SOLICITATION NO: W912P620B0002

US Army Corps of Engineers®
CHICAGO DISTRICT
LEADERS IN CUSTOMER CARE

LEVEE 37 PUMP STATION UPGRADE
VILLAGE OF MOUNT PROSPECT

CONSTRUCTION SOLICITATION AND SPECIFICATIONS

Certified Final Documents – Ready to Advertise
W912P620B0002
March 31, 2020

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SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO. W912P620B0002	2. TYPE OF SOLICITATION [X] SEALED BID (IFB) [ ] NEGOTIATED (RFP)	3. DATE ISSUED 31-Mar-2020	PAGE OF PAGES 1 OF 49

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO. W81G6693097811	6. PROJECT NO.

7. ISSUED BY CODE W912P6	8. ADDRESS OFFER TO (If Other Than Item 7) CODE
U.S. ARMY ENGINEER DISTRICT, CHICAGO 231 SOUTH LASALLE STREET SUITE 1500 CHICAGO IL 60604-1437 TEL: 312.846.5371 FAX:	**See Item 7** TEL: FAX:

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS)
	ERICKA D. HILLARD	312-846-5378

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

Project Title: Levee 37 Pump Station Upgrade, Village of Mount Prospect, Cook County, Illinois (USACE Acquisition)

Project Description: The Contractor will be required to perform: An additional pump station, adjacent to the existing pump station #2 with total capacity of 120 cfs, will be constructed. The design intent is to raise the level of protection by increasing the pumping capacity and perform other improvements. The three submersible axial flow pumps, 40 cfs each, will satisfy the pumping capacity requirement. Each pump will be installed inside the wet well and will be equipped with a Formed Suction Intake (FSI) unit which will ensure smooth laminar type flow towards the pump's suction side.

COMPETITION FOR THIS ACQUSIITION IS RESERVED EXCLUSIVELY for eligible Small Business Concerns. The North American Industry Classification (NAICS) Code is 237110, with a size standard in dollars of $39.5M

The estimated Magnitude of Construction cost is between $1M and $5M

Applicable Construction Wage Rates are contained under General Decision Number: IL20200009 02/07/2020 and are attached hereto

ELECTRONIC AND FAXED BIDS WILL NOT BE ACCEPTED. SPLIT AWARDS WILL NOT RESULT FROM THIS ACQUISITION. WHEREIN STATED IN THIS SOLICITATION "OFFER OR OFFEROR", IT MEANS BID OR BIDDER

DRAFT

11. The Contractor shall begin performance within 10 calendar days and complete it within 365 calendar days after receiving [ ] award, [X] notice to proceed. This performance period is [X] mandatory, [ ] negotiable. (See Sect. 00 70 00 .)

12 A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12B.) [X] YES [ ] NO	12B. CALENDAR DAYS 10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 1 copies to perform the work required are due at the place specified in Item 8 by 01:00 PM (hour) local time 25 Feb 2020 (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee [X] is, [ ] is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

SOLICITATION, OFFER, AND AWARD (Continued)

(Construction, Alteration, or Repair)

OFFER ***(Must be fully completed by offeror)***

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*		15. TELEPHONE NO. *(Include area code)*
		16. REMITTANCE ADDRESS *(Include only if different than Item 14)* **See Item 14**
CODE	FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirements stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)*

AMOUNTS	SEE SCHEDULE OF PRICES

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each)

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*	20B. SIGNATURE	20C. OFFER DATE

AWARD ***(To be completed by Government)***

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified)*	**ITEM**	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 U.S.C. 2304(c) ☐ 41 U.S.C. 253(c)
26. ADMINISTERED BY	CODE	27. PAYMENT WILL BE MADE BY: CODE

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return _____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.		☐ 29. AWARD *(Contractor is not required to sign this document.)* Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*		31A. NAME OF CONTRACTING OFFICER *(Type or print)* TEL: EMAIL:
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY
		31C. AWARD DATE

DRAFT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001		1	Job		

MOBILIZATION (BASE)
FFP
Under this CLIN, the contractor is required to perform mobilization activities. The contractor will be compensated for the totality of its activities needed to mobilize its equipment and labor force to the project site.

Payment Provisions: The Government will pay all costs for the mobilization of all of the Contractor's plant and equipment at the lump sum price for this item. The Contracting Officer or its Representative may require the Contractor to furnish cost data to justify its bid price for this item if the Contracting Officer deems there's no reasonable relationship to the cost of the work in this contract. Failure to justify the line item price to the satisfaction of the Contracting Officer will result in payment determined by the Contracting Officer of the actual costs, which is not subject to appeal.
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0002		1	Job		

DEMOBILIZATION (BASE)
FFP
Under this CLIN, the contractor is required to perform demobilization activities.The contractor will be compensated for the totality of its activities needed to demobilize its equipment and labor force to the project site.

Payment Provisions: The Government will pay all costs for the demobilization of all of the Contractor's plant and equipment at the lump sum price for this item. The Contracting Officer or its Representative may require the Contractor to furnish cost data to justify its bid price for this item if the Contracting Officer deems there's no reasonable relationship to the cost of the work in this contract. Failure to justify the line item price to the satisfaction of the Contracting Officer will result in payment determined by the Contracting Officer of the actual costs, which is not subject to appeal.
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0003		1	Job		

TEMPORARY CONSTRUCTION FACILITIES (BASE)
FFP
& CONTROLS
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004		1	Job		
	MAINTENANCE OF TRAFFIC (BASE) FFP PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005		1	Job		
	DEMOLITION AND REMOVAL (BASE) FFP PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0006		1	Acre		
	CLEARING AND GRUBBING (BASE) FFP PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0007		1	Job		

REINFORCED CONCRETE STRUCTURE (BASE)
FFP
AND MISCELLANEOUS METAL

For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.1.6.
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0008		1	Job		

AXIAL FLOW PROPELLER PUMP (BASE)
FFP
The work for this Contract Line Item includes but is not limited to: three axial flow pumps, three FSI devices, 30" discharge pipe with flanges, three discharge columns, three 6" steel pipe air vents, pump/pipe supports.

Full requirements are located at the Project Specifications, Section 35 45 02.00 10.

The FSI devices, the discharge pipe with flanges, 6" stell pipe air vent, the discharge columns, pump/pipe supports shall be painted in accordance with paragraph "COLE TAR EPOXY PAINTING SYSTEM" Project Specifications, Section 33 61 13.19.
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0009		1	Job		

SUMP PUMP (BASE)
FFP
The work for this Contract Line Item includes but is not limited to: one sump pumps, 6" discharge pipe with flanges, an air release valve, pump/pipe supports.

Full requirements are located at the Project Specifications, Section 33 61 13.19.

The discharge pipe with flanges, pump/pipe supports shall be painted in accordance with paragraph "COLE TAR EPOXY PAINTING SYSTEM" Project Specifications, Section 33 61 13.19.
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0010		3	Each		

FLAP GATE (BASE)
FFP
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0011		1	Each		
	DUCKBILL VALVE (BASE) FFP PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0012		1	Job		
	ELECTRICAL COMPONENTS (BASE) FFP For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.1.9. PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0013		1	Job		
	SEEDING (BASE) FFP For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.1.10. PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0014		1	Job		
	TOPSOIL (BASE) FFP For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.1.11. PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0015		1	Job		
	CLOSURE STRUCTURE 6 (BASE) FFP MODIFICATIONS PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0016		45	Linear Foot		

5' X 5' CULVERT (BASE)
FFP
For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.2.4.
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0017		1	Job		

PUMP STATION #2 MODIFICATIONS (BASE)
FFP
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0018		37	Linear Foot		

6' X 4' CULVERT (BASE)
FFP
For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.2.5.
PURCHASE REQUEST NUMBER: W81G6693097811

NET AMT

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0019		1	Job		
	PUMPSTATION OUTLET (BASE) FFP PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0020		1	Lot		
	PERFORMANCE AND PAYMENT BOND (BASE) FFP FOR BID ITEMS 0001 THROUGH 0019 THIS IS A COST-REIMBURSABLE LINE ITEM - The government will reimburse the Contractor for the actual cost of acceptable performance and payment bonds, upon receiving evidence of payment (paid invoice) from the bonding company or agency, not to exceed the total amount of the contract line item. The Government will not pay more than the total line item amount for the performance and payment bonds. If the actual cost of the bonds is less than the line item amount, the contract will modified to adjust the line item accordingly. Adjustment(s) to the line item will also be made for any revisions to the actual bond costs associated with contract changes. PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0021		1	Job		
OPTION	DEMOLITION AND REMOVAL (OPTION) FFP PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0022		1	Job		
OPTION	BACKFLOW STRUCTURE #1 (OPTION) FFP MODIFICATIONS PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0023		75	Linear Foot		
OPTION	6' X 4' CULVERT (OPTION) FFP For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.2.5. PURCHASE REQUEST NUMBER: W81G6693097811				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0024 OPTION	SEEDING (OPTION) FFP For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.1.10. PURCHASE REQUEST NUMBER: W81G6693097811	1	Job		
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0025 OPTION	TOPSOIL (OPTION) FFP For the work involved for this Contract Line Item, the Contractor shall refer to the Project Specifications, Section 01 22 00, para 1.1.11. PURCHASE REQUEST NUMBER: W81G6693097811	1	Job		
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0026		1	Job		
OPTION	PRIMARY DUCT BANK (OPTION) FFP				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0027		1	Job		
OPTION	750 KVA PAD MOUNT SERVICE (OPTION) FFP TRANSFORMER				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0028		1	Lot		
OPTION	PERFORMANCE AND PAYMENT BOND (OPTION) FFP FOR BID ITEMS 0021 THROUGH 0027 THIS IS A COST-REIMBURSABLE LINE ITEM - The government will reimburse the Contractor for the actual cost of acceptable performance and payment bonds, upon receiving evidence of payment (paid invoice) from the bonding company or agency, not to exceed the total amount of the contract line item. The Government will not pay more than the total line item amount for the performance and payment bonds. If the actual cost of the bonds is less than the line item amount, the contract will modified to adjust the line item accordingly. Adjustment(s) to the line item will also be made for any revisions to the actual bond costs associated with contract changes. PURCHASE REQUEST NUMBER: W81G6693097811				

NET AMT

SUMMATION OF BID PRICES

TOTAL AMOUNT FOR BASE WORK (ITEM Nos 0001 THROUGH 0020):
$_____

TOTAL AMOUNT FOR THE OPTION ITEMS (OPTION LINE ITEMS 0021 THROUGH 0026):
$_____

OVERALL TOTAL BID AMOUNT: (LINE ITEMS 0001 THROUGH 0026):
$_____

Section 00 21 13 - Instructions to Bidders

CLAUSES INCORPORATED BY REFERENCE

52.204-7	System for Award Management	OCT 2018
52.204-16	Commercial and Government Entity Code Reporting	JUL 2016
52.204-18	Commercial and Government Entity Code Maintenance	JUL 2016
52.214-3	Amendments To Invitations For Bids	DEC 2016
52.214-4	False Statements In Bids	APR 1984
52.214-5	Submission Of Bids	DEC 2016
52.214-6	Explanation To Prospective Bidders	APR 1984
52.214-7	Late Submissions, Modifications, and Withdrawals of Bids	NOV 1999
52.214-18	Preparation of Bids-Construction	APR 1984
52.214-19	Contract Award-Sealed Bidding-Construction	AUG 1996
52.214-34	Submission Of Offers In The English Language	APR 1991
52.232-15	Progress Payments Not Included	APR 1984
252.204-7008	Compliance With Safeguarding Covered Defense Information Controls	OCT 2016
252.236-7008	Contract Prices-Bidding Schedules	DEC 1991

CLAUSES INCORPORATED BY FULL TEXT

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a FIRM FIXED PRICE Construction contract resulting from this solicitation.

(End of provision)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of provision)

52.222-5 CONSTRUCTION WAGE RATE REQUIREMENTS--SECONDARY SITE OF THE WORK (MAY 2014)

(a)(1) The offeror shall notify the Government if the offeror intends to perform work at any secondary site of the work, as defined in paragraph (a)(1)(ii) of the FAR clause at 52.222-6, Construction Wage Rate Requirements, of this solicitation.

(2) If the offeror is unsure if a planned work site satisfies the criteria for a secondary site of the work, the offeror shall request a determination from the Contracting Officer.

(b)(1) If the wage determination provided by the Government for work at the primary site of the work is not applicable to the secondary site of the work, the offeror shall request a wage determination from the Contracting Officer.

(2) The due date for receipt of offers will not be extended as a result of an offeror's request for a wage determination for a secondary site of the work.

(End of provision)

52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
19.6%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. 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, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the --

(1) Name, address, and telephone number of the subcontractor;

(2) Employer's identification number of the subcontractor;

(3) Estimated dollar amount of the subcontract;

(4) Estimated starting and completion dates of the subcontract; and

(5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is Illinois, county of Cook, and Village of Mount Prospect.

(End of provision)

52.225-10 NOTICE OF BUY AMERICAN REQUIREMENT--CONSTRUCTION MATERIALS (MAY 2014)

(a) Definitions. “Commercially available off-the-shelf (COTS) item,” “construction material,” “domestic construction material,” and “foreign construction material,” as used in this provision, are defined in the clause of this solicitation entitled “Buy American --Construction Materials” (Federal Acquisition Regulation (FAR) clause 52.225-9).

(b) Requests for determinations of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American statute should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of the clause at FAR 52.225-9 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American statute before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American statute, based on claimed unreasonable cost of domestic construction material, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(3)(i) of the clause at FAR 52.225-9.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in this solicitation in paragraph (b)(2) of the clause at FAR 52.225-9, the offeror also may submit an alternate offer based on use of equivalent domestic construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of the clause at FAR 52.225-9 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of the clause at FAR 52.225-9 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material. An offer based on use of the foreign construction material for which an exception was requested--

(i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.228-1 BID GUARANTEE (SEP 1996)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-

(c) The amount of the bid guarantee shall be 20 percent of the bid price or $3M, whichever is less.-

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.-

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of provision)

52.233-2 SERVICE OF PROTEST (SEP 2006)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the Government Accountability Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from:

Ms. Regina G. Blair, Contracting Chief
USACE - Chicago District
231 South LaSalle Street, Suite 1500
Chicago, Illinois 60604

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) Site visits may be arranged during normal duty hours by contacting:
Name: Richard Hurt

Address: 620 Barry Road, Bldg #158, Great Lakes, IL 60088
Telephone: 312-860-0083

(End of provision)

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.acquisition.gov/far

(End of provision)

Section 00 22 13 - Supplementary Instructions to Bidders

IMPORTANT BID NOTES
THE ABOVE SOLICITATION SECTION 00 10 00 IS TO BE USED BY BIDDERS TO SUBMIT THEIR BIDS; IT IS ALSO CONSIDERED THE "BID SCHEDULE" AS TERMED THROUGHOUT THE SOLICITATION.

1. BID CONDITIONS:

a. The Contractor shall bid ALL items that are contained in the Bid Schedule INCLUDING ALL OPTION ITEMS, with no exceptions. Should a Contractor fail to fully complete the bid schedule, its bid will not be considered responsive to the solicitation and eligible for the resultant contract award. Therefore, the bidder's total price for the work shall be based on the TOTAL of all BASE AND OPTION items included in the Bid Schedule. **The Contractor shall enter both its unit price and extended price for each Bid Item and all Option Items.**

b. The Government intends to award a contract to the responsive, responsible bidder submitting the lowest aggregate price for all items (including the Options) in the bid schedule.

c. Split or multiple awards will not result from this Solicitation.

2. OPTION PROVISIONS & RELATED PERFORMANCE TIMEFRAMES:

The government, at its discretion, may award any, all or none of the items under Option Items. If an option is exercised, it will result by an award within 60 calendar days following the Contractor's acknowledgement of the Notice to Proceed. If any Option is exercised, the work must be performed within the time remaining under the Contract, meaning no additional time will added to the Contract. Performance and Payment Bond it will be awarded if any option is exercised as bonding is required once the contract price is increased – see provision at Solicitation Section 00 70 00, Federal Acquisition Regulation Clause No. 52.228-15.

