PVC materials.
      b. Unit shall be a titanium tube in insulated PVC shell type.
      c. Heat exchanger shell shall be constructed of PVC pipe with internal water baffles. Heat exchanger shell shall have at least 12 mm thick foam sheet insulation.
      d. Removable heat exchanger shell must be flanged on one end for ease of cleaning. Flange fasteners shall be 304 stainless steel.
      e. The shell shall have built-in titanium sensor well and air bleed. Shell water inlet and outlet shall have slip pipe disconnect unions.
   2. Heat Exchanger:
      a. Titanium tube material ASTM B338 0.75" OD Grade 2 welded tubing with a wall thickness of at least 0.35".
      b. Titanium tubes shall have internal augmentation and orifices to increase performance.
      c. Heat exchanger to be mounted on a 304 stainless steel stand with heat exchangers mounted horizontally or vertically on the stand.

J. Control & Refrigeration Components:
   1. Temperature controller with a digital display with a ± 0.3˚C differential
   2. Safety water flow switch
   3. Single phase / voltage monitoring
   4. Low/high pressure cut outs
   5. TXV's
   6. Sight glass and drier
   7. Unit is pre-wired and pre-charged with R-410A refrigerant. Contractor add charge where pre-charge is not adequate to fill field piping.

8. Each package shall cool when ambient air is at least as low as 20 ˚F.

K. Condenser Fans:
   1. Condenser Fans are direct drive with motors having thermal overland protection and permanently lubricated ball bearings

L. Stand: All heat exchanger components to be mounted on 1-1/2 IN square 16 gauge or stronger, 304 or 316 stainless steel tubing.

PART 3 - EXECUTION

3.1 EXECUTION OF WORK, CLEANUP, AND ADJUSTMENT

A. All work shall be executed with the maximum speed consistent with good workmanship. Upon completion of the Contract, all remaining materials and rubbish resulting from the Work shall be removed from the building and premises by the Contractor and the work areas shall be left clean and free from stains, mortar, paint spots, etc.

3.2 INSTALLATION

A. Incubation chilling systems shall be installed in accordance with manufacturer's written instructions. Mount outdoor unit on concrete pad.

B. Incubation chilling systems shall be tested, adjusted, and started in accordance with manufacturer's written instructions.

C. Contractor shall demonstrate incubation chilling system performance by operating system for four continuous hours, periodically changing the water temperature set-point and observing system achievement of set-points.

3.3 START-UP

A. Prior to Component Startup the Contractor shall have attained complete Operation and Maintenance Manuals from the supplier and submitted at least one copy to the Engineer. Another copy shall be kept at the site and made accessible to the Hatchery Manager. Other copies shall be per Division 1.

B. After the Contractor confirms that scheduled flowing water will be available to pass through the incubation chilling systems, the Contractor shall arrange to have a factory-authorized field technician to the project site for the purpose of verification of installation of the equipment and initial equipment programming start-up and calibration trouble-shooting and to train the Contractor how to operate so that the Contractor can later demonstrate operation during training.

3.4 TRAINING

A. The Contractor shall have a factory authorized field technician again review the installation, operate the incubation chilling systems on hatchery overflow water and train the hatchery personnel how to operate and maintain the drumfilter. This shall be done after the Startup. The Contractor shall coordinate the scheduling of this visit with the hatchery manager and the incubation chilling system manufacturer. This shall not be during the same week as the System Test. The Contractor shall submit written record of this training.

END OF SECTION

DIVISION 43

PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

SECTION 43 21 00
PUMPING EQUIPMENT - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pumping equipment.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 43 25 13 – Pumping Equipment – Septic System Pump

1.2 QUALITY ASSURANCE

A. Fully coordinate all mechanical seal systems specified to ensure pump and seal compatibility.

1.3 DEFINITIONS

A. The abbreviations are defined as follows:
   1. IPS: Iron Pipe Size.
   2. NPSHR: Net Positive Suction Head Required.
   3. TDH: Total Dynamic Head.
   4. TEFC: Totally Enclosed Fan Cooled.
   5. VFD: Variable Frequency Drive.

B. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 01 61 03.
   3. Product technical data including:
      a. Performance data and curves with flow (gpm), head (FT), horsepower, submergence requirement.
      b. Solids passage information.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 00 and 01 78 23 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
   1. Certifications:
      a. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pumps:
      a. See individual pump Specification Sections.
   2. Mechanical seals:
      a. Chesterton.
      b. Garlock.
      c. Or as noted in the individual pump Specification Sections.

2.2 CENTRIFUGAL PUMP DESIGN

A. Provide units with increasing head characteristics from the end run out portion of the curve to shut-off condition.

2.3 ACCESSORIES

A. See Specification Section 01 61 03.

B. Mechanical Seals:
   1. Provide as specified in the narrow-scope pump sections.

PART 3 - EXECUTION

3.1 INSTALLATION – SEE NARROW SCOPE PUMP SECTIONS

3.2 FIELD QUALITY CONTROL – SEE NARROW SCOPE PUMP SECTIONS

END OF SECTION

SECTION 43 21 13
INLINE CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Base Bid: Inline centrifugal pumps and accessories.
   2. Part of Deductive Alternate 4: Delete Inline centrifugal pumps tagged CLP-1 and CLP-2.

B. Related Sections include but are not necessarily limited to:
   1. Section 01 23 00 – Alternates
   2. Section 43 21 00 - Pumping Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. ASTM International (ASTM):
      a. A48, Standard Specification for Gray Iron Castings.
      b. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
   3. Hydraulic Institute (HI):
      a. Standards for Centrifugal, Rotary and Reciprocating Pumps.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Section 43 21 00.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Inline centrifugal pumps:
      a. Grundfos
      b. Taco

2.2 INLINE PUMPS

A. Split coupled, in-line, single-stage design, for installation in a vertical position motor up.

B. Pump volute shall be of Class 30 cast iron or ductile iron. The impeller shall be of cast iron, enclosed type, balanced to Hydraulic Institute Standards, keyed to the stainless steel shaft and locked. The pump shaft shall be guided by a carbon graphite lower throttle bushing.

C. Mechanical seal shall be tungsten vs tungsten or silicon carbide vs silicon carbide and have secondary seal.

D. Pumps shall be rated for continuous operation at a minimum of 175 psi working pressure and 250ºF. The volute shall have gauge tapings at the suction and discharge and vent and drain tapings at the top and bottom.

E. Motor shall be TEFC NEMA Premium Efficient with overload protection.

F. Each pump shall be hydrostatically tested at the factory per Hydraulic Institute standards. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

G. Pumps tagged in the Drawings TP-1 thru 3 shall be for 60 gpm @ 13' TDH, ¾ hp max., 2 inch connections such as Taco KS 2006 and Grundfos TP-50 Series and pump tagged TP-4 shall be for 35 gpm @ 6' TDH, ½ hp max., 1-1/2 inch connections such as Taco 1506 and Grundfos TP-40 Series. All are 1800 rpm, 208 volt 1 phase. .

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 43 21 00.

3.2 FIELD QUALITY CONTROL

A. See Section 43 21 00.

END OF SECTION

43 25 13.1
SUBMERSIBLE PUMPS STATIC MIXERS

PART 1 - PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submersible pumps, lift out check valves, rail systems and controls.
   2. Static Mixers
B. Related Specification Sections include but are not necessarily limited to:
   1. Division 01 - General Requirements.
   2. Section 26 05 00 - Electrical: Basic Requirements.
   3. Section 43 21 00 - Pumping Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI).
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   3. National Fire Protection Agency (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 500, Hazardous (Classified) Locations, Classes I, II, and III, Divisions 1 and 2.
   4. Underwriters Laboratories, Inc. (UL).
      a. 62, Flexible Cord and Fixture Wire

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Requirements in Specification Section 43 21 00.
B. Operation and Maintenance Manuals:
   1. See Specification 01 33 00 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Submersible Pumps tagged in the Drawings WRP-1 thru 6 for Walleye Reuse Pumps:
      a. Ebara
      b. Mody
      c. Tsurumi
   2. Submersible Pumps tagged in the Drawings ERP-1 & 2 for Esocid Reuse Pumps.
      a. Zoeller
      b. Liberty
   3. Rail and Lift Out Check Valve System:
      a. Jackel Engineered Products

4. Static Mixers
    a. Komax
    b. Koflo
    c. Filter Tech Systems, Grand junction, CO

2.2 ESOCID RESUE PUMPS

A. CONSTRUCTION: Stainless body or epoxy or powder coated body of class 25 cast iron. All mating parts shall be machined and sealed with a Buna-N O-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring. The pump shall be furnished with stainless steel handle.