3. SUBMISSION OF BIDS:

a. BIDS OR MODIFICATIONS TO BIDS THAT ARE RECEIVED BY FACSIMILE OR TELETYPE WILL NOT BE CONSIDERED. All Sealed Bids must be submitted in accordance with the procedures set forth in Block No. 13 of Page 1 of this Solicitation Document and comply with all other instructions provided herein this solicitation.

b. Bidders are required to acknowledge the receipt of all amendments to the Solicitation on the Standard Form 1442 in the space provided, by completing Blocks 8 and 15 of the Amendment (Standard Form 30), by separate letter, or by telegram prior to opening of bids.

c. SF 1442 BACK (Page 2 of the Solicitation): Bidders shall fully complete all the required areas located under the section designated as "BID" (refer to Items 14 through 20C).

d. Section 00 45 00 (Representations and Certifications): The bidder must fully complete Section 00 45 00 of this Solicitation and submit it along with all other documents required by this Solicitation. However, if the bidder is currently registered in System for Award Management (SAM), and has completed the Representations and Certifications section of SAM electronically, the bidder may choose to use paragraph (d) of FAR provision 52.204-8 (ANNUAL REPRESENTATIONS AND CERTIFICATION) instead of completing the individual representations and certifications in this solicitation. The bidder shall indicate which option applies by checking the appropriate box at the aforementioned FAR provision, which is located in Section 00 45 00 of this Solicitation. Bids received without this Section completed may be rejected, considered non-responsive and ineligible for award.

e. BID GUARANTEE: The bidder is required to submit a Bid Guarantee for this procurement. Any bidder failing to submit an authentic Bid Guarantee will be considered non-responsive to the Solicitation and ineligible for award. The Bid Guarantee shall be in the amount of 20% of the bidder's price or $3,000,000.00, whichever is less.

f. DELIVERY OF BIDS:

(1) Sealed Bids: Regardless of the method of delivery (mailed or hand-carried), bids and all other documents called out in the Solicitation shall be enclosed and sealed in an envelope that is clearly marked "Bid" and shall include the assigned Solicitation Number, and the Bid Opening Date and Time.

(2) Mailed Bids: It is the responsibility of each bidder to ensure that its Sealed Bid is received by the Chicago District's – USACE Contracting Branch, located at 231 South LaSalle Street, Suite 1500, Chicago, IL 60604 prior to the date and time set for the opening of the bids – See Block 13A of Page 1 of the Solicitation.

(3) Hand-carried Bids Delivered on the Day of the Bid Opening PRIOR TO NOON: For bids being Hand-carried prior to 12:00 NOON (CDT) on the date of the bid opening, the bidder shall CONTACT Ericka Hillard at 312-846-5378, or Mike Jones at 312-846-5373 to retrieve its Bid from the Lobby Area of the USACE's office location, which is located at 231 South LaSalle Street, Chicago, Illinois 60604.

(4) Hand-carried Bids Delivered on the Day of the Bid Opening AFTER 12:00 NOON: For bids being hand carried after 12:00 Noon (CDT) on the date of the bid opening, the bidder shall be prepared to check in at the Security desk (see detailed instructions provided below at Paragraph 3) and from there, sign in at Suite 1500 wherein afterwards it will be directed to the designated Bid Opening Room to furnish its sealed bid.

4. BID OPENING ROOM:

a. The designated Bid Opening Room is located on the 16th floor at 231 South LaSalle Street, Suite 1500, Chicago, Illinois 60604.

b. In order to gain access, all interested participants must check in at the Security Desk in the lobby (Clark Street entrance) with a valid photo ID. The Security desk will issue an access card for gaining access to the USACE Main Office, Suite 1500.

c. Each visitor is required to check-in at the USACE Main Office, Suite 1500, where they will be asked to sign-in and will then be directed to the Bid Opening Room. All individuals intending to attend the Bid Opening must allow enough time to go through security and check in at the USACE office before being escorted to the Bid opening room.

5. QUESTIONS: PLEASE NOTE: INTERESTED BIDDERS MUST SUBMIT THEIR CONTRACTING AND TECHNICAL INQUIRIES to Ms. Ericka Hillard at email: ericka.d.hillard@usace.army.mil – **BE SURE TO INCLUDE THE SOLICIATION NUMBER W912P620B0002 AND PROJECT TITLE ON THE SUBJECT LINE OF YOUR EMAIL.**

PRE-BID MEETING & PROJECT SITE VISIT

A pre-bid meeting and project site visit will be held for this project on January 28, 2020 at _____ Central Time at the following location:
_____

At the pre-bid meeting, Government representatives will highlight specific contract requirements. The objective is to provide an information exchange between potential bidders and the Government to avoid the possibility of misinterpretation of the contract requirements. The Corps of Engineers strongly encourages all potential bidders to attend the pre-bid meeting and, in the interest of making the meeting more meaningful, prospective bidders are urged to present any written questions concerning the project bid documents, bidding, and construction requirements or other related matters prior to the pre-bid meeting. Send written questions to Ericka Hillard at ericka.d.hillard@usace.army.mil – BE SURE TO INCLUDE THE SOLICIATION NUMBER W912P620B0002 AND PROJECT TITLE ON THE SUBJECT LINE OF YOUR EMAIL.

With respect to questions, written questions may be submitted at the beginning of the pre-bid meeting and oral questions may be submitted from the floor, will only be addressed if they are clarifications of information provided in the solicitation and in subsequent amendments issued before the scheduled pre-bid meeting and site visit. Answers, interpretations, and decisions made at the meeting will not become official unless and until verified by an amendment to the solicitation issued prior to the receipt of bids. Following the meeting, prospective bidders will be permitted to inspect the site where services are to be performed and to satisfy themselves as to all general and local conditions that may affect the cost of performance of the contract to the extent such information is reasonably obtained.

Section 00 45 00 - Representations and Certifications

CLAUSES INCORPORATED BY REFERENCE

52.203-19	Prohibition on Requiring Certain Internal Confidentiality Agreements or Statements	JAN 2017
52.204-19	Incorporation by Reference of Representations and Certifications.	DEC 2014

CLAUSES INCORPORATED BY FULL TEXT

52.204-8 ANNUAL REPRESENTATIONS AND CERTIFICATIONS (OCT 2018)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 237110.

(2) The small business size standard is $39,500,000.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b)(1) If the provision at 52.204-7, System for Award Management, is included in this solicitation, paragraph (d) of this provision applies.

(2) If the provision at 52.204-7, System for Award Management, is not included in this solicitation, and the Offeror has an active registration in the System for Award Management (SAM), the Offeror may choose to use paragraph (d) of this provision instead of completing the corresponding individual representations and certifications in the solicitation. The Offeror shall indicate which option applies by checking one of the following boxes:

( ) Paragraph (d) applies.

( ) Paragraph (d) does not apply and the offeror has completed the individual representations and certifications in the solicitation.

(c) (1) The following representations or certifications in SAM are applicable to this solicitation as indicated:

(i) 52.203-2, Certificate of Independent Price Determination. This provision applies to solicitations when a firm-fixed-price contract or fixed-price contract with economic price adjustment is contemplated, unless—

(A) The acquisition is to be made under the simplified acquisition procedures in Part 13;

(B) The solicitation is a request for technical proposals under two-step sealed bidding procedures; or

(C) The solicitation is for utility services for which rates are set by law or regulation.

(ii) 52.203-11, Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions. This provision applies to solicitations expected to exceed $150,000.

(iii) 52.203-18, Prohibition on Contracting with Entities that Require Certain Internal Confidentiality Agreements or Statements--Representation. This provision applies to all solicitations.

(iv) 52.204-3, Taxpayer Identification. This provision applies to solicitations that do not include the provision at 52.204-7, System for Award Management.

(v) 52.204-5, Women-Owned Business (Other Than Small Business). This provision applies to solicitations that—

(A) Are not set aside for small business concerns;

(B) Exceed the simplified acquisition threshold; and

(C) Are for contracts that will be performed in the United States or its outlying areas.

(vi) 52.209-2; Prohibition on Contracting with Inverted Domestic Corporations--Representation.

(vii) 52.209-5; Certification Regarding Responsibility Matters. This provision applies to solicitations where the contract value is expected to exceed the simplified acquisition threshold.

(viii) 52.209-11, Representation by Corporations Regarding Delinquent Tax Liability or a Felony Conviction under any Federal Law. This provision applies to all solicitations.

(ix) 52.214-14, Place of Performance--Sealed Bidding. This provision applies to invitations for bids except those in which the place of performance is specified by the Government.

(x) 52.215-6, Place of Performance. This provision applies to solicitations unless the place of performance is specified by the Government.

(xi) 52.219-1, Small Business Program Representations (Basic & Alternate I). This provision applies to solicitations when the contract will be performed in the United States or its outlying areas.

(A) The basic provision applies when the solicitations are issued by other than DoD, NASA, and the Coast Guard.

(B) The provision with its Alternate I applies to solicitations issued by DoD, NASA, or the Coast Guard.

(xii) 52.219-2, Equal Low Bids. This provision applies to solicitations when contracting by sealed bidding and the contract will be performed in the United States or its outlying areas.

(xiii) 52.222-22, Previous Contracts and Compliance Reports. This provision applies to solicitations that include the clause at 52.222-26, Equal Opportunity.

(xiv) 52.222-25, Affirmative Action Compliance. This provision applies to solicitations, other than those for construction, when the solicitation includes the clause at 52.222-26, Equal Opportunity.

(xv) 52.222-38, Compliance with Veterans' Employment Reporting Requirements. This provision applies to solicitations when it is anticipated the contract award will exceed the simplified acquisition threshold and the contract is not for acquisition of commercial items.

(xvi) 52.223-1, Biobased Product Certification. This provision applies to solicitations that require the delivery or specify the use of USDA-designated items; or include the clause at 52.223-2, Affirmative Procurement of Biobased Products Under Service and Construction Contracts.

(xvii) 52.223-4, Recovered Material Certification. This provision applies to solicitations that are for, or specify the use of, EPA- designated items.

(xviii) 52.223-22, Public Disclosure of Greenhouse Gas Emissions and Reduction Goals--Representation. This provision applies to solicitations that include the clause at 52.204-7.)

(xix) 52.225-2, Buy American Certificate. This provision applies to solicitations containing the clause at 52.225-1.

(xx) 52.225-4, Buy American--Free Trade Agreements--Israeli Trade Act Certificate. (Basic, Alternates I, II, and III.) This provision applies to solicitations containing the clause at 52.225- 3.

(A) If the acquisition value is less than $25,000, the basic provision applies.

(B) If the acquisition value is $25,000 or more but is less than $50,000, the provision with its Alternate I applies.

(C) If the acquisition value is $50,000 or more but is less than $80,317, the provision with its Alternate II applies.

(D) If the acquisition value is $80,317 or more but is less than $100,000, the provision with its Alternate III applies.

(xxi) 52.225-6, Trade Agreements Certificate. This provision applies to solicitations containing the clause at 52.225-5.

(xxii) 52.225-20, Prohibition on Conducting Restricted Business Operations in Sudan--Certification. This provision applies to all solicitations.

(xxiii) 52.225-25, Prohibition on Contracting with Entities Engaging in Certain Activities or Transactions Relating to Iran—Representation and Certification. This provision applies to all solicitations.

(xxiv) 52.226-2, Historically Black College or University and Minority Institution Representation. This provision applies to solicitations for research, studies, supplies, or services of the type normally acquired from higher educational institutions.

(2) The following representations or certifications are applicable as indicated by the Contracting Officer:

[Contracting Officer check as appropriate.]

X (i) 52.204-17, Ownership or Control of Offeror.

X (ii) 52.204-20, Predecessor of Offeror.

(iii) 52.222-18, Certification Regarding Knowledge of Child Labor for Listed End Products.

(iv) 52.222-48, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment--Certification.

(v) 52.222-52 Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services--Certification.

(vi) 52.223-9, with its Alternate I, Estimate of Percentage of Recovered Material Content for EPA-Designated Products (Alternate I only).

(vii) 52.227-6, Royalty Information.

(A) Basic.

(B) Alternate I.

(viii) 52.227-15, Representation of Limited Rights Data and Restricted Computer Software.

(d) The Offeror has completed the annual representations and certifications electronically in SAM accessed through https://www.sam.gov. After reviewing the SAM information, the Offeror verifies by submission of the offer that the representations and certifications currently posted electronically that apply to this solicitation as indicated in paragraph (c) of this provision have been entered or updated within the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer and are incorporated in this offer by reference (see FAR 4.1201); except for the changes identified below [offeror to insert changes, identifying change by clause number, title, date]. These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer.

FAR Clause	Title	Date	Change

Any changes provided by the offeror are applicable to this solicitation only, and do not result in an update to the representations and certifications posted on SAM.

(End of provision)

52.209-7 INFORMATION REGARDING RESPONSIBILITY MATTERS (OCT 2018)

(a) Definitions. As used in this provision--

Administrative proceeding means a non-judicial process that is adjudicatory in nature in order to make a determination of fault or liability (e.g., Securities and Exchange Commission Administrative Proceedings, Civilian Board of Contract Appeals Proceedings, and Armed Services Board of Contract Appeals Proceedings). This includes administrative proceedings at the Federal and State level but only in connection with performance of a Federal contract or grant. It does not include agency actions such as contract audits, site visits, corrective plans, or inspection of deliverables.

Federal contracts and grants with total value greater than $10,000,000 means--

(1) The total value of all current, active contracts and grants, including all priced options; and

(2) The total value of all current, active orders including all priced options under indefinite-delivery, indefinite-quantity, 8(a), or requirements contracts (including task and delivery and multiple-award Schedules).

Principal means an officer, director, owner, partner, or a person having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a division or business segment; and similar positions).

(b) The offeror ( ) has ( ) does not have current active Federal contracts and grants with total value greater than $10,000,000.

(c) If the offeror checked “has” in paragraph (b) of this provision, the offeror represents, by submission of this offer, that the information it has entered in the Federal Awardee Performance and Integrity Information System (FAPIIS) is current, accurate, and complete as of the date of submission of this offer with regard to the following information:

(1) Whether the offeror, and/or any of its principals, has or has not, within the last five years, in connection with the award to or performance by the offeror of a Federal contract or grant, been the subject of a proceeding, at the Federal or State level that resulted in any of the following dispositions:

(i) In a criminal proceeding, a conviction.

(ii) In a civil proceeding, a finding of fault and liability that results in the payment of a monetary fine, penalty, reimbursement, restitution, or damages of $5,000 or more.

(iii) In an administrative proceeding, a finding of fault and liability that results in--

(A) The payment of a monetary fine or penalty of $5,000 or more; or

(B) The payment of a reimbursement, restitution, or damages in excess of $100,000.

(iv) In a criminal, civil, or administrative proceeding, a disposition of the matter by consent or compromise with an acknowledgment of fault by the Contractor if the proceeding could have led to any of the outcomes specified in paragraphs (c)(1)(i), (c)(1)(ii), or (c)(1)(iii) of this provision.

(2) If the offeror has been involved in the last five years in any of the occurrences listed in (c)(1) of this provision, whether the offeror has provided the requested information with regard to each occurrence.

(d) The offeror shall post the information in paragraphs (c)(1)(i) through (c)(1)(iv) of this provision in FAPIIS as required through maintaining an active registration in the System for Award Management, which can be accessed via https://www.sam.gov (see 52.204-7).