B. ELECTRICAL POWER CORD: The submersible pump shall be supplied with multiple conductor power cord capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code.

C. MOTORS: Three phase motors, overload protection incorporated into control panel, Class B or better insulation, rated for continuous duty at not less than 104 F.

D. BEARINGS AND SHAFT: Upper and lower ball bearings, permanently lubricated. The motor shaft shall be made of stainless steel.

E. SEALS: The pump shall have a unitized carbon/ceramic seal, with stainless steel housing. The motor plate/housing interface shall be sealed with a neoprene or Buna-N ring.

F. IMPELLER: Bronze or cast iron.

G. CONTROLS: See Float Switches and see Control Panel under PUMP ACCESSORIES later.

H. PERFORMANCE AND MAKES AND MODELS: 30 gpm to at least 41’ TDH, 208 volt 3 phase motor of 6/10 horsepower max., 1-1/2” female threaded vertical outlet, 80 lbs weight max., Zoeller J161 or Liberty FL63M Series.

2.3 WALLEYE REUSE PUMPS

A. General:
    1. Ebara 80DWP63 or Mody M204T or Tsurumi KTZ 32.2
    2. Maximum 3 HP motor, 208VAC, 3PH, 60Hz.
    3. The design point is 115 gpm at 45 ft TDH.
    4. Discharge 3 inch vertical out top of motor. Max. weight 77 lbs.
    5. Provide pumps capable of handling solid sizes schedule one the Drawings.
    6. Where watertight sealing is required, machine and fit mating surfaces with O-rings.
    7. Provide with heavy duty lift lugs or hoisting bail designed for lifting the entire pump and motor assembly.
    8. Round hole cylindrical intake strainer.

B. Impeller:
    1. Provide non-clog type dynamically balanced impeller of stainless steel or hi chrome iron.

C. Shaft:
    1. Design pump shaft of sufficient size to transmit full driver output.
    2. Use shaft which is accurately machined and constructed with sufficient materials.
    3. Shaft shall be 400 series stainless steel.

D. Shaft Seal:
    1. Seal shaft with two seals running in an oil filled chamber. At least one seal face shall be silicon carbide or tungsten carbide.
    2. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.

E. Motors:
   1. Suitable for operating with a variable frequency drive.
   2. Motors shall have internal thermal overload protection.
   3. Provide motor of totally submersible design, constructed with epoxy or poly-seal encapsulated windings, with Class F or better insulation and rated for continuous duty operation.
   4. Assure motor is capable of running dry for extended periods without damage to motor or seal.
   5. The motor horsepower provided shall be adequate for all points on the pump curve.
F. Power and Control Cables:
   1. Provide power and control cables which are listed and labeled per NEC requirements and approved for the installation types indicated on the drawings. As a minimum the cable shall be suitable for installation in conduit, submersible applications, and cable tray. The cable and markings shall conform to NEC requirements and indicate AWG size, listing agency, and suitability for installation types listed above.
   2. Provide length of power cable and control cable as needed for the project base on study of the Drawings.
G. Controls: See Electrical Drawings and Electrical Specifications.