(End of provision)

Section 00 70 00 - Conditions of the Contract

CLAUSES INCORPORATED BY REFERENCE

52.202-1	Definitions	NOV 2013
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	MAY 2014
52.203-6	Restrictions On Subcontractor Sales To The Government	SEP 2006
52.203-6 Alt I	Restrictions On Subcontractor Sales To The Government (Sep 2006) -- Alternate I	OCT 1995
52.203-7	Anti-Kickback Procedures	MAY 2014
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	MAY 2014
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	MAY 2014
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	OCT 2010
52.203-17	Contractor Employee Whistleblower Rights and Requirement To Inform Employees of Whistleblower Rights	APR 2014
52.204-4	Printed or Copied Double-Sided on Postconsumer Fiber Content Paper	MAY 2011
52.204-9	Personal Identity Verification of Contractor Personnel	JAN 2011
52.204-10	Reporting Executive Compensation and First-Tier Subcontract Awards	OCT 2018
52.204-13	System for Award Management Maintenance	OCT 2018
52.204-22	Alternative Line Item Proposal	JAN 2017
52.204-23	Prohibition on Contracting for Hardware, Software, and Services Developed or Provided by Kaspersky Lab and Other Covered Entities.	JUL 2018
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	OCT 2015
52.209-9	Updates of Publicly Available Information Regarding Responsibility Matters	OCT 2018
52.209-10	Prohibition on Contracting With Inverted Domestic Corporations	NOV 2015
52.209-13	Violation of Arms Control Treaties or Agreements -- Certification.	JUN 2018
52.211-18	Variation in Estimated Quantity	APR 1984
52.219-8	Utilization of Small Business Concerns	OCT 2018
52.219-14 (Dev)	Limitations on Subcontracting (DEVIATION 2019-O0003).	JAN 2019
52.222-1	Notice To The Government Of Labor Disputes	FEB 1997
52.222-2	Payment For Overtime Premiums	JUL 1990
52.222-3	Convict Labor	JUN 2003
52.222-4	Contract Work Hours and Safety Standards - Overtime Compensation	MAY 2018
52.222-5	Construction Wage Rate Requirements--Secondary Site of the Work	MAY 2014
52.222-6	Construction Wage Rate Requirements	AUG 2018
52.222-7	Withholding of Funds	MAY 2014
52.222-8	Payrolls and Basic Records	AUG 2018
52.222-9	Apprentices and Trainees	JUL 2005
52.222-10	Compliance with Copeland Act Requirements	FEB 1988
52.222-11	Subcontracts (Labor Standards)	MAY 2014
52.222-12	Contract Termination-Debarment	MAY 2014

52.222-13	Compliance With Construction Wage Rate Requirements and Related Regulations	MAY 2014
52.222-14	Disputes Concerning Labor Standards	FEB 1988
52.222-15	Certification of Eligibility	MAY 2014
52.222-19	Child Labor -- Cooperation with Authorities and Remedies	OCT 2019
52.222-21	Prohibition Of Segregated Facilities	APR 2015
52.222-27	Affirmative Action Compliance Requirements for Construction	APR 2015
52.222-37	Employment Reports on Veterans	FEB 2016
52.222-40	Notification of Employee Rights Under the National Labor Relations Act	DEC 2010
52.222-50	Combating Trafficking in Persons	JAN 2019
52.222-54	Employment Eligibility Verification	OCT 2015
52.222-55	Minimum Wages Under Executive Order 13658	DEC 2015
52.222-62	Paid Sick Leave Under Executive Order 13706	JAN 2017
52.223-2	Affirmative Procurement of Biobased Products Under Service and Construction Contracts	SEP 2013
52.223-5	Pollution Prevention and Right-to-Know Information	MAY 2011
52.223-6	Drug-Free Workplace	MAY 2001
52.223-17	Affirmative Procurement of EPA-Designated Items in Service and Construction Contracts	AUG 2018
52.223-18	Encouraging Contractor Policies To Ban Text Messaging While Driving	AUG 2011
52.225-13	Restrictions on Certain Foreign Purchases	JUN 2008
52.227-1	Authorization and Consent	DEC 2007
52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	DEC 2007
52.227-4	Patent Indemnity-Construction Contracts	DEC 2007
52.228-2	Additional Bond Security	OCT 1997
52.228-11	Pledges Of Assets	AUG 2018
52.228-12	Prospective Subcontractor Requests for Bonds	MAY 2014
52.228-14	Irrevocable Letter of Credit	NOV 2014
52.229-3	Federal, State And Local Taxes	FEB 2013
52.232-5	Payments under Fixed-Price Construction Contracts	MAY 2014
52.232-17	Interest	MAY 2014
52.232-23 Alt I	Assignment of Claims (May 2014) - Alternate I	APR 1984
52.232-27	Prompt Payment for Construction Contracts	JAN 2017
52.232-33	Payment by Electronic Funds Transfer--System for Award Management	OCT 2018
52.232-40	Providing Accelerated Payments to Small Business Subcontractors	DEC 2013
52.233-1	Disputes	MAY 2014
52.233-3	Protest After Award	AUG 1996
52.236-2	Differing Site Conditions	APR 1984
52.236-3	Site Investigation and Conditions Affecting the Work	APR 1984
52.236-4	Physical Data	APR 1984
52.236-5	Material and Workmanship	APR 1984
52.236-6	Superintendence by the Contractor	APR 1984
52.236-7	Permits and Responsibilities	NOV 1991
52.236-8	Other Contracts	APR 1984
52.236-9	Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements	APR 1984
52.236-10	Operations and Storage Areas	APR 1984
52.236-11	Use and Possession Prior to Completion	APR 1984
52.236-12	Cleaning Up	APR 1984

52.236-13	Accident Prevention	NOV 1991
52.236-15	Schedules for Construction Contracts	APR 1984
52.236-17	Layout of Work	APR 1984
52.236-21	Specifications and Drawings for Construction	FEB 1997
52.236-26	Preconstruction Conference	FEB 1995
52.242-13	Bankruptcy	JUL 1995
52.242-14	Suspension of Work	APR 1984
52.244-6	Subcontracts for Commercial Items	AUG 2019
52.246-12	Inspection of Construction	AUG 1996
52.246-21	Warranty of Construction	MAR 1994
52.248-3	Value Engineering-Construction	OCT 2015
52.249-2 Alt I	Termination for Convenience of the Government (Fixed-Price) (Apr 2012) - Alternate I	SEP 1996
52.249-10	Default (Fixed-Price Construction)	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7000	Requirements Relating to Compensation of Former DoD Officials	SEP 2011
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	DEC 2008
252.203-7005	Representation Relating to Compensation of Former DoD Officials	NOV 2011
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004	Antiterrorism Awareness Training for Contractors.	FEB 2019
252.204-7012	Safeguarding Covered Defense Information and Cyber Incident Reporting	OCT 2016
252.204-7015	Notice of Authorized Disclosure of Information for Litigation Support	MAY 2016
252.205-7000	Provision Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Country that is a State Sponsor of Terrorism	MAY 2019
252.215-7013	Supplies and Services Provided by Nontraditional Defense Contractors.	JAN 2018
252.223-7008	Prohibition of Hexavalent Chromium	JUN 2013
252.225-7012	Preference For Certain Domestic Commodities	DEC 2017
252.225-7048	Export-Controlled Items	JUN 2013
252.225-7978 (Dev)	Restriction on Acquisition of Certain Magnets and Tungsten. (DEVIATION 2019-O0006)	JAN 2019
252.227-7033	Rights in Shop Drawings	APR 1966
252.232-7003	Electronic Submission of Payment Requests and Receiving Reports	DEC 2018
252.232-7010	Levies on Contract Payments	DEC 2006
252.236-7000	Modification Proposals-Price Breakdown	DEC 1991
252.243-7001	Pricing Of Contract Modifications	DEC 1991
252.243-7002	Requests for Equitable Adjustment	DEC 2012
252.244-7000	Subcontracts for Commercial Items	JUN 2013
252.247-7023	Transportation of Supplies by Sea	FEB 2019

CLAUSES INCORPORATED BY FULL TEXT

52.204-21 BASIC SAFEGUARDING OF COVERED CONTRACTOR INFORMATION SYSTEMS (JUN 2016)

(a) Definitions. As used in this clause--

Covered contractor information system means an information system that is owned or operated by a contractor that processes, stores, or transmits Federal contract information.

Federal contract information means information, not intended for public release, that is provided by or generated for the Government under a contract to develop or deliver a product or service to the Government, but not including information provided by the Government to the public (such as on public Web sites) or simple transactional information, such as necessary to process payments.

Information means any communication or representation of knowledge such as facts, data, or opinions, in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual (Committee on National Security Systems Instruction (CNSSI) 4009).

Information system means a discrete set of information resources organized for the collection, processing, maintenance, use, sharing, dissemination, or disposition of information (44 U.S.C. 3502).

Safeguarding means measures or controls that are prescribed to protect information systems.

(b) Safeguarding requirements and procedures.

(1) The Contractor shall apply the following basic safeguarding requirements and procedures to protect covered contractor information systems. Requirements and procedures for basic safeguarding of covered contractor information systems shall include, at a minimum, the following security controls:

(i) Limit information system access to authorized users, processes acting on behalf of authorized users, or devices (including other information systems).

(ii) Limit information system access to the types of transactions and functions that authorized users are permitted to execute.

(iii) Verify and control/limit connections to and use of external information systems.

(iv) Control information posted or processed on publicly accessible information systems.

(v) Identify information system users, processes acting on behalf of users, or devices.

(vi) Authenticate (or verify) the identities of those users, processes, or devices, as a prerequisite to allowing access to
organizational information systems.

(vii) Sanitize or destroy information system media containing Federal Contract Information before disposal or release for reuse.

(viii) Limit physical access to organizational information systems, equipment, and the respective operating environments to authorized individuals.

(ix) Escort visitors and monitor visitor activity; maintain audit logs of physical access; and control and manage physical access devices.

(x) Monitor, control, and protect organizational communications (i.e., information transmitted or received by organizational information systems) at the external boundaries and key internal boundaries of the information systems.

(xi) Implement subnetworks for publicly accessible system components that are physically or logically separated from internal networks.

(xii) Identify, report, and correct information and information system flaws in a timely manner.

(xiii) Provide protection from malicious code at appropriate locations within organizational information systems.

(xiv) Update malicious code protection mechanisms when new releases are available.

(xv) Perform periodic scans of the information system and real-time scans of files from external sources as files are downloaded, opened, or executed.

(2) Other requirements. This clause does not relieve the Contractor of any other specific safeguarding requirements specified by Federal agencies and departments relating to covered contractor information systems generally or other Federal safeguarding requirements for controlled unclassified information (CUI) as established by Executive Order 13556.

(c) Subcontracts. The Contractor shall include the substance of this clause, including this paragraph (c), in subcontracts under this contract (including subcontracts for the acquisition of commercial items, other than commercially available off-the-shelf items), in which the subcontractor may have Federal contract information residing in or transiting through its information system.

(End of clause)

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor acknowledges the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 365 calendar days following the contractor’s acknowledgement of the notice to proceed. The time stated for completion shall include final cleanup of the premises.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of $1,657.86 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.217-7 OPTION FOR INCREASED QUANTITY--SEPARATELY PRICED LINE ITEM (MAR 1989)

The Government may require the delivery of the numbered line item, identified in the Schedule as an option item, in the quantity and at the price stated in the Schedule.

The government, at its discretion, may award any, all or none of the items under Option Items. If an option is exercised, it will result by an award within 60 calendar days following the Contractor's acknowledgement of the Notice to Proceed. If any Option is exercised, the work must be performed within the time remaining under the Contract, meaning no additional time will added to the Contract. Performance and Payment Bond it will be awarded if any option is exercised as bonding is required once the contract price is increased – see provision at Solicitation Section 00 70 00, Federal Acquisition Regulation Clause No. 52.228-15.

Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

(End of clause)

52.219-6 NOTICE OF TOTAL SMALL BUSINESS SET-ASIDE (NOV 2011)

(a) Definition.

"Small business concern," as used in this clause, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the size standards in this solicitation.

(b) Applicability. This clause applies only to--

(1) Contracts that have been totally set aside or reserved for small business concerns; and

(2) Orders set aside for small business concerns under multiple-award contracts as described in 8.405-5 and 16.505(b)(2)(i)(F).

(c) General. (1) Offers are solicited only from small business concerns. Offers received from concerns that are not small business concerns shall be considered nonresponsive and will be rejected.

(2) Any award resulting from this solicitation will be made to a small business concern.

(d) Agreement. A small business concern submitting an offer in its own name shall furnish, in performing the contract, only end items manufactured or produced by small business concerns in the United States or its outlying areas. If this procurement is processed under simplified **acquisition** procedures and the total amount of this contract does not exceed $25,000, a small business concern may furnish the product of any domestic firm. This paragraph does not apply to construction or service contracts.

(End of clause)

52.219-28 POST-AWARD SMALL BUSINESS PROGRAM REREPRESENTATION (JULY 2013)

(a) Definitions. As used in this clause--

Long-term contract means a contract of more than five years in duration, including options. However, the term does not include contracts that exceed five years in duration because the period of performance has been extended for a cumulative period not to exceed six months under the clause at 52.217-8, Option to Extend Services, or other appropriate authority.

Small business concern means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in paragraph (c) of this clause. Such a concern is ``not dominant in its field of operation'' when it does not exercise a controlling or major influence on a national basis in a kind of business activity in which a number of business concerns are primarily engaged. In determining whether dominance exists, consideration shall be given to all appropriate factors, including volume of business, number of employees, financial resources, competitive status or position, ownership or control of materials, processes, patents, license agreements, facilities, sales territory, and nature of business activity.

(b) If the Contractor represented that it was a small business concern prior to award of this contract, the Contractor shall rerepresent its size status according to paragraph (e) of this clause or, if applicable, paragraph (g) of this clause, upon the occurrence of any of the following:

(1) Within 30 days after execution of a novation agreement or within 30 days after modification of the contract to include this clause, if the novation agreement was executed prior to inclusion of this clause in the contract.

(2) Within 30 days after a merger or acquisition that does not require a novation or within 30 days after modification of the contract to include this clause, if the merger or acquisition occurred prior to inclusion of this clause in the contract.

(3) For long-term contracts--

(i) Within 60 to 120 days prior to the end of the fifth year of the contract; and

(ii) Within 60 to 120 days prior to the date specified in the contract for exercising any option thereafter.

(c) The Contractor shall rerepresent its size status in accordance with the size standard in effect at the time of this rerepresentation that corresponds to the North American Industry Classification System (NAICS) code assigned to this contract. The small business size standard corresponding to this NAICS code can be found at http://www.sba.gov/content/table-small-business-size-standards.

(d) The small business size standard for a Contractor providing a product which it does not manufacture itself, for a contract other than a construction or service contract, is 500 employees.

(e) Except as provided in paragraph (g) of this clause, the Contractor shall make the representation required by paragraph (b) of this clause by validating or updating all its representations in the Representations and Certifications section of the System for Award Management (SAM) and its other data in SAM, as necessary, to ensure that they reflect the Contractor's current status. The
Contractor shall notify the contracting office in writing within the timeframes specified in paragraph (b) of this clause that the data have been validated or updated, and provide the date of the validation or update.

(f) If the Contractor represented that it was other than a small business concern prior to award of this contract, the Contractor may, but is not required to, take the actions required by paragraphs (e) or (g) of this clause.

(g) If the Contractor does not have representations and certifications in SAM, or does not have a representation in SAM for the NAICS code applicable to this contract, the Contractor is required to complete the following rerepresentation and submit it to the contracting office, along with the contract number and the date on which the rerepresentation was completed:

The Contractor represents that it ( ) is, ( ) is not a small business concern under NAICS Code - assigned to contract number .

(Contractor to sign and date and insert authorized signer's name and title).

(End of clause)

52.222-26 EQUAL OPPORTUNITY (SEPT 2016)

(a) Definitions. As used in this clause--

Compensation means any payments made to, or on behalf of, an employee or offered to an applicant as remuneration for employment, including but not limited to salary, wages, overtime pay, shift differentials, bonuses, commissions, vacation and holiday pay, allowances, insurance and other benefits, stock options and awards, profit sharing, and retirement.

Compensation information means the amount and type of compensation provided to employees or offered to applicants, including, but not limited to, the desire of the Contractor to attract and retain a particular employee for the value the employee is perceived to add to the Contractor's profit or productivity; the availability of employees with like skills in the marketplace; market research about the worth of similar jobs in the relevant marketplace; job analysis, descriptions, and evaluations; salary and pay structures; salary surveys; labor union agreements; and Contractor decisions, statements and policies related to setting or altering employee compensation.

Essential job functions means the fundamental job duties of the employment position an individual holds. A job function may be considered essential if--

(1) The access to compensation information is necessary in order to perform that function or another routinely assigned business task; or

(2) The function or duties of the position include protecting and maintaining the privacy of employee personnel records, including compensation information.

Gender identity has the meaning given by the Department of Labor's Office of Federal Contract Compliance Programs, and is found at www.dol.gov/ofccp/LGBT/LGBT_FAQs.html.

Sexual orientation has the meaning given by the Department of Labor's Office of Federal Contract Compliance Programs, and is found at www.dol.gov/ofccp/LGBT/LGBT_FAQs.html.

United States means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b)(1) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of $10,000, the Contractor shall comply with this clause, except for work performed outside the United States by employees who were not recruited within the United States. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(2) If the Contractor is a religious corporation, association, educational institution, or society, the requirements of this clause do not apply with respect to the employment of individuals of a particular religion to perform work connected with the carrying on of the Contractor's activities (41 CFR 60-1.5).

(c) (1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(5)(i) The Contractor shall not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This prohibition against discrimination does not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.

(ii) The Contractor shall disseminate the prohibition on discrimination in paragraph (c)(5)(i) of this clause, using language prescribed by the Director of the Office of Federal Contract Compliance Programs (OFCCP), to employees and applicants by--

(A) Incorporation into existing employee manuals or handbooks; and

(B) Electronic posting or by posting a copy of the provision in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(7) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(8) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(9) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The

Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(10) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(11) The Contractor shall include the terms and conditions of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(12) The Contractor shall take such action with respect to any subcontract or purchase order as the Director of OFCCP may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(d) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR part 60-1.

(End of clause)

52.222-35 EQUAL OPPORTUNITY FOR VETERANS (OCT 2015)

(a) Definitions. As used in this clause--

``Active duty wartime or campaign badge veteran,'' ``Armed Forces service medal veteran,'' ``disabled veteran,'' ``protected veteran,'' ``qualified disabled veteran,'' and ``recently separated veteran'' have the meanings given at FAR 22.1301.

(b) Equal opportunity clause. The Contractor shall abide by the requirements of the equal opportunity clause at 41 CFR 60-300.5(a), as of March 24, 2014. This clause prohibits discrimination against qualified protected veterans, and requires affirmative action by the Contractor to employ and advance in employment qualified protected veterans.

(c) Subcontracts. The Contractor shall insert the terms of this clause in subcontracts of $150,000 or more unless exempted by rules, regulations, or orders of the Secretary of Labor. The Contractor shall act as specified by the Director, Office of Federal Contract Compliance Programs, to enforce the terms, including action for noncompliance. Such necessary changes in language may be made as shall be appropriate to identify properly the parties and their undertakings.

(End of clause)

52.222-36 EQUAL OPPORTUNITY FOR WORKERS WITH DISABILITIES (JUL 2014)

(a) Equal opportunity clause. The Contractor shall abide by the requirements of the equal opportunity clause at 41 CFR 60-741.5(a), as of March 24, 2014. This clause prohibits discrimination against qualified individuals on the basis of disability, and requires affirmative action by the Contractor to employ and advance in employment qualified individuals with disabilities.

(b) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of $15,000 unless exempted by rules, regulations, or orders of the Secretary, so that such provisions will be binding upon each subcontractor or vendor. The Contractor shall act as specified by the Director, Office of Federal Contract Compliance Programs of the U.S. Department of Labor, to enforce the terms, including action for noncompliance. Such necessary changes in language may be made as shall be appropriate to identify properly the parties and their undertakings.

(End of clause)

52.225-9 BUY AMERICAN—CONSTRUCTION MATERIALS (MAY 2014)

(a) Definitions. As used in this clause--

Commercially available off-the-shelf (COTS) item—

(1) Means any item of supply (including construction material) that is--

(i) A commercial item (as defined in paragraph (1) of the definition at FAR 2.101);

(ii) Sold in substantial quantities in the commercial marketplace; and

(iii) Offered to the Government, under a contract or subcontract at any tier, without modification, in the same form in which it is sold in the commercial marketplace; and

(2) Does not include bulk cargo, as defined in 46 U.S.C. 40102(4) such as agricultural products and petroleum products.

Component means an article, material, or supply incorporated directly into a construction material.

Construction material means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the construction material.

Domestic construction material means--

(1) An unmanufactured construction material mined or produced in the United States;

(2) A construction material manufactured in the United States, if--

(i) The cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic; or

(ii) The construction material is a COTS item.

Foreign construction material means a construction material other than a domestic construction material.

United States means the 50 States, the District of Columbia, and outlying areas.

(b) Domestic preference.

(1) This clause implements 41 U.S.C. chapter 83, Buy American, by providing a preference for domestic construction material. In accordance with 41 U.S.C. 1907, the component test of the Buy American statute is waived for construction material that is a COTS item. (See FAR 12.505(a)(2)). The Contractor shall use only domestic construction material in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to information technology that is a commercial item or to the construction materials or components listed by the Government as follows:

(3) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(2) of this clause if the Government determines that

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the requirements of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act. (1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(3) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American statute applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(3)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American statute applies, use of foreign construction material is noncompliant with the Buy American statute.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) \1\
Item 1			
Foreign construction material....	..... ___	.... ……. ___	.... ___ .....
Domestic construction material...	..... ___	.... ___	.... ___ .....
Item 2			
Foreign construction material....	..... ___	.... ……. ___	.... ___ .....
Domestic construction material...	..... ___	.... ___	.... ___ .....

Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).
List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.
Include other applicable supporting information.

(End of clause)

52.228-5 INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997)

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION (OCT 2010)

(a) Definitions. As used in this clause--

Original contract price means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is $150,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular

570 is published in the Federal Register or may be obtained from the U.S. Department of the Treasury, Financial Management Service, Surety Bond Branch, 3700 East West Highway, Room 6F01, Hyattsville, MD 20782. Or via the internet at http://www.fms.treas.gov/c570/.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 3133(c)). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

52.232-39 UNENFORCEABILITY OF UNAUTHORIZED OBLIGATIONS (JUN 2013)

(a) Except as stated in paragraph (b) of this clause, when any supply or service acquired under this contract is subject to any End User License Agreement (EULA), Terms of Service (TOS), or similar legal instrument or agreement, that includes any clause requiring the Government to indemnify the Contractor or any person or entity for damages, costs, fees, or any other loss or liability that would create an Anti-Deficiency Act violation (31 U.S.C. 1341), the following shall govern:

(1) Any such clause is unenforceable against the Government.

(2) Neither the Government nor any Government authorized end user shall be deemed to have agreed to such clause by virtue of it appearing in the EULA, TOS, or similar legal instrument or agreement. If the EULA, TOS, or similar legal instrument or agreement is invoked through an ``I agree'' click box or other comparable mechanism (e.g., ``click-wrap'' or ``browse-wrap'' agreements), execution does not bind the Government or any Government authorized end user to such clause.

(3) Any such clause is deemed to be stricken from the EULA, TOS, or similar legal instrument or agreement.

(b) Paragraph (a) of this clause does not apply to indemnification by the Government that is expressly authorized by statute and specifically authorized under applicable agency regulations and procedures.

(End of clause)

52.233-4 APPLICABLE LAW FOR BREACH OF CONTRACT CLAIM (OCT 2004)

United States law will apply to resolve any claim of breach of this contract.

(End of clause)

52.243-4 CHANGES (JUN 2007)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

(1) In the specifications (including drawings and designs);

(2) In the method or manner of performance of the work;

(3) In the Government-furnished property or services; or

(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

(1) the date, circumstances, and source of the order and

(2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

(1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

www.acquisition.gov/far

(End of clause)

52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any FAR or Defense Federal Acquisition Regulation (DFARS) (48 CFR Chapter 2) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

(End of clause)

252.236-7001 CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies;

(4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

(c) In general--

(1) Large-scale drawings shall govern small-scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified on the following index of drawings:

SHEET NUMBER	SHEET REFERENCE	TITLE
1	G-001	LOCATION, VINCINITY MAP AND SHEET INDEX
2	G-002	GENERAL NOTES, LEGENDS AND SYMBOLS
3	G-003	ABBREVIATIONS
4	G-101	WORK POINTS
5	V-001	SURVEY CONTROL POINTS AND BENCHMARK
6	CD-101	CIVIL DEMOLITION SHEET
7	C-101	CIVIL PLAN VIEW
8	C-102	SOIL DISPOSAL LOCATION
9	C-501	GUARDRAIL DETAILS

10	C-502	RIPRAP DETAILS
11	SD-201	FLOODWALL DEMOLITION
12	SD-501	BACKFLOW STRUCTURE 1 DEMOLITION
13	S-101	NEW PUMP STATION PLAN VIEW
14	S-102	HEAD WALL PLAN VIEW - SECTION
15	S-201	ELEVATION VIEWS
16	S-202	NEW FLOODWALL ELEVATION
17	S-501	DETAIL 1
18	S-502	DETAIL 2
19	S-503	DETAIL 3
20	S-504	DETAIL 4
21	S-505	TRASHRACK DETAIL
22	S-506	HEAD WALL DETAIL
23	S-507	BACKFLOW STRUCTURE 1 MODIFICATION
24	S-508	BACKFLOW STRUCTURE 1 MODIFICATION DETAIL
25	S-509	BACKFLOW STRUCTURE 1 MODIFICATION DETAIL
26	M-101	PUMP STATION PLAN VIEW
27	M-301	SECTION 1
28	M-302	SECTION 2
29	M-303	SECTION 3
30	M-304	SECTION 4
31	M-305	DUCKBILL VALVE DETAIL
32	M-501	FSI INLET CONE DETAIL
33	M-502	FLAP GATE AND DUCKBILL DETAIL
34	M-503	PUMP ENCLOSURE DETAILS
35	M-601	SCHEDULES
36	M-901	3D PRESENTATION
37	E-001	LEGEND AND ABBREVATION
38	E-101	STATION PLAN
39	E-301	STATION SECTION
40	E-501	CONTROL PANEL ELEVATION
41	E-502	MCC DETAILS
42	E-503	DETAILS
43	E-504	DETAILS
44	E-601	POWER ONE LINE DIAGRAM
45	E-602	PLC LOGIC
46	E-603	PLC LOGIC
47	E-604	MOTOR STARTER CIRCUIT DIAGRAM, COTROL SYSTEM COMMUNICATIONS ARCHITECTURE
48	E-605	ONE LINE DIAGRAM
49	R-001	REFERENCE DRAWING
50	R-002	REFERENCE DRAWING
51	R-003	REFERENCE DRAWING

52	R-004	REFERENCE DRAWING
53	R-005	REFERENCE DRAWING
54	R-006	REFERENCE DRAWING
55	R-007	REFERENCE DRAWING
56	R-008	REFERENCE DRAWING
57	R-009	REFERENCE DRAWING
58	R-010	REFERENCE DRAWING

(End of clause)

Section 00 73 00 - Supplementary Conditions

POST AWARD DOCUMENTATION

SUBMISSION OF POST AWARD CONTRACT DOCUMENTATION

Following contract award, the Contractor shall provide contract documentation in an electronic format to the greatest extent practicable. Contract documentation to be submitted electronically may include, but is not limited to, the following:

Submittals, including ENG 4025 transmittal form Meeting Minutes
Construction Photographs
Correspondence
Requests for Information
Payroll Documents
Statement and Acknowledgement Forms (SF 1413)
Request for Additional Classification (SF 1444)
Progress Payment Requests and Supporting Documentation
Contract Modification Documentation, including SF 30, Contractor's Offer, Cost/Pric ing Audit Report, and Certificate of Current Cost or Pricing Data
Contractor Quality Control Reports (with attachments) Accident Reports
Schedules and Schedule Updates
Closeout Documentation, including Release of Claims

Electronic files must be of sufficient quality that all information is legible. Electronic format shall be in Adobe.PDF format, unless otherwise specified or directed by the Contracting Officer's Representative (COR). Whenever possib le , PDF files shall be generated from original documents so that the text included in the PDF file is both searchable and can be copied . If documents are scanned, Optical Character Resolution (OCR) routines are required. Files exceeding 30 pages shall be indexed and bookmarked to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature, or scan of a signature. Email electronic documents fewer than 10MB to an email address as directed by the COR. Electronic documents over 10MB shall be provided on a CD/DVD, or through an electronic file sharing system Attunity RepliWeb Managed File Transfer (A-RMFT) located at the following website:

https://aceit.usace.army.mil/Support/Software/Pages/RepliWeb.aspx

The Government reserves the right to request hard copy submission of any item, if deemed necessary. The Contractor shall be prepared to provide up to eight (8) additional paper hard copies of any contract document at the discretion of the COR, at no additional cost to the Government. In addition to the electronic file format described above, the following list of documents shall be provided in their original format because law or other regulations require signed originals be kept in accordance with FAR 4.805 -- Storage, Handlin g, and Disposal of Contract Files: (this list is taken from appendix 5 to annex C to OPORD 2012-66)

- Advance Payment Bond
- Bid Bond including Annual Bid Bond
- Performance Bond including Annual Performance Bond
- Payment Bond
- Patent Infringement Bond
- Any performance security instruments
- Certificate of Insurance
- Novation/Change of Name Agreement
- Assignment of Claims
- Any document containing a raised seal. Examples include
- Notarized documents
- Architecture Drawings
- Paper Payroll Documents
- Physical signatures on contracts and modifications
- SF 1442

- SF 30

(End of special contract requirement)

"General Decision Number: IL20200009 02/07/2020

Superseded General Decision Number: IL20190009

State: Illinois

Construction Types: Building, Heavy, Highway and Residential

County: Cook County in Illinois.

BUILDING, RESIDENTIAL, HEAVY, AND HIGHWAY PROJECTS (does not include landscape projects).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.80 for calendar year 2020 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.80 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR

5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2020
1	01/24/2020
2	02/07/2020

ASBE0017-001 06/01/2019

	Rates	Fringes
ASBESTOS WORKER/INSULATOR Includes the application of all insulating materials, protective coverings, coatings, and finishes to all types of mechanical systems	$ 50.50	27.80
Fire Stop Technician	$ 40.40	24.54
HAZARDOUS MATERIAL HANDLER includes preparation, wetting, stripping removal scrapping, vacuuming, bagging and disposal of all insulation materials, whether they contain asbestos or not, from mechanical systems	$ 37.80	24.54

BOIL0001-001 05/01/2017

	Rates	Fringes

BOILERMAKER.....$ 46.18 29.58

BRIL0021-001 06/01/2016

	Rates	Fringes
BRICKLAYER.....	$ 44.88	26.62

BRIL0021-004 06/01/2017

	Rates	Fringes
Marble Mason.....	$ 44.63	26.83

BRIL0021-006 06/01/2017

	Rates	Fringes
TERRAZZO WORKER/SETTER.....	$ 44.38	25.84
TILE FINISHER.....	$ 38.56	22.10
TILE SETTER.....	$ 45.49	25.72

BRIL0021-009 06/01/2017

	Rates	Fringes
MARBLE FINISHER.....	$ 33.95	26.03

BRIL0021-012 06/01/2017

	Rates	Fringes
Pointer, cleaner and caulker.....	$ 45.42	24.06

CARP0555-001 06/01/2018

BUILDING, HEAVY, AND HIGHWAY

	Rates	Fringes
CARPENTER		
Carpenter, Lather, Millwright, Piledriver, and Soft Floor Layer		
Building	$ 47.35	32.83
Heavy & Highway	$ 47.35	32.83

CARP0555-002 10/01/2018

RESIDENTIAL CONSTRUCTION

	Rates	Fringes
CARPENTER	$ 38.11	32.83

ELEC0009-003 06/03/2018

	Rates	Fringes
Line Construction		
Groundman	$ 40.48	61.52%
Lineman and Equipment Operator	$ 51.90	61.52%

ELEC0134-001 06/03/2019

	Rates	Fringes
ELECTRICIAN	$ 49.35	3%+34.32

ELEC0134-003 06/03/2019

	Rates	Fringes
ELECTRICIAN		
ELECTRICAL TECHNICIAN.....	$ 44.86	3%+24.72

The work shall consist of the installation, operation, inspection, maintenance, repair and service of radio, television, recording, voice sound vision production and reproduction, telephone and telephone interconnect, facsimile, data appatatus, coaxial, fibre optic and wireless equipment, appliances and systems used for the transmission and reception of signals of any nature, business, domestic, commercial, education, entertainment and residential purposes, including but not limited to communication and telephone, electronic and sound equipment, fibre optic and data communication systems, and the performance of any task directly related to such installation or service whether at new or existing sites, such tasks to include the placing of wire and cable and electrical power conduit or other raceway work within the equipment room and pulling wire and/or cable through conduit and the installation of any incidential conduit.