2.4 PUMP ACCESSORIES

A. See Specification Section 43 21 00.
B. Float switches:
   1. Provide sealed, float-type switches to control pumps and provide alarm signal.
   2. Suspend floats on a dedicated stainless steel cable stainless steel cable clamps to set level.
   3. Provide floats to operate at elevations shown on Drawings.
   4. Design floats to be field-adjustable.
   5. At least three (3) floats:
      a. One (1) for lead pump start.
      b. One (1) for lag pump start and alarm.
      c. One (1) for pumps to stop.
C. Control Panel
   1. Control panel shall automatically restart after power interruptions.
   2. Provide combination magnetic motor starter(s).
   3. Provide motor protective switches with overload protection.
   4. Include a terminal board for connection of level sensors.
   5. NEMA 4X enclosure.
   6. Hand-Off-Automatic selector switches.
   7. Automatic alternator.
   8. High level alarm with alarm horn, silence pushbutton, and alarm light.
   9. Pump running lights.
   10. Pump sequence selector switch which overrides automatic alternator.
   11. Float switch test pushbuttons.
   12. Auxiliary contacts wired to terminal blocks.
   13. Power ON control relay.
   14. Inner door in cabinet-mounted on a continuous vertical steel hinge; size to completely cover wiring and components mounted on the back panel; provide for mounting of controls and instruments on inner door.
   15. At least three level float switch operation.
D. Rail and Lift Out Check Valve System for Esocid Reuse Pumps with 1-1/2” vertical discharges:
   1. Provide package including stainless rails, lifting cables or chains, pump discharge brass sliding disconnect and a stainless steel threaded drop pipe with an epoxy coated iron wye pattern ball check valve that comes out of the pit with the pump when the pump is lifted straight up and away from the sliding quick disconnect. Also provide galvanized steel or SCH 80 PVC header with brass gate valves with extended handles.

2.5 STATIC MIXERS

A. PVC or stainless steel mixing elements in a flanged PVC body no thinner than Schedule 40.
B. Three stage. Project Drawings are based on not using a factory side port.
C. For units tagged SM-1 thru 3 in the Drawings, diameter shall be 8" and pressure drop at 175 gpm shall be 0.5 ft water max. and for unit tagged SM-4, diameter shall be 4" and pressure drop at 65 gpm shall be 0.9 ft water max.

PART 3 - PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 43 21 00.
B. Seal pump cable end with a high quality protective covering, to make it impervious to moisture or water seepage prior to electrical installation.

3.2 FIELD QUALITY CONTROL

A. See Specification Section 43 21 00.

END OF SECTION

SECTION 43 27 73
STACKED DISCFILTER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The work under this section shall consist of providing all work, materials, labor, tools, and services necessary to provide for stacked discfilter systems with air aided backwash in accordance with provisions of Contract Documents. This section includes specifications for full-stream automatic disc filter system with air aided backwash, including all valves for automatic operation, a backwash controller, accumulator, filter or filters for compressed air and all related accessories as hereinafter specified - to perform the intended function and achieve a fully integrated and operational filtration system. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment application. Completely coordinate with work of other trades.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 01 79 02 - Component and System Verification.
   4. Section 40 05 00 - Pipe And Pipe Fittings: Basic Requirements

1.2 REFERENCE

A. Applicable provisions of DIVISION 1 govern work under this section.

1.3 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Specification Section 01 25 00

1.4 SUBMITTALS

A. All submittals are to comply with submission and content requirements specified within Section 01 33 00.

B. Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories. Submit installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23.

B. In addition to the general content specified under 01 33 00, supply the following additional documentation:
   1. Installation instructions.

PART 2 - PRODUCTS

2.1 STACKED DISCFILTER SYSTEMS (TAGGED ON DRAWINGS AS DCF-1, DCF-2, DCF-3 AND DCF-4)

A. The contractor shall provide an automatic stacked discfilter system with the capability of initiating a backwash cycle based on differential pressure, elapsed time, or a manual backwash. The automatic stacked discfilter system shall consist of at least (3) filter housings or pods (two pods for unit tagged DCF-4) with 2” inlet/outlet connections, 3 or 4” Type 304 stainless steel or

plastic inlet/outlet manifolds (with 3" connections to accept 3" inlet/outlet connections on individual filter housings) and accumulator, backwash exhaust manifold and backwash source manifold, pneumatically-actuated backwash and accumulator valves, solenoid valves, motor starter, and controller. Contractor shall connect 3" SCH 80 PVC pipe to the inlet and outlet.

B. Flow shall continue out of the system to the process even during a backwash cycle.

C. Width shall not exceed 32 inches. Length of units with 3 filtering pods shall not exceed 48 inches and length of units with 2 filtering pods shall not exceed 37 inches.