ELEV0002-001 01/01/2020

	Rates	Fringes
ELEVATOR MECHANIC.....	$ 58.47	34.765+a+b

FOOTNOTES:

a) PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Day after Thanksgiving Day; Veterans' Day and Christmas Day.

b) Employer contributes 8% of regular hourly rate as vacation pay credit for employee with more than 5 years of service, and 6% for employee with less than 5 years service

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* ENGI0150-006 06/01/2019

Building and Residential Construction

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1	$ 51.10	41.00
GROUP 2	$ 49.80	41.00
GROUP 3	$ 47.25	41.00
GROUP 4	$ 45.50	41.00

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Mechanic; Asphalt Plant*; Asphalt Spreader; Autograde*; Backhoes with Caisson attachment*:Batch Plant*; Benoto(Requires two Engineers); Boiler and Throttle Valve; Caisson Rigs*; Central Redi-Mix Plant*; Combination Backhoe Front Endloader Machine; Compressor and Throttle Valve; Concrete Breaker (Truck Mounted)*; Concrete Conveyor; Concrete Conveyor, Truck Mounted; Concrete Paver over 27E cu. ft.*; Concrete Paver 27E cu ft and Under*; Concrete Placer*; Concrete Placing Boom; Concrete Pump (Truck Mounted); Concrete Tower; Cranes*; Cranes, Hammerhead*; Cranes, (GCI and similar type Requires two operators only); Creter Crane; Crusher, Stone, etc; Derricks; Derricks,

Traveling*; Formless Curb and Gutter Machine*; Grader, Elevating; Grouting Machines; Highlift Shovels or Front Endloader 2 1/4 yd. and over; Hoists, Elevators, Outside Type Rack and pinion and similar Machines; Hoists, One, Two, and Three Drum; Hoists, Two Tugger One Floor; Hydraulic Backhoes*; Hydraulic Boom Trucks; Hydraulic Vac (and similar equipment);Locomotives; Motor Patrol*; Pile Drivers amd Skid Rig*; Post Hole Digger; Pre- Stress Machine; Pump Cretes Dual Ram(Requiring frequent Lubrication and Water); Pump Cretes; Squeeze Cretes-Screw Type Pumps Gypsum Bulker and Pump; Raised and Blind Hole Drill*; Roto Mill Grinder (36"" and Over)*; Roto Mill Grinder (Less Than 36"")*; Scoops-Tractor Drawn; Slip-Form Paver*; Straddle Buggies; Tournapull; Tractor with Boom, and Side Boom; and Trenching Machines*.

GROUP 2: Bobcat (over 3/4 cu yd); Boilers; Broom, Power Propelled; Bulldozers; Concrete Mixer (Two Bag and over); Conveyor, Portable; Forklift Trucks; Greaser Engineer; Highlift Shovels or Front End loaders under 2 1/4 cu yd; Aotomatic Hoists, Hoists, Inside Elevators; Hoists, Sewer Dragging Machine; Hoists, Tugger Single Drum; Laser Screed; Rock Drill (Self-Propelled); Rock Drill (Truck Mounted)*; Rollers; Steam Generators; Tractors; Tractor Drawn Vibratory Roller (Receives an additional $.50 per hour); Winch Trucks with ""A"" Frame.

GROUP 3: Air Compressor-Small 250 and Under (1 to 5 not to exceed a total of 300 ft); Air Compressor-Large over 250; Combination-Small Equipment Operator; Generator- Small 50 kw and under; Generator-Large over 50 kw; Heaters, Mechanical; Hoists, Inside Elevators (Remodeling or Renovatin work); Hydrualic Power Units (Pile Driving, Extracting, and Drilling); Low Boys; Pumps Over 3"" (1 To 3 not to exceed a total of 300 ft); Pumps, Well Points;

Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches; Bobcat (up to and including 3/4 cu yd)

GROUP 4 - Bobcats and/or other Skid Steer Loaders; Brick Forklifts; Oilers

*-Requires Oiler

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* ENGI0150-025 06/01/2019

Heavy and Highway Construction

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1	$ 49.30	41.00
GROUP 2	$ 48.75	41.00
GROUP 3	$ 46.70	41.00
GROUP 4	$ 45.30	41.00
GROUP 5	$ 44.10	41.00

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Asphalt Plant*; Asphalt Heater and Planer combination; Asphalt Heater Scarfire*, Asphalt Spreader; Autograder/ GOMACO or similar; ABG Paver*, Backhoes with Caisson attachment*, Ballast Regulator, Belt Loader*; Caisson Rigs*Car Dumper, Central Redi-Mix Plant*, Combination Backhoe; Front End Loader Machine (1 cu yd or over Backhoe bucket or with attachments); Concrete Breaker (truck mounted); Concrete Conveyor; Concrete Paver over 27E cu ft*; Concrete Placer*; Concrete Tube Float; Cranes, all attachments*; Cranes, Hammerhead, Linden, Peco and machines of a like nature*; Creter Crane; Crusher, stone; All

Derricks; Derrick Boats; Derricks, traveling*; Dowell Machine with Air Compressor ($1.00 above Class 1); Dredges*; Field Mechanic Welder; Formless Curb and Gutter Machine*; Gradall and machines of a like nature*; Grader, Elevating; Grader, Motor Grader, Motor Patrol, Auto Patrol, Form Grader, Pull Grader, Subgrader; Guard Rail Post Driver mounted*; Hoists, one, two, and three Drum; Hydraulic Backhoes*; Backhoes with Shear attachments*; Mucking Machine; Pile Drivers and Skid Rig*; Pre-Stress Machine; Pump Cretes Dual Ram (requires frequent lubrication and water)*; Rock Drill- Crawler or Skid Rig*; Rock Drill truck mounted*; Rock/ Track Tamper; Roto Mill Grinder, (36"" and over)*; Slip-Form Paver*; Soil Test Drill Rig, truck mounted*; Straddle Buggies; Hydraulic Telescoping Form (tunnel); Tractor Drawn Belt Loader*; Tractor Drawn Belt Loader with attached Pusher (two engineers); Tractor with boom; Tractaire with attachment; Traffic Barrier Transfer Machine*; Trenching Machine; Truck Mounted Concrete Pump with boom*; Underground Boring and/or Mining Machines 5 ft in diameter and over tunnel, etc.*; Wheel Excavator* & Widener (Apsco); Raised or Blind Hoe Drill, Tunnel & Shaft*

GROUP 2: Batch Plant*; Bituminous Mixer; Boiler and Throttle Valve; Bulldozer; Car Loader Trailing Conveyors; Combination Backkhoe Front End Loader Machine, (less than 1 cu yd Backhoe Bucket with attachments); Compressor and Throttle Valve; Compressor, common receiver (3); Concrete Breaker or Hydro Hammer; Concrete Grinding Machine; Concrete Mixer or Paver 7S series to and including 27 cu ft; Concrete Spreader; Concrete Curing Machine; Burlap Machine; Belting Machine and Sealing Machine; Concrete Wheel Saw; Conveyor Muck Cars (Haglund or similar type); Drills (all); Finishing Machine-Concrete; Greaser Engineer; Highlift Shovels or Front End Loader; Hoist- Sewer Dragging Machine; Hydraulic Boom Trucks, all attachments;

Hydro-Blaster (requires two operators); Laser Screed*; Locomotives, Dinky; Off-Road Hauling Units (including articulating); Pump Cretes; Squeeze Cretes-Screw Type pumps, Gypsum Bulker and Pump; Roller Asphalt; Rotary Snow Plows; Rototiller, Seaman, self-Propelled; Scoops-Tractor Drawn; Self- propelled Compactor; Spreader-Chip-Stone; Scraper; Scraper-Prime Mover in Tandem regardless of size (add $1.00 to Group 2 hourly rate for each hour and for each machine attached thereto add $1.00 to Group 2 hourly rate for each hour); Tank Car Heater; Tractors, Push, pulling Sheeps Foot, Disc, or Compactor, etc; Tug Boats

GROUP 3: Boilers; Brooms, all power propelled; Cement Supply Tender; Compressor, Common Receiver (2); Concrete Mixer, two bag and over; Conveyor, Portable; Farm type Tractors used for mowing, seeding, etc; Fireman on Boilers; Forklift Trucks; Grouting Machines; Hoists, Automatic; Hoists, all Elevators; Hoists, Tugger single Drum; Jeep Diggers; Low Boys; Pipe Jacking Machines; Post-hole Digger; Power Saw, Concrete, Power Driven; Pug Mills; Rollers, other than asphalt; Seed and Straw Blower; Steam Generators; Stump Machine; Winch Trucks with A-Frame; Work Boats; Tamper-Form motor driven

GROUP 4: Air compressor - Small 250 and under (1 to 5 not to exceed a total of 300 ft); Air Compressor - Large over 250; Combination - Small Equipment Operator; Directional Boring Machine; Generators - Small 50 kw and under; Generators - Large , over 50 kw; Heaters, Mechanical; Hydraulic power unit (Pile Driving, Extracting or Drilling); Light Plants (1 to 5); Pumps, over 3"" (1 to 3, not to exceed a total of 300 ft); Pumps, Well Points; Tractaire; Welding Machines (2 through 5); Winches, 4 small electric drill winches;

GROUP 5: Bobcats (All); Brick Forklifts; Oilers; Directional

Boring

*Requires Oiler

IRON0001-026 06/01/2019

	Rates	Fringes
IRONWORKER		
Sheeter	$ 50.88	39.37
Structural and Reinforcing	$ 50.63	39.37

IRON0063-001 06/01/2018

	Rates	Fringes
IRONWORKER, ORNAMENTAL	$ 48.05	35.93

IRON0063-002 06/01/2018

	Rates	Fringes
IRONWORKER		
Fence Erector	$ 40.88	28.74

IRON0136-001 07/01/2018

	Rates	Fringes
IRONWORKER		
Machinery Movers; Riggers;		
Macinery Erectors	$ 41.00	33.96
Master Riggers	$ 43.50	33.96

LABO0002-006 06/01/2018

	Rates	Fringes
LABORER (BUILDING & RESIDENTIAL)		
GROUP 1	$ 42.72	28.19
GROUP 2	$ 42.72	28.19
GROUP 3	$ 42.80	28.19
GROUP 4	$ 42.82	28.19
GROUP 5	$ 42.87	28.19
GROUP 6	$ 42.92	28.19
GROUP 7	$ 42.95	28.19
GROUP 8	$ 43.05	28.19
GROUP 9	$ 43.07	28.19
GROUP 10	$ 43.17	28.19
GROUP 11	$ 43.00	28.19
GROUP 12	$ 43.72	28.19

LABORER CLASSIFICATIONS

GROUP 1: Building Laborers; Plasterer Tenders; Pumps for Dewatering; and other unclassified laborers.

GROUP 2: Fireproofing and Fire Shop laborers.

GROUP 3: Cement Gun.

GROUP 4: Chimney over 40 ft.; Scaffold Laborers.

GROUP 5: Cement Gun Nozzle Laborers (Gunite); Windlass and capstan person.

GROUP 6: Stone Derrickmen & Handlers.

GROUP 7: Jackhammermen; Power driven concrete saws; and other power tools.

GROUP 8: Firebrick & Boiler Laborers.

GROUP 9: Chimney on fire brick; Caisson diggers; & Well Point System men.

GROUP 10: Boiler Setter Plastic Laborers.

GROUP 11: Jackhammermen on fire brick work only.

GROUP 12: Dosimeter use (any device) monitoring nuclear exposure); Asbestos Abatement Laborer; Toxic and Hazardous Waste Removal Laborers.

LABO0002-007 06/01/2018

	Rates	Fringes
LABORER (HEAVY & HIGHWAY)		
GROUP 1	$ 42.72	28.19
GROUP 2	$ 42.80	28.19
GROUP 3	$ 42.87	28.19
GROUP 4	$ 43.00	28.19
GROUP 5	$ 42.72	28.19

LABORER CLASSIFICATIONS

GROUP 1: Common laborer; Tenders; Material expeditor (asphalt plant); Street paving, Grade separation, sidewalk, curb & gutter, strippers & All laborers not otherwise mentioned

GROUP 2: Asphalt tampers & smoothers; Cement gun laborers

GROUP 3: Cement Gun Nozzle (laborers), Gunite

GROUP 4: Rakers, Lutemen; Machine-Screwmen; Kettlemen; Mixermen; Drun-men; Jackhammermen (asphalt); Paintmen; Mitre box spreaders; Laborers on birch, overman and similar spreader equipment; Laborers on APSCO; Laborers on air compressor; Paving Form Setter; Jackhammermen (concrete); Power drive concrete saws; other power tools.

GROUP 5: Asbestos Abatement Laborers; Toxic and Hazardous Waste Removal Laborers, Dosimeter (any device) monitoring nuclear exposure

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LABO0002-008 06/01/2018

	Rates	Fringes
LABORER (Compressed Air)		
0 - 15 POUNDS	$ 43.72	28.19
16 - 20 POUNDS	$ 44.22	28.19
21 - 26 POUNDS	$ 44.72	28.19
27 - 33 POUNDS	$ 45.72	28.19
34 - AND OVER	$ 46.72	28.19
LABORER (Tunnel and Sewer)		
GROUP 1	$ 42.72	28.19
GROUP 2	$ 42.85	28.19
GROUP 3	$ 42.95	28.19
GROUP 4	$ 43.07	28.19
GROUP 5	$ 42.72	28.19

LABORER CLASSIFICATIONS (TUNNEL)

GROUP 1: Cage tenders; Dumpmen; Flagmen; Signalmen; Top laborers

GROUP 2: Air hoist operator; Key board operator; concrete laborer; Grout; Lock tenders (Free Air Side); Steel setters; Tuggers; Switchmen; Car pusher

GROUP 3: Concrete repairmen; Lock tenders (pressure side); Mortar men; Muckers; Grout machine operators; Track layers

GROUP 4: Air trac drill operator; Miner; Bricklayer tenders; Concrete blower operator; Drillers; Dynamiters; Erector operator; Form men; Jackhammermen; Powerpac; Mining machine operators; Mucking machine operator; Laser beam operator; Liner plate and ring setters; Shield drivers; Power knife operator; Welder- burners; Pipe jacking machine operator; skinners; Maintenance technician

GROUP 5: Asbestos abatement laborer; Toxic and hazardous waste removal laborer; Dosimeter (any device) monitoring nuclear exposure

LABORER CLASSIFICATIONS (SEWER)

GROUP 1: Signalmen; Top laborers and All other laborers

GROUP 2: Concrete laborers and Steel setters

GROUP 3: Cement carriers; Cement mixers; Concrete repairmen; Mortar men; Scaffold men; Second Bottom men

GROUP 4: Air trac drill operator; Bottom men; Bracers-bracing; Bricklayer tenders; Catch basin diggers; Drainlayers; dynamiters; Form men; Jackhammermen; Powerpac; Pipelayers; Rodders; Welder-burners; Well point systems men

GROUP 5: Asbestos abatement laborer, Toxic and hazardous waste removal laborer; Dosimeter (any device) monitoring nuclear exposure

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LABO0225-001 06/01/2018

	Rates	Fringes
LABORER (DEMOLITION/WRECKING)		
GROUP 1	$ 37.52	28.19
GROUP 2	$ 42.72	28.19
GROUP 3	$ 42.72	28.19

LABORER CLASSIFICATIONS

GROUP 1 - Complete Demolition

GROUP 2 - Interior Wrecking and Strip Out Work

GROUP 3 - Asbestos Work with Complete Demolition/Wrecking or Strip Out Work

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PAIN0014-001 06/01/2018

	Rates	Fringes
PAINTER (including taper)	$ 46.55	27.24

PAIN0027-001 06/01/2019

	Rates	Fringes

GLAZIER.....$ 44.85 37.72

PLAS0005-002 07/01/2015

	Rates	Fringes
PLASTERER.....	$ 42.25	26.65

PLAS0502-001 06/01/2018

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 45.25	33.48

PLUM0130-001 06/01/2019

	Rates	Fringes
PLUMBER.....	$ 51.00	31.47

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* PLUM0597-002 06/01/2019

	Rates	Fringes
PIPEFITTER.....	$ 49.60	33.09

ROOF0011-001 12/01/2019

	Rates	Fringes
ROOFER.....	$ 44.60	24.65

SFIL0281-001 01/01/2018

	Rates	Fringes

SPRINKLER FITTER.....$ 48.10 27.05

SHEE0073-001 06/08/2018

	Rates	Fringes
Sheet Metal Worker.....	$ 44.25	37.02

SHEE0073-002 06/08/2018

	Rates	Fringes
Sheet Metal Worker		
ALUMINUM GUTTER WORK.....	$ 31.32	37.02

TEAM0731-001 06/01/2017

COOK COUNTY - HEAVY AND HIGHWAY

	Rates	Fringes
TRUCK DRIVER		
2 or 3 Axles.....	$ 35.60	22.10
4 Axles.....	$ 35.85	22.10
5 Axles.....	$ 36.05	22.10
6 Axles.....	$ 36.25	22.10

FOOTNOTES:

A. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.