D. Filter system and all ancillary equipment, valves, and controls required for automatic operation of the filter system shall be mounted on adjustable pipe supports and stands of the system manufacturer.

E. To ensure unity of responsibility, the complete filter system and associated controls shall be furnished and coordinated by filter manufacturer. The contractor shall assume full responsibility for the satisfactory installation of the filter system as specified and directed by manufacturer.

F. All equipment furnished under these specifications shall be new and unused and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and system specified herein for a minimum of twelve (12) years including at least 4 years in North America.

G. Provide an automatic stacked discfilter with 150-pound stainless steel or plastic flanged inlet/outlet connections complete with 3-dimensional disc media with openings that measure not more than 50 microns across.

H. Filter system shall be capable of backwashing based on differential-pressure, elapsed time (or a combination of DP and elapsed time) - or manually by the operator.

I. Operating conditions are as follows:

1.	System clean pressure drop:	1-2 psi
2.	System dirty pressure drop:	5 psi
3.	Max. water lost to backwash per pod:	5.8 gallons
4.	Max. backwash duration per pod:	8.8 seconds
5.	Dwell time between backwashes:	20-25 seconds
6.	Compressed air pressure:	65 psi
7.	Compressed air flow demand max:	5.3 cfm
8.	Controller voltage:	120
9.	Minimum Flow Rate:	30-GPM for DCF-1 to 3; 8 gpm for DCF-4
10.	Maximum Flow Rate:	115-GPM at DCF-1 to 3; 30 gpm at DCF-4
11.	Minimum Operating Temperature (water):	35 degrees F
12.	Maximum Operating Temperature (water):	140 degrees F
13.	Minimum Operating Backpressure Pressure:	5 PSI
14.	Maximum Operating Pressure (PSI):	140 PSI

J. Each filter housing shall be injection-molded of Polyamide with EPDM internal gasket material. System shall be fully assembled at factory using grooved couplings.

K. Filter disc cartridges shall be comprised of a compressed stack of vertically stacked injection-molded Polypropylene 3-dimensional discs.

L. Each individual disc shall be 5.125 inches in outside diameter and 4.010 inches in inside diameter.

M. Each disc cartridge shall have an external filter surface area of 228 square inches minimum and a volume of 113 cubic inches minimum.

N. Intrinsic to the design, during filtration mode, filter shall incorporate a fluid spinning turbine mechanism inside filter housing at the base of each disc cartridge, generating a centrifugal effect. This centrifugal effect shall spin heavier particles (i.e. sediment) to the outer wall of filter housing, away from the disc stack located in the inner portion of housing. The purpose of the

centrifugal action is to minimize loading of the disc media; therefore, minimizing backwash frequency – ultimately minimizing overall backwash water volume.

O. A differential-pressure switch shall be provided with the filter system integrated with the backwash controller, sensing the differential-pressure across the inlet and outlet manifold of the filter system, capable of initiating a backwash cycle based on a preset (but adjustable) differential-pressure.

P. Filter system shall be furnished with an air-assist backwash to minimize loss of water from the system. Compressed air is to push filtered water out of an accumulator to backwash a pod.

Q. Filter housings shall sequentially backwash, accomplished by 3-way backwash valves installed on the inlet side of each filter housing. Actuation of 3-way backwash valves is controlled by solenoid valves furnished with system. Backwash water flow direction shall be from the inside of the of the disc media - to the outside. During backwash, the disc media is decompressed causing disc media to be free-floating. Simultaneously with the decompressing of the disc media, clean water from the outlet manifold of the filter is introduced from the inner diameter of the disc stack. The backwash spray is introduced tangentially to the disc media, causing a high velocity spinning action of the disc media.

R. The backwash exhaust manifold of the filter system shall be 3" dia.

S. The backwash source manifold of the filter system shall be 3" dia.

T. Controller shall consist of a Controller equipped with sufficient memory and I/O's, to control all critical functions of filter operation; including monitoring the differential-pressure switch, and controlling valve operation. A corrosion resistant factory stand shall be provided for the controller.