B. 900 straight time hours or more in 1 calendar year for

the same employer shall receive 1 week paid vacation; 3 years - 2 weeks paid vacation; 10 years - 3 weeks paid vacation; 20 years - 4 weeks paid vacation.

C. An additional $.20 per axle shall be paid for all vehicles with more than six (6) axles.

TEAM0731-002 03/01/2012

	Rates	Fringes
Traffic Control Device Monitor TRAFFIC SAFETY WORKER: Primary duties include but are not limited to the delivery, maintenance and pick-up of traffic control devices, the set-up and installation of traffic signs, pavement markings, barricades, crash barrels and glare screens, traffic control surveillance, the repair and maintenance trucks, cars, arrow boards, message signs, barricade and sign fabrication equipment.....	$ 28.25	9.08

TEAM0786-001 06/01/2017

COOK COUNTY - BUILDING AND RESIDENTIAL

	Rates	Fringes

TRUCK DRIVER

2 & 3 Axles	$ 39.942	0.25+a
4 Axles	$ 39.75	0.25+a
5 Axles	$ 39.967	0.25+a
6 Axles	$ 40.184	0.25+a

FOOTNOTES:

a. $719.00 per week.

An additional $.20 per axle shall be paid for all vehicles with more than six (6) axles.

Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.

900 straight time hours or more in 1 calendar year for the same employer shall receive 1 week paid vacation; 3 years - 2 weeks paid vacation; 10 years - 3 weeks paid vacation; 20 years - 4 weeks paid vacation.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours

they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were

prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted

because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board

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            U.S. Department of Labor
            200 Constitution Avenue, N.W.
            Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION”

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DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

SECTION 00 31 32.13 03

SUBSURFACE DRILLING AND SAMPLING INFORMATION

PART 1 GENERAL

1.1 SUBSURFACE CONDITIONS
1.2 SITE SPECIFIC DATA

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

ATTACHMENTS:

00 31 32.13 03_Boring Logs

-- End of Section Table of Contents --

SECTION 00 31 32.13 03

SUBSURFACE DRILLING AND SAMPLING INFORMATION

PART 1 GENERAL

1.1 SUBSURFACE CONDITIONS

Subsurface exploratory borings have been obtained by the Government to determine the general character of the subsurface materials within the project area. Locations of the borings are shown on the Drawings, and the logs of those borings that fall within the area of this contract are included for the convenience of the Contractor. The Government assumes no responsibility for any interpretation or deductions made by the Contractor from the logs and data. While the borings are generally representative of subsurface conditions at their respective locations and for their respective vertical reaches, localized variations of characteristics of the subsurface materials of this region should be anticipated. Groundwater elevations, shown on the boring logs, are those encountered at the time when the borings were taken and will fluctuate due to factors such as rainfall, lake and/or river stages and factors unknown.

1.2 SITE SPECIFIC DATA

Boring logs and complete laboratory tests results are provided at the end of this section as 00 31 32.13 03_Boring Logs.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

Hole No. DPRL-6

DRILLING LOG

DIVISION	North Central
INSTALLATION	Chicago District
SHEET	1 OF 1 SHEETS
1. PROJECT	Des Plaines River Levee - 5235.10
2. LOCATION (Coordinates or Station)	Levee 37 N 1979028 E 620340
3. DRILLING AGENCY	Patrick Drilling
4. HOLE NO. (As shown on drawing title and file number)	DPRL-6
5. NAME OF DRILLER	Jerry Copak
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	15.0
8. DEPTH DRILLED INTO ROCK	0.0
9. TOTAL DEPTH OF HOLE	15.0
10. SIZE AND TYPE OF BIT	3 1/4" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 8 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	626.0
16. DATE HOLE	STARTED JUN 16 97 / COMPLETED JUN 16 97
17. ELEVATION TOP OF HOLE	634.5
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Dark brown SILT, trace clay, trace organics, moist, topsoil ML -FILL-		AU-1 0.0 1.0	2" split-spoon samples were obtained using a 140 lb. hammer falling 30 inches.
633.0	1.5		Very stiff brown silty CLAY and coarse to fine sand, low plasticity, moist -FILL- CL	14/24"	SS-2 1.0 3.0	4/6/11/12 qu* = 3.4tsf
				6/24"	SS-3 3.0 5.0	9/11/15/18 Coarse gravel in spoon tip. Moisture Content = 15.4%
630.2	4.3		Hard grayish brown silty CLAY, trace medium to fine sand, high plasticity, wet CH	24/24"	SS-4 5.0 7.0	9/11/16/21 Moisture Content = 21.7% qu* = 4.25tsf LL = 50 PL = 21
627.3	7.2		Very stiff to medium stiff gray SILT and clay, trace medium to fine sand, low plasticity, wet ML	18/24"	SS-5 7.0 9.0	9/11/14/14 qu* = 0.8tsf
						Water level approximately 8.5' after 18 hours with approximately 4.0' of cave-in.
				24/24"	SS-6 9.0 11.0	6/9/11/12 qu* = 1.8tsf Moisture Content = 22.0%
				24/24"	SS-7 11.0 13.0	4/6/9/11 qu* = 1.75tsf Gravel = 0.0% Sand = 6.9% Silt = 72.6% Clay = 20.5%
				24/24"	SS-8 13.0 15.0	4/7/11/14 qu* = 2.5tsf Moisture Content = 13.0%
619.5	15.0		End of Boring at 15.0'.			Borehole backfilled with granular bentonite. Offset hole to obtain a Shelby tube sample. See Log DPRL-6A.

D-9-15

Hole No. DPRL-6A

DRILLING LOG

DIVISION	North Central
INSTALLATION	Chicago District
SHEET	1 OF 1 SHEETS
1. PROJECT	Des Plaines River Levee - 5235.10
2. LOCATION (Coordinates or Station)	Levee 37 N 1979028 E 620340
3. DRILLING AGENCY	Patrick Drilling
4. HOLE NO. (As shown on drawing title and file number)	DPRL-6A
5. NAME OF DRILLER	Jerry Copak
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	5.5
8. DEPTH DRILLED INTO ROCK	0.0
9. TOTAL DEPTH OF HOLE	5.5
10. SIZE AND TYPE OF BIT	3 1/4" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED JUN 16 97 / COMPLETED JUN 16 97
17. ELEVATION TOP OF HOLE	634.5
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Blind drilled to 5.0'.			
				0/6"	3T-1 5.0	Attempted to push 3" Shelby tube. Unable to push tube through the hard clay.
629.0	5.5		End of Boring at 5.5'.		5.5	Borehole backfilled with granular bentonite.

D-9-16

DRILLING LOG

DIVISION	
INSTALLATION	
SHEET	1 OF 3 SHEETS
1. PROJECT	Des Plaines River, IL Floodwall 37
JOB NUMBER	31130-A
2. LOCATION (Coordinates or Station)	Cook County, IL N 1979142.887 E 620345.437
3. DRILLING AGENCY	Subsurface Exploration, Inc.
4. HOLE NO. (As shown on drawing title and file number)	L-37-21-05
5. NAME OF DRILLER	Jack Lehtinen
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	41.5
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	41.5
10. SIZE AND TYPE OF BIT	4-1/2" PA to 10 ft.; 3-7/8" RB to 40 ft.
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	B-57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 17; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	623.243 WS; 629.243 BCR, ACR
16. DATE HOLE	STARTED 6/10/05; COMPLETED 6/10/05
17. ELEVATION TOP OF HOLE	635.243
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	

ELEVATION (ft) a	DEPTH (ft) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Fill: Silty clay, trace fine to medium sand and roots - brown - hard (CL)	5"	S-1	9-10-10 WC = 10.8 Qp = 4.5+ tsf
632.74	2.5					
			Fill: Silty clay, trace fine to coarse sand and wood - brown and black - hard (CL)	12"	S-2	2-4-4 WC = 14.9 Qp = 4.5+ tsf
			Sample 3: Plastic noted	1"	S-3	3-2-3 WC = 14.1 Qp = 4.5+ tsf
628.74	6.5					
			Silty clay, little fine to coarse sand, trace fine gravel and shale - gray - medium (CL)			
			LL=30% PL=11% PI=19%	18"	S-4	1-1-3 WC = 21.2 Qp = 0.5 tsf
625.24	10.0					
			Silty clay, little fine to coarse sand, trace fine gravel and shale - gray - very stiff to hard (CL)	12"	S-5	4-7-9 WC = 12.9 Qp = 2.0 tsf
			LL=21% PL=12% PI=9%	12"	S-6	2-4-6 WC = 12.3 Qp = 2.0 tsf

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 635.2

Hole No. L-37-21-05

PROJECT: Des Plaines River, IL Floodwall 37

INSTALLATION:

SHEET 2 OF 3 SHEETS

ELEVATION (ft) a	DEPTH (ft) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Silty clay, little fine to coarse sand, trace fine gravel and shale - gray - very stiff to hard (CL)	12"	S-7	3-4-7 WC = 14.7 Qp = 2.75 tsf
				12"	S-8	2-4-6 WC = 14.3 Qp = 2.0 tsf
				12"	S-9	4-6-8 WC = 14.6 Qp = 4.5 tsf
612.74	22.5		Silt, little clay, trace fine to coarse sand - gray - very dense to dense - moist (ML)	18"	S-10	14-28-31 WC = 13.8
610.24	25.0		Silty clay, trace fine to coarse sand - gray (CL) LL=23% PL=14% PI=9%	18"	S-11	18-15-17 WC = 14.0 Qp = N/A
607.74	27.5		Silty clay, trace fine gravel, fine to coarse sand and shale - gray - very stiff to hard (CL)	12"	S-12	6-11-13 WC =13.7 Qp = 3.5 tsf
				12"	S-13	6-9-13 WC = 14.0 Qp = 4.5+ tsf
				12"	S-14	8-13-17 WC = 13.4 Qp = 4.5+ tsf

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 635.2

Hole No. L-37-21-05

PROJECT: Des Plaines River, IL Floodwall 37

INSTALLATION:

SHEET 3 OF 3 SHEETS

ELEVATION (ft) a	DEPTH (ft) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Silty clay, trace fine gravel, fine to coarse sand and shale - gray - very stiff to hard (CL)			
			LL=31% PL=15% PI=16%	18"	S-15	8-14-17 WC = 14.2 Qp = 4.5+ tsf
				18"	S-16	6-13 WC = 15.0 Qp = 4.5+ tsf
				18"	S-17	9-13-21 WC = 10.2 Qp = 4.5+ tsf
593.74	41.5		End of Boring Borehole backfilled upon completion. Casing used: 11 ft. of 4 in. Automatic-Mobile hammer used for Standard Penetration Tests.			

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SECTION 01 10 00

GENERAL PROVISIONS

06/15

PART 1 GENERAL

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1.15 COORDINATION WITH OTHERS
1.16 SPECIAL SAFETY REQUIREMENTS
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PART 3 EXECUTION (NOT USED)

-- End of Section Table of Contents --

SECTION 01 10 00
06/15

GENERAL PROVISIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 CERTIFICATES OF COMPLIANCE

Any certificates required for demonstrating proof of compliance of materials with specification requirements must be executed in two copies. Each certificate must be signed by an official authorized to certify on behalf of the manufacturing company and must contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates must contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet specific requirements.

1.3 RESPONSIBLITY OF THE CONTRACTOR

The Contractor shall be responsible for the professional quality, technical accuracy and the coordination of all designs, drawings and specifications furnished by the Contractor under this contract. The Contractor shall, without additional compensation, correct or revise designs, drawings and specifications.

Neither the Government's review, approval or acceptance of, nor payment for, any of the services required under this contract shall be construed to operate as a waiver of any rights under this contract or of any cause or action arising out of the performance of this contract, and the Contractor shall be and remain liable to the Government in accordance with applicable law for all damages to the Government caused by the Contractor's negligence in connection with designs, drawings and specifications, furnished under this contract.

The rights and remedies of the Government provided for under the contract are in addition to any other rights and remedies provided by law.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following must be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Schedule; G, CN

In addition to CN, field representative, other parties who will be reviewing the Construction Schedule will be DC, Civil Engineering Design Branch.

Condition of Existing Structures

Coordination with Others; G, CN

Drug Free Workplace

List of E-Verified/Eligible Candidates; G, GSE

SD-06 Test Reports

Construction Progress Photographs; G, CN

SD-11 Closeout Submittals

Construction Complete Photographs; G, CN

1.5 DRUG FREE WORKPLACE

Refer to FAR CLAUSE 52.223-6 entitled DRUG FREE WORKPLACE in Section 00 70 0 - Conditions of the Contract. Submit within 45 calendar days of Contractor's receipt of the "Development and Submission of Initial Project Submittals".

1.6 REAL ESTATE

All required right-of-way to do the work is available to the Contractor, and is included on the contract drawings. In the event the Contractor requires any additional access roads and storage areas, obtain such areas at his own expense. Furnish to the Contracting Officer copies of all legal documents or leases permitting his use of private or other properties other than included in the contract.

1.7 CONSTRUCTION SCHEDULE

An initial baseline Construction Schedule Construction Schedule shall be submitted within 14 calendar days of Notice to Proceed. This schedule shall use the date of Notice to Proceed as the start date and shall show the work completed on the Contract Required Completion Date, as indicated in the FAR clause entitled COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK in Section 00 70 00 - Conditions of the Contract. At a minimum, the schedule shall include the following items:

a. Submittal, Government review, and approval of preconstruction submittals, including the Contractor Quality Control Plan, the Accident Prevention Plan, the Environmental Protection Plan, and other major work plan and materials submittals;

b. Procurement of any long lead-time equipment or materials, if any;

c. Mobilization;

d. The sequencing of each major on-site work activity from preparatory work through completion of the field work;

e. Pre-final inspection, correction of punch list items, and final inspection;

f. Demobilization; and

g. Preparation, submittal, and Government review and approval of as-built drawings and closeout submittals.

In addition to the initial baseline schedule, electronic and hard copies of an updated Construction Schedule Submittal shall be included with each payment estimate/request for payment. These schedule updates shall compare the initial baseline schedule to an updated schedule showing the actual work progress to date and a projection of the work schedule for the remainder of the Contract.