U. Filter controller shall be programmed to be capable of automatically controlling and monitoring the filter system and capable of the following:
   1. Real-time system status on LCD display
   2. Elapsed time since last backwash (and display reason for last backwash)
   3. Adjustable dwell time and duration of backwash.
   4. Trip and life backwash counter (including a trip reset)
   5. Output Voltage 24VDC

V. Controller shall:
   1. Be in a NEMA 4X or IP55 enclosure.
   2. Include an auto-resetting surge suppression device.
   3. Be ready for sequencing of operation including a low pressure switch to activate/de-activate the controller.

W. Compressed Air:
   1. The facility already has an oil lubricated Ingersoll Rand 5 hp reciprocating air compressor rated 135 psi with a 60 gallon receiver. They also have a refrigerated air dryer. Some air from it shall be piped to the discfilter controller which shall have any air, water and oil filter or filters recommended by the discfilter system manufacturer for protection of the discfilter controls.

X. Manufacturers
   1. Azud/Luxud, LLC model Helix Automatic 203/3VX AA and 202/3VX are depicted in the Drawings and all require controllers.

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

A. Filtration system shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the equipment is ready for startup and operation.

3.2 INSTALLATION

A. Install units as shown on plans, as detailed and according the manufacturer's installation instructions.

3.3 START-UP AND COMPONENT VERIFICATION

A. Prior to A/E observed Component Verification the Contractor shall have attained complete Operation and Maintenance Manuals from the supplier and submitted at least one copy to the Architect/Engineer's corporate home office. Another copy shall be kept at the site and made accessible to the Architect/Engineer. Other copies shall be per Division 1.

B. After the Contractor confirms that scheduled flowing water will be available to pass through the discfilter units, the Contractor shall arrange to have a factory-authorized field technician to the project site for the purpose of verification of installation of the equipment and initial equipment start-up and trouble-shooting. The technician shall also train the Contractor how to operate the equipment so that the Contractor can demonstrate operation to the A/E during the Component Verification visit.

3.4 AGENCY TRAINING

A. The Contractor shall have a factory authorized field technician review the installation, operate the equipment using hatchery water and give 4 hrs. hands-on training to the using Agency staff on how to operate and maintain the equipment. The Contractor shall coordinate the scheduling of this visit with the hatchery manager and the equipment maker's authorized representative. This shall occur between the weeks of A/E observed Component Verification and A/E observed System Test.

B. The Contractor shall make a factory-authorized field technician make another visit between 3 and 9 months after Agency Training at a time agreed upon by the hatchery manager for a period of four (4) working hours for the purpose of inspection of the equipment and re-training the facility personnel on proper operation and maintenance procedures.

END OF SECTION

SECTION 43 41 26
AQUACULTURE TANKS & HATCHING JARS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The work includes furnishing all labor, materials and equipment for the installation of fiberglass aquaculture tanks (fry tanks, walleye fry tanks, musky fry tank(s), fry transfer tank(s), walleye reuse pump sumps) and hatching jars as indicated in the Drawings and as specified herein.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 – Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 SUBMITTALS

A. Provide the following submittals in accordance with Specification Section 01 33 00.
   1. For any tank larger than 8’ diameter or more than 8’ long, submit documentation signed and sealed by a licensed professional engineer with fiberglass tank design experience indicating that the design and proposed construction of the FRP tanks meets the deflection specified herein and specified in AWWA F101-02 Standard for Contact-Molded, Fiberglass-Reinforced Plastic Wash Water Troughs and Launders.
   2. Shop Drawings. Shop drawings of fiberglass tanks shall be submitted showing details of construction and layouts for review and acceptance before materials are fabricated.
   3. Product Data. Submit manufacturer’s printed literature for care and maintenance for review and acceptance.
   4. Color samples.

PART 2 - PRODUCTS

2.1 FIBERGLASS TANK REQUIREMENTS

A. Acceptable Manufacturers
   1. Reiff Manufacturing
   2. C.F. Maier

B. Description of Fiberglass Tanks
   1. Provide fiber-reinforced plastic tanks complete and ready for piping hookup and installation. The tanks are to be used for the production of fish in water temperatures ranging from 60 to 75 degrees F. The tanks are to be used for interior and exterior application as indicated on the Drawings and may be subjected to the maximum ambient temperature range and fluctuations for the geographical location.
   2. Tanks shall conform to all dimensions and have the features indicated on the Drawings. Contractor shall verify tank dimensions and resolve any spacing changes required prior to installation. Units to be provided with exterior, integral reinforcement, sufficient to maintain less than 1/4" total wall deflection at midpoint and 3/32” rim and floor deflection when filled to top with water. Tanks shall be structurally designed by the manufacturer for sitting on bottom supports as shown on the Drawings, water filled to top. Tank stability shall be such that they can be moved empty with a forklift in the center or can be carried by each end without causing deformation or damage to the unit.
   3. Tanks shall be supplied colors selected by DNR.
   4. Tank standpipe sockets, screen recesses, bulkheads (tank adapters), drain couplings, etc. shall be fabricated for use as shown on the project plans.
   5. The DNR will fabricate their own screens.

C. Extended Warranty
   1. The tanks shall be warranted in writing for a period of three (3) years from the date of substantial completion and acceptance. This date shall be confirmed in writing. The warranty shall include defective work, breakage, deformation, cracking, delamination, leakage and loss of finishes or fading of color.

2.2 FIBERGLASS TANK MATERIALS

A. The Contractor shall not install any material containing cadmium, brass, bronze, copper, zinc, or their alloys, which could come in contact with fish rearing water. These heavy metal materials have been shown to be toxic to fish.

B. Resin
   1. The resin shall be US FDA-approved for use with foods and potable water. The resin, unless otherwise specified shall be as produced by Reichhold, Dow, Ashland or approved equal. The same resin shall be used throughout the laminate unless otherwise specified.
   2. An isophthalic polyester resin, rated for use in fresh water applications at temperatures up to 65.6°C (150°F), shall be used for all FRP vessels, except where contact with ozone could occur when an ozone-resistant epoxy vinyl ester resin such as Derakane 411 by Ashland shall be used.
   3. The resin used shall not contain fillers, unless specified. When specified up to 2% by weight thixotropic agent, Cab-O-Sil, or equal, may be used for viscosity control in the paraffinated top coat on vertical surfaces, provided it will not interfere with visual inspection.
   4. Unless otherwise agreed upon by the manufacturer and the Engineer, the cure system used for the resin shall be in accordance with the resin manufacturer's current recommendations. Proper curing of the resin is the FRP vessel manufacturer's responsibility. All products fabricated to this specification shall be cured to at least 90% of the minimum Barcol Hardness specified by the resin manufacturer. This requirement applies to both interior and exterior surfaces. (Note: The use of paraffin in the resin or the use of synthetic veil may lower the Barcols below the resin manufacturer's specifications, this is acceptable.)
   5. No chemical-resistant surface, interior or exterior, shall be acetone sensitive.

C. Reinforcement
   1. Woven roving shall be Type E (electrical borosilicate) glass, nominal 24 oz./sq. yd., 4 by 5 weave, with a silane-type finish and a binder compatible with the lay-up resin.
   2. Chopped strand mat shall be Type E glass, 1-1/2 oz. per sq. ft., with a silane finish and a styrene-soluble reactive binder.
   3. Continuous roving used in chopper gun for spray-up shall be Type E.

D. Laminate Construction
   1. The vessel shall be constructed using a multi-layered system consisting of, at minimum, the following layers:
      a. Polyester gel coat
      b. Chop strand fiberglass
      c. Woven roving
      d. Chop strand fiberglass
      e. Polyester gel coat
   2. The minimum thickness shall be 3/16 inches (4.763 mm).
   3. The inner surface of each tank shall be smooth from a molded surface and consist of a polyester gel coat 15 to 18 mil thick and dark green in color. The exterior of each tank shall be finished with a polyester gel coat a minimum of 10 mil thick and dark green in color.
   4. All factory perforations must be sealed with resin and gel coat. Field cut perforations may be sealed with epoxy or polyester resin and gel coat or with marine grade sealant.