All schedule submittals shall include a tabulated earnings projection, in a format acceptable to the COR, that lists the estimated earnings for each month of the Contract duration.

1.8 CONSTRUCTION PROGRESS PHOTOGRAPHS

Provide photographs documenting the work progress during construction.

Monthly photography must be performed between the first and fifth of each month during construction.

Submit photographs to the Contracting Officer no later than the tenth of each month the photographs are taken.

1.8.1 Photographic Documentation

Provide a minimum of six views from varying positions to document the monthly work accomplished. Additional views and positions may be required by the Contracting Officer to document the monthly work progress. Any additional photographs required must be done at no additional cost to the Government.

1.8.1.1 Digital Photographic Media

Photographs must be a minimum of four megapixels in JPEG format and submitted on CD-ROM or DVD. Submit two copies of all disks. All disks must be labled accordingly:

a. Contract Title,

b. Contract Number,

c. Photography Date, and

d. File name shall include date, location, and brief description.

1.8.2 Construction Complete Photographs

Pursuant to the final inspection by the Contracting Officer, submit photographs documenting the final conditions at the completion of the contract.

Submit photographs in the same quantity, media and labeling as the construction progress photographs.

Submit construction complete photographs within ten business days after final inspection by the Contracting Officer.

1.8.3 Payment and Acceptance

No separate payment will be made for providing approved progress and completion photographs required under this contract. All costs in connection therewith shall be considered a subsidiary obligation of the Contractor.

The progress photographs and the final conditions photographs will be jointly reviewed for accuracy and completeness by the COR and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the progress photographs as specified, the COR must deduct from the monthly progress payment an amount representing the estimated cost of the progress photographs.

1.9 INSPECTION

The presence or absence of a Quality Assurance representative shall not relieve the Contractor of responsibility for the proper execution of work in accordance with the plans and specifications.

1.10 CONDITION OF EXISTING STRUCTURES

Prior to commencement of operations by the Contractor at the site, a detailed survey will be made of all existing structures that may be affected by the Contractor's operations. The survey will be conducted in coordination with local interests, Contractor, Corps of Engineers Representative, and private parties concerned and will be sufficient in scope to provide advance agreement among all concerned as to the condition of the existing structures. Participate in pre-construction surveys of existing structures as deemed necessary to permit determination and accurate assessment of any subsequent damage to existing structures that may be incurred during the period of the contract.

1.11 PRESERVATION OF HISTORICAL, ARCHAEOLOGICAL AND CULTURAL RESOURCES

If, during construction activities, the Contractor observes items that might have historical or archaeological value, such observations must be reported immediately to the COR so that the appropriate authorities may be notified and a determination can be made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in the destruction of these resources and prevent employees from trespassing on, removing, or otherwise damaging such resources.

1.12 MINIMUM AMOUNT OF INSURANCE REQUIRED

In accordance with FAR CLAUSE entitled INSURANCE - WORK IN A GOVERNMENT

INSTALLATION, the following minimum insurance coverages and limits are required. The term "Installation" referred to in this clause is deemed to mean Corps of Engineers project site or Federal property.

a. Evidence of the following minimum insurance coverages and limits, with concurrent policy expiration dates, must be received by the Department of the Army, Corps of Engineers before the Contractor can begin work. This evidence must be on a fully-completed, signed and dated ACORD Certificate of Insurance. In addition, policy endorsements must be issued by or in behalf of the insuring company or companies naming the Department of the Army, Corps of Engineers as Additional Interest Insured regarding the work. The endorsements must also provide that the Department of the Army, Corps of Engineers receive direct written notice at least 30 calendar days before the effective date of any material changes to, any cancellation of, or any non-renewal of these coverages during the time period of the Contractor's work. These endorsements must also be received by the Department of the Army, Corps of Engineers before the Contractor can begin work.

b. Should the coverages expire or be terminated during the time period of the Contractor's work, the Department of the Army, Corps of Engineers must receive an ACORD Certificate of Insurance as evidence of renewal or replacement insurance coverage and the supporting policy endorsements as specified above. The required evidence of renewal replacement insurance must be received by either the Contracting Officer or Contracting Officer's Representative at least 10 calendar days before the coverage expires or is being terminated.

c. All insuring companies must be rated A- or Excellent or better, by A.M. Best Company, an independent insurance rating service. The ACORD Certificate must list the A.M. Best Company insurance company code of listed insurance companies being offered.

Comprehensive General Liability	
(Occurrence policy form only)	
General Aggregate	$2,000,000
Products/Completed Operations	$2,000,000
Each Occurrence	$1,000,000
Fire Damage Legal Liability	$ 50,000
Comprehensive Automobile Liability	
(Including Hired Automobile Liability	
and Non-Owned Automobile Liability)	
Combined Single Limit	$1,000,000
Employers' Liability	
Each Occurrence	$ 500,000
Policy Limit	$ 500,000
Each Employee	$ 500,000
Workers Compensation	
(As required by state law or Federal law)	
Umbrella Liability	
(Occurrence policy form only)	
Each Occurrence and Aggregate	$5,000,000

1.13 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

This clause specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE entitled "DEFAULT (FIXED PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
BUSINESS DAYS BASED ON A FIVE DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
15	13	7	5	5	5	3	4	2	4	5	12

Upon acknowledgement of Notice to Proceed (NTP) and continuing throughout the contract, record on the daily Contractor Quality Control report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled business day.

The number of actual adverse weather delay days must include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delays exceeds the number of days anticipated in paragraph 2, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather business days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)".

1.14 PERMITS AND RESPONSIBILITIES

Obtain all permits/licenses required for this project as required under CONTRACT CLAUSES paragraph entitled "PERMITS AND RESPONSIBILITIES".

1.15 COORDINATION WITH OTHERS

Schedule and coordinate operations affecting other Contractors, Government hired labor forces, utilities, and/or property within the work limits. Schedule with lead time sufficient for coordination of all involved parties as necessary for timely completion of each contract feature. As evidence of this compliance with this General Provision, furnish the COR with a copy of each coordinated schedule prior to commencing operations affecting such other Contractors, utilities, and/or property.

Coordinate with Illinois Department of Transportation (IDOT) for permit requirements for any road closures or other impacts to IDOT right-of-way (ROW) and property.

For any coordination required with the city, contact:

Jeff Wulbecker
illage Engineer
Village of Mount Prospect
1700 West Central Road
Mount Prospect, IL 60056
Phone: 847-870-5640
jwulbeck@mountprospect.org

1.16 SPECIAL SAFETY REQUIREMENTS

Comply with all applicable Federal, state and local safety requirements including, but not limited to, those provided in EM 385-1-1.

1.17 ONE CALL SYSTEMS FOR EXCAVATORS

One call systems, established by law, are operated by owners of underground facilities for excavators. Upon notification by an excavator through a one call system, all participating operators of underground facilities in a covered area will identify and locate their facilities. One call systems will be identified by contacting the following:

ILLINOIS
JULIE UTILITIES PROTECTION SERVICES
1-800-892-0123

1.18 ELECTRICAL POWER LINES

Study the construction plans and site and know in detail all locations of power lines within the rights of way. Prior to performing any construction operation adjacent to power lines, appropriate danger signs must be provided where any equipment scheduled for use on the site is capable of contacting such lines. Confirm the location of underground lines, contact the appropriate council listed in paragraph ONE CALL SYSTEMS FOR EXCAVATORS. Aerial power lines must either be shut off and a positive means taken to prevent the lines from being energized, or clearances required by EM 385-1-1, Safety and Health Requirements Manual, must be maintained. Work must not proceed into dangerous areas without an additional workman being assigned the crew to watch the movements of other personnel and equipment to assure that designated clearances are maintained.

1.19 BORROW/DISPOSAL SITES AND QUARRIES

This paragraph, Borrow/Disposal Sites and Quarries, applies only to the ability of the Contractor to utilize a particular borrow/disposal site or quarry, and does not address the use of materials from that site or quarry. Nothing in this paragraph, Borrow/Disposal, shall relieve the Contractor of complying with the specific testing requirements for material taken from any borrow/disposal sites or quarries as set forth in the technical provisions of this Contract.

a. Definitions. For purposes of this general provision, the following definitions apply:

(1) Government-Suggested borrow/disposal site or quarry means a site or quarry suggested by the Government for use by the Contractor concerning which all applicable Federal, state and

local environmental statutory and regulatory requirements may or may not have been satisfied.

(2) Commercial/existing borrow/disposal site or quarry means a site or quarry which is either in the business of providing borrow material or has been used as a disposal site for other purposes and is available for use; and concerning which all applicable Federal, state and local environmental statutory and regulatory requirements have been satisfied.

(3) Contractor-chosen borrow/disposal site or quarry means a site or quarry chosen by the Contractor for use concerning which none or not all of the applicable Federal, state and local environmental statutory and regulatory requirements have been satisfied.

b. If a borrow/disposal site or quarry is identified in the contract specifications as Government-Suggested, it is the responsibility of the Contractor to ascertain whether or not all Federal, state and local environmental statutory and regulatory requirements have been satisfied. If any of such requirements have not been satisfied, the Contractor is required to follow the procedures set forth in paragraph d(4) below. Use of such a site or quarry must be approved by the Contracting Officer.

c. If the Contractor chooses a commercial/existing borrow/disposal site or quarry, the Contractor is not required to ensure that all applicable Federal, state and local environmental statutory and regulatory requirements have been satisfied, but is required to provide to the Government either, as a minimum, a letter from the owner/operator of the commercial/existing borrow/disposal site or quarry certifying that all environmental and operating permits have been acquired, or actual copies of all such environmental and operating permits. Use of such a site or quarry must be approved by the Contracting Officer. Adhere to all rules, regulations and business practices required by the owner/operator.

d. If a Contractor decides to use a Contractor-chosen borrow/disposal site or quarry, it is the Contractor's responsibility to ensure that all applicable Federal, state and local environmental statutory and regulatory requirements have been satisfied. Use of such a site or quarry must be approved by the Contracting Officer, and such approval shall not be granted unless all applicable requirements have been met and such use of the site does not pose significant environmental impacts.

(1) The specific requirements which must be met by the Contractor before a Contractor-chosen (or, when applicable, a Government-recommended) site or quarry must be approved by the COR include, at a minimum, but are not necessarily limited to, compliance with the following environmental laws, regulations and executive orders:

Federal Laws, Regulations, and Executive Orders

Name	Agency
Section 404, Clean Water Act (Permit)	U.S. Army Corps of Engineers, Chicago District (IL)

Section 10, River and Harbor Act of 1899 (Permit)	U.S. Army Corps of Engineers
Emission Limitations, Clean Air Act	U.S. Environmental Protection Agency
Section 9, Endangered Species Act of 1973	U.S. Fish and Wildlife Service, Barrington Office (IL)
Section 703, Migratory Bird Treaty Act of 1918	U.S. Fish and Wildlife Service
Section 106, National Historic Preservation Act of 1966	Illinois Historic Preservation Agency (IL)
Flood Plain Management, Executive Order 11988	U.S. Army Corps of Engineers, Chicago District
Surface Mining Control and Reclamation Act of 1977	Bureau of Mines
Resource Conservation and Recovery Act of 1976	U.S. Environmental Protection Agency
Toxic Substance Control Act	U.S. Environmental Protection Agency

Illinois State Statutes

Construction Within a Floodway (Permit)	Illinois Department of Transportation, Division of Water Resources
Illinois Endangered Species	Illinois Department of Conservation
Section 401, Clean Water Act (Permit)	Illinois Environmental Protection Agency, Division of Water Pollution Control
Section 402, Clean Water Act (NPDES Permit)	Illinois Environmental Protection Agency, Division of Water Pollution Control
State Agency Historic Resources Protection Act	Illinois Historic Preservation Agency
Human Grave Protection Act	Illinois Historic Preservation Preservation Agency

It is the Contractor's responsibility to ensure that all applicable Federal, state and local environmental statutory and regulatory requirements are satisfied, regardless of their presence on, or absence from, the above list.

(2) It is the responsibility of the Government to ensure that the requirements of the National Environmental Policy Act (NEPA) have been complied with. If the Contractor decides to use a site or quarry which has not previously undergone an environmental review under NEPA (either Government-recommended or Contractor-chosen), notify the Contracting Officer, who shall arrange for such an environmental review. This review and compliance process may include inter-agency coordination and the preparation and circulation for public review of environmental documentation. It is the responsibility of the Contractor to allow sufficient time in the construction schedule to accommodate this review and compliance process, and to provide the Contracting Officer with any and all information that the Contracting Officer deems necessary to facilitate the process. The review and compliance process requires a minimum time frame of 90 calendar days, but could take substantially longer, possibly up to one year or, in unusual circumstances, even longer than one year, to complete. Any construction delays caused by the need to conduct an environmental review under NEPA shall be solely the responsibility of the Contractor, at no additional cost to the Government.

(3) It is also the responsibility of the Government to perform Section 7 consultation under the Endangered Species Act, to coordinate with the United States Fish and Wildlife Service and appropriate state wildlife agencies under the Fish and Wildlife Coordination Act, and to perform a Farmland Conversion Impact Rating under the Farmland Protection Policy Act for all Government-Suggested or Contractor-Chosen sites. This must be accomplished concurrently with the NEPA environmental review process. It is the responsibility of the Contractor to allow sufficient time in the construction schedule to accommodate these consultation and coordination requirements as well as the NEPA review process, and to provide the Contracting Officer with any and all information that the Contracting Officer deems necessary to facilitate the completion of these consultation and coordination requirements.

(4) The Government cannot guarantee that any Government-Suggested or Contractor-chosen site is capable of complying with all applicable Federal, state and local environmental statutory and regulatory requirements and may reject any such site proposed for use by the Contractor for environmental reasons. If the Contracting Officer does not approve the use of a Government-recommended or Contractor-chosen borrow/disposal site or quarry because not all applicable Federal, state or local environmental statutory and regulatory requirements have been satisfied, or because the Government determines that such site or quarry could not be used for environmental reasons as a result of the environmental review under NEPA, it is the Contractor's responsibility to locate an alternate site or quarry and to perform all necessary reviews to obtain approval of the use of such alternative site or quarry. Any construction delays caused by the need to locate an alternate site or quarry, shall be solely the responsibility of the Contractor, at no additional cost to the

Government.

(5) Nothing in this clause shall relieve the Contractor from the responsibility of obtaining all non-environmental permits and licenses which may be required under Federal, state or local statutes, regulations and ordinances.

1.20 TAX EXEMPTION

ILLINOIS RETAILER'S OCCUPATIONAL TAX AND USE TAX EXEMPTION

Pursuant to the rulings of the Illinois Department of Revenue, materials which are to be physically incorporated into real estate owned by the Government are exempt from Illinois Retailers' Occupational Tax and Use Tax. However, sales of tools, fuel, lumber for forms and other end use or consumption items which are not physically incorporated into real estate are taxable sales. After contract award, the Contractor may request the Government Sales Tax Exemption Number, which must be used when purchasing tax exempt material. Nothing herein shall be construed to affect the provisions contained in Section 00700, Contract Clause entitled FEDERAL, STATE, AND LOCAL TAXES.

1.21 BARRICADES AND WARNING SIGNS

Provide and maintain barricades, danger and warning signs and suitable and efficient lights at all points of entry to the section or sections of roadway which are to be closed to public travel during construction operations under the contract. Furnish flagmen and watchmen to warn and direct traffic or to prevent travel on any portion of roadways during the periods in which operations under the contract are performed as may be required to ensure safety and prevent accidents. All facilities furnished by the Contractor under this paragraph must be as prescribed by local highway authorities and must be subject to approval by the Contracting Officer. Traffic control must be in accordance with the by the State and local authorities having jurisdiction. A copy of the plan must be submitted to the Contracting Officer for approval. Separate payment shall not be made for any costs incurred by the Contractor in compliance with the provisions of this paragraph but all costs therefore shall be considered as a subsidiary obligation of the Contractor and are included in the contract price for other contract items as applicable.