5. A visual inspection of the laminate shall be made by the manufacturer. ASTM D2563 shall be used for quality control of construction. Laminate defects and the permissible limits shall be in accordance with the following table:

Defect	Process Surface	None Process Surface
Blisters	None	Max ¼ inch diameter, 0.0625 inch high
Burned Areas	None	None
Chips	None	Max ¼ inch with max thickness 20% of wall
Cracks	None	None
Crazing	None	Slight
Dry Spots	None	Max 2 sq. in./sq. ft.
Entrapped Air	None at surface	0.125 inch diameter max; no more than 3% laminate, 0.0625 inch diameter of area, max 10/sq. in.
Exposed Glass	None	None
Exposed Cut Edges	None	None
Foreign Mater	None	None if it effects the properties of the laminate
Pits	Max 0.125 inch by 0.03125 inch deep, max 10/sq. ft.	Max 0.125 inch diameter by 0.0625 inch deep
Scratches	None (Coated)	None (Coated)
Surface Porosity	None	None
Wrinkles	Max deviation 20% of wall thickness	Max deviation 20% of wall thickness
Sharp Discontinuity	None	None

2.3 FIBERGLASS TANK COMPONENTS

A. Use 316 stainless steel fasteners where required to assemble component pieces unless noted otherwise.

B. Provide casters or legs where Drawings indicate.

2.4 HATCHING JARS

A. Provide 6.25” diameter x 18-1/4” high acrylic fish egg hatching jars complete with fish filter screen and internal fill pipe at locations shown on this project’s process Drawings.

B. Suppliers:
1. PENTAIR Aquatic Eco-Systems, Inc., Apopka, FL.
2. Global Aquaculture Supply, Alton, IA.
3. Fish Farm Supply Co., Elmira, Ontario.

PART 3 - EXECUTION

3.1 FIBERGLASS TANK INSTALLATION AND DELIVERY

A. The fiberglass tank manufacturer shall review and certify in writing that all installation requirements as shown on the plans are in accordance with design character and limitations of the unit.

B. The tanks are to be covered and protected to prevent damage in shipment and handling. All finished surfaces are to be protected. Tanks shall not be stored in the open at manufacturer’s site or at job site. Any damage to the units incurred in transit and unloading will be the responsibility of the manufacturer. Permits, import requirements, and precautionary measures required for highway transport are the entire responsibility of the manufacturer.

C. The manufacturer shall be responsible for delivering and supervising the unloading of the units at the hatchery. Visually imperfect units will be rejected. The manufacturer and Contractor shall fully cooperate in the unloading and installation of the units at the hatchery.

D. The manufacturer shall fully cooperate and will assist the Contractor with respect to the tank shipping and loading/unloading schedule. The shipping schedule shall conform to the project completion schedule.

E. The manufacturer must provide a qualified site representative with the first shipment of units to the project site to insure proper unloading, handling and final installation. The Contractor will provide equipment to handle and install the tanks in strict accordance with the manufacturer's instructions.

F. All minor defects must be refinished by the manufacturer prior to completion of the Project and acceptance by the owner's representative. The refinished surface shall show no discernible variations in appearance from the surrounding areas. The Contractor and manufacturer shall cooperate in this requirement; the intent is to provide high quality, identical rearing units. The Contractor must take all necessary precautions to protect the tanks during completion of this project.

G. Prior to shipment, the tanks shall be cleaned to remove any residual parting agent, film or other deleterious material. The units shall be carefully cleaned (per the manufacturer's instructions) prior to completion of the project.

H. The Fish Culture tank installation shall be coordinated with the process piping and other aquaculture equipment. Elevation of equipment should conform to the requirements of the engineer responsible for system hydraulics.

3.2 FIBERGLASS TANK ADJUSTING

A. Upon completion of the installation, the fish culture tanks shall be tested for satisfactory operation. All equipment shall be adjusted and checked for alignment, levelness, clearances, supports, and adherence to safety standards, until found satisfactory. This work will be performed by the Contractor

3.3 FIBERGLASS TANK DEMONSTRATION

A. Test for leaks and defects in the fish culture tanks and parts of existing piping that have been altered, extended or repaired. Perform hydrostatic testing in accordance with manufacturer's instructions and test to design flow conditions. Repair leaks and defects with new materials and retest until satisfactory results are obtained.

END OF SECTION