1.22 PRECONSTRUCTION CONFERENCE

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation of the schedule of prices or earned value report, shop drawings, and other submittals, scheduling programming, and prosecution of the work. Major subcontractors who will engage in the work must also attend.

1.23 PROGRESS MEETINGS

1.23.1 PROGRESS MEETINGS

A progress meeting will be held weekly. The meetings will occur on-site, in the Contractor's field trailer, as conditions allow. The day for conducting meetings will be mutually agreed to between the Contractor, the Government and the Local Sponsors within 10 calendar days after receipt

of the notice to proceed. Unless the COR specifically indicates in writing otherwise, prepare meeting agendas and meeting minutes for each meeting.

Progress meeting will consist of a written agenda of topics and issues to be discussed during the meeting and followed up with draft meeting minutes prepared by the Contractor. The draft meeting minutes will be emailed out to all attendees one business day after the meeting for review and approval. The review and approval process will allow for mutual acceptance of the draft minutes as written, or editing to add, delete, and/or correct items that were covered in the weekly meeting. The edited draft meeting minutes will be published and handed out by the Contractor at each following week's progress meeting. If all attendees agree the minutes have been properly edited; then those minutes become the official final minutes of the previous week's progress meeting. All attendees will be required to sign an attendance sheet that will become an attachment to the official final meeting minutes.

The progress meeting agendas will at a minimum contain the following items (Italic wording represents example input per item):

1. Contract Schedule and S-curve status
   a. *Dollar driven schedule how much will the Contractor need in the next three months*
   b. *Status of the contract and funds*

2. Weather days for the last two weeks

3. Go over Punch/Discrepancy list Items
   a. *Not in contract compliance*
   b. *Methods of correction*
   c. *Where does it fit in the schedule?*
   d. *Is it holding up a critical path item?*
   e. *Is it a critical path item?*

4. Status of stored materials
   a. *When to fund stored materials and when to subtract materials from the stored state*
   b. *Where is the item on the scheduled?*

5. Work performed since last progress meeting
   a. *Last week did we do what we said we were going to do?*
   b. *Is there some slippage according to schedule?*

6. Two week look ahead.

7. Submittal register open / closed items.
   a. *Status of needed submittals*
   b. *Missing/overdue*

8. Visit any open items from previous week's agenda.

9. Pay estimate
   a. *Questions*
   b. *Concerns*
   c. *Progress*

10. Status of safety plan and accident prevention

11. Review of the QCS program
    a. *Questions*
    b. *Problems*
    c. *Observations*
    d. *Review Reports (Contractor Action Items, Submittals in Review, Submittals due in 30 calendar days, etc)*

12. Status and review of testing
    a. *Concrete*
    b. *Soil*
    c. *Asphalt*

13. Requests for Information (RFIs) / RFC's
    a. *New*
    b. *Unanswered*

14. Requests for Proposals (RFPs)
    a. *New*
    b. *Unanswered*

15. Differing Site Conditions

16. Security issues
    a. *Status of coordination with the Others/Local Sponsor, Any Item*

17. Other

During the first progress meeting the agenda format will be reviewed and agreed to by all parties in attendance.

Prior to the first progress meeting the Contractor and the Government will agree on a method for conducting the meeting. This method will consist of one of the following alternatives:

a. Government conducts the progress meeting.

b. Contractor conducts the progress meeting.

Prepare the updated agenda for the meeting prior to the scheduled day, and any information in dispute will be addressed at the meeting.

1.24 VETERANS EMPLOYMENT EMPHASIS FOR U.S. ARMY CORPS OF ENGINEERS CCONTRACTS

In addition to complying with the requirements outlined in FAR Part 22.13, FAR Clause 52.222-35, FAR Clause 52.222-37, DFARS 222.13, and Department of Labor regulations, United States Army Corps of Engineers (USACE) contractors and subcontractors at all tiers are encouraged to promote the training and employment of United States veterans while performing under a USACE contract. While no set-aside, evaluation preference, or incentive applies to the solicitation or performance under the resultant contract, USACE contractors are encouraged to seek out highly qualified veterans to perform services under this contract. The following resources are available to assist USACE contractors in their outreach efforts.

U.S. Department of Labor Veteran Employment: www.vets.gov/

Federal Veteran Employment Information: www.fedshirevets.gov/index.aspx

Veterans' Employment and Training Services (VETS): http://www.dol.gov/vets/

Veterans Opportunity to Work (VOW) Program: https://benefits.va.gov/vow/

Hiring Our Heroes Initiative: www.uschamberfoundation.org/hiring-our-heroes

1.25 SECURITY REQUIREMENTS

1.25.1 CLAUSE 2 - Access and General Protection/Security Policy and Procedures

All contractor and all associated sub-contractors employees shall comply with applicable facility access and local security policies and procedures (provided by government representative). The contractor shall also provide all information required for background checks to meet facility access requirements to be accomplished by the facility Security Office. Contractor workforce must comply with all personal identity verification requirements (FAR clause 52.204-9, Personal Identity Verification of Contractor Personnel) as directed by Department of Defense (DoD), Headquarters Department of Army (HQDA) and/or local policy. In addition to the changes otherwise authorized by the changes clause of this contract, should the Force Protection Condition (FPCON) at any installation or facility change, the Government may require changes in contractor security matters or processes.

1.25.2 CLAUSE 15 - E-Verify Program

The Contractor must pre-screen candidates using the E-verify Program (http://www.uscis.gov/e-verify) website to meet the established employment eligibility requirements. The Vendor must ensure that the candidate has two valid forms of Government issued identification prior to enrollment to ensure the correct information is entered into the E-verify system. The vendor must ensure the correct information is entered into the E-verify system. A list of E-verified/eligible candidates for each verified/eligible contractor candidate, working on this contract, shall be submitted to the COR no later than three business days after the initial contract award.

When contracts are with individuals, the individuals will be required to complete a Form I-9, Employment Eligibility Verification, with the designated Government representative. Form I-9 will be provided to the Contracting Officer and shall become part of the official contract file. (The purpose of using E-Verify is to ensure all contractors are U.S. citizens or documented foreign citizens with authority to work in the United States of America).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01 11 00

SUMMARY OF WORK
08/15

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The Des Plaines River originates in Racine and Kenosha Counties in southeastern Wisconsin. The river enters the state of Illinois in Lake County and flows southward through Cook County and eventually merges with Chicago Sanitary and Ship Canal. A detailed design for the Mount Prospect/Prospect Heights flood control project (Levee/Floodwall 37) has been developed by the Chicago District Corps of Engineers. The flood control project consists approximately of 9,000 linear feet of floodwall including a small portion of levee, three pumping stations, a number of gravity outlet structures, a roadway closure structure and a road raise. The three pump stations are constructed along the floodwall on Des Plaines River Road and Milwaukee Avenue. Pump Stations #1 and #3 each have two 2,600 gallons per minute (gpm) storm water pumps and the Pump Station #2 has three 2,600 gpm storm water pumps.

An additional pump station, adjacent to the existing Pump Station #2 with total capacity of 120 cubic feet per second (cfs), will be constructed. The design intent is to raise the level of protection by increasing the pumping capacity and perform other improvements. The approximate size of the wet well and the inlet structure is 22 feet by 27 feet. In addition, the existing 30-inch inlet pipe will be replaced with new five feet by five feet and four feet by six feet concrete culverts, and the four connection points will be retrofitted to accommodate the larger culverts. The retrofitting of connection points will include partial demolition of pump station #2 and closure structure #6, and the addition of three culvert supports at those same structures. The three submersible axial flow pumps, 40 cfs each, will satisfy the pumping capacity requirement. Each pump will be installed inside the wet well and will be equipped with a Formed Suction Intake (FSI) device which will ensure smooth laminar type flow towards the pump’s suction side.

The construction of the new pump station requires partial demolition of the flood-wall and modification of the backflow structure 1 listed as option item in the front end section. In addition, the following electrical work will be performed: new utility transformer, transformer connections, transformer pad, ductbank and cabling for the new pump station, new Motor Control Center (MCC) and housekeeping pad for the MCC, power cabling and Variable Frequency Drives for the pumps, all controls wiring and programming of the Programmable Logic Controllers for the pumps.

1.1.2 Location

The work is located in the Village of Mount Prospect, Illinois, along the Des Plains River, as shown on the drawings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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08/15

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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONTRACT COST BREAKDOWN

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SECTION 01 22 00.00 10

PRICE AND PAYMENT PROCEDURES
08/15

PART 1 GENERAL

1.1 SINGLE JOB PAYMENT ITEMS

Payment items for the work of this contract for which contract job payments will be made are listed in the SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular job or unit price payment item, are included in the listed job item most closely associated with the work involved. The job price and payment made for each item listed constitutes full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

1.1.1 Mobilization (Base Bid Item 0001)

1.1.1.1 Payment

Payment will be made for costs associated with mobilization. The contractor will be compensated for the totality of its activities needed to mobilize its equipment and labor force to the project site. The Government will pay all costs for the mobilization of all of the Contractor's plant and equipment at the job price for this item. The Contracting Officer Representative may require the Contractor to furnish cost data to justify its bid price for this item if the Contracting Officer deems there is no reasonable relationship to the cost of the work in this contract. Failure to justify the line item price to the satisfaction of the Contracting Officer will result in payment determined by the Contracting Officer of the actual cost, which is not subject to appeal.

1.1.1.2 Unit of Measure

Unit of Measure: JOB

1.1.2 Demobilization (Base Bid Item 0002)

1.1.2.1 Payment

Payment will be made for costs associated with demobilization. The contractor will be compensated for the totality of its activities needed to demobilize its equipment and labor force to the project site. The Government will pay all costs for the demobilization of all of the Contractor's plant and equipment at the job price for this item. The Contracting Officer Representative may require the Contractor to furnish cost data to justify its bid price for this item if the Contracting Officer deems there is no reasonable relationship to the cost of the work in this contract. Failure to justify the line item price to the satisfaction of the Contracting Officer will result in payment determined

by the Contracting Officer of the actual cost, which is not subject to appeal.

1.1.2.2 Unit of Measure

Unit of Measure: JOB

1.1.3 Temporary Construction Facilities (Base Bid Item 0003)

1.1.3.1 Payment

Payment will be made at the contract JOB price for all labor, equipment and materials for the contractor's temporary field office, temporary fencing and gates, restoration, project and safety signs, and other incidental items as described in Section 01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS and Section 01 58 00 PROJECT IDENTIFICATION.

1.1.3.2 Unit of Measure

Unit of Measure: JOB

1.1.4 Maintenance of Traffic (Base Bid Item 0004)

1.1.4.1 Payment

Payment will be made for costs associated with maintenance of traffic, to include any Illinois Department of Transportation (IDOT) requirements and Section 01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS.

1.1.4.2 Unit of Measure

Unit of Measure: JOB

1.1.5 Demolition and Removal (Base Bid Item 0005 and Option Bid Item 0021)

1.1.5.1 Payment

Payment will be made for costs associated with all demolition and removal as shown on the plans and detailed in Section 02 41 00 DEMOLITION.

1.1.5.2 Unit of Measure

Unit of Measure: JOB

1.1.6 Reinforced Concrete Structure and Miscellaneous Metal (Base Bid Item 0007)

1.1.6.1 Payment

Payment will be made for costs associated with the construction of the new Pump Station, including but not limited to all excavation and backfill, concrete, structural reinforcement, and miscellaneous metals including ladder and gratings. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work

1.1.6.2 Unit of Measure

Unit of Measure: JOB

1.1.7 Axial Flow Propeller Pump (Base Bid Item 0008)

1.1.7.1 Payment

Payment will be made at the contract lump sum price for all material, fabrication, delivery, installation, testing procedures, and disposal associated with the installation of the storm water pumps, 30 inch discharge pipe with flanges, three discharge columns, three 6 inch steel pipe air vents, pump/pipe supports, and FSI devices as shown on the contract drawings and as described in Section 35 45 02.00 10 SUBMERSIBLE PUMP, AXIAL-FLOW AND MIXED-FLOW TYPE. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.7.2 Unit of Measure

Unit of Measure: JOB

1.1.8 Sump Pump (Base Bid Item 0009)

1.1.8.1 Payment

Payment will be made at the contract lump sum price for all material, fabrication, delivery, installation, testing procedures, and disposal associated with the installation of the sump pump, air release valves, pump/pipe supports, and piping as shown on the contract drawings and as described in Section 33 61 13.19 VALVES, PIPING, SUMP PUMPS, AND EQUIPMENT IN VALVE MANHOLES. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.8.2 Unit of Measure

Unit of Measure: JOB

1.1.9 Electrical Components (Base Bid Item 0012)

1.1.9.1 Payment

Payment will be made for costs associated with the preparation, installation, and testing of all electrical equipment including transformer concrete pads, secondary duct banks, electric service meter base, cables, conduit, and other electrical equipment required by the design. All installations will be in accordance with these specifications. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.9.2 Unit of Measure

Unit of Measure: JOB

1.1.10 Seeding (Base Bid Item 0013 and Option Bid Item 0024)

1.1.10.1 Payment

Payment will be made for costs associated with all seeding restoration work per Section 32 92 19 SEEDING.

1.1.10.2 Unit of Measure

Unit of Measure: JOB

1.1.11 Topsoil (Base Bid Item 0014 and Option Bid Item 0025)

1.1.11.1 Payment

Payment will be made for costs associated with removing and restoring topsoil per Section 31 00 00 EARTHWORK and Section 32 92 19 SEEDING.

1.1.11.2 Unit of Measure

Unit of Measure: JOB

1.1.12 Closure Structure 6 Modifications (Base Bid Item 0015)

1.1.12.1 Payment

Payment will be made for costs associated with structural modifications to the existing Closure Structure #6, as deatiled on the plans and specifications. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.12.2 Unit of Measure

Unit of Measure: JOB

1.1.13 Pump Station #2 Modifications (Base Bid Item 0017)

1.1.13.1 Payment

Payment will be made for costs associated with structural modifications to the existing Pump Station #2, as deatiled on the plans and specifications. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.13.2 Unit of Measure

Unit of Measure: JOB

1.1.14 Pump Station Outlet (Base Bid Item 0019)

1.1.14.1 Payment

Payment will be made for costs associated with the construction of the new Pump Station outlet, including but not limited to the five foot RCP outlet pipe, headwall structure, ditch grading and riprap installation, and all associated excavation and backfill. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.14.2 Unit of Measure

Unit of Measure: JOB

1.1.15 Backflow Structure #1 Modifications (Option Bid Item 0022)

1.1.15.1 Payment

Payment will be made for costs associated with structural modifications to the existing Backflow Structure #1, as detailed on the plans and specifications. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.15.2 Unit of Measure

Unit of Measure: JOB

1.1.16 Primary Duct Bank (Option Bid Item 0026)

1.1.16.1 Payment

Payment will be made for costs associated with furnishing and installing a primary duct bank from existing utility pole to transformer location. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.16.2 Unit of Measure

Unit of Measure: JOB

1.1.17 750 kVA Pad Mount Service Transformer (Option Bid Item 0027)

1.1.17.1 Payment

Payment will be made for costs associated with furnishing and installing a 750 kVA Pad Mount Service Transformer at the location shown on the drawings. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.1.17.2 Unit of Measure

Unit of Measure: JOB

1.1.18 Performance and Payment Bond (Base Bid Item 0020 and Option Bid Item 0028)

1.1.18.1 Payment

Payment will be made for the performance and payment bonds that are required as part of this contract. The Government will pay the actual cost of the bonds or the Contractor's bid price, whichever is less, after receiving evidence of payment (paid invoice) from the bonding company or agency.

1.1.18.2 Unit of Measure

Unit of Measure: LOT

1.2 UNIT PRICE PAYMENT ITEMS

Payment items for the work of this contract on which the contract unit price payments will be made are listed in the SCHEDULE and described below. The unit price and payment made for each item listed constitutes full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

1.2.1 Clearing and Grubbing (Base Bid Item 0006)

1.2.1.1 Payment

Payment will be made for costs associated with Clearing and Grubbing within the work limits as required to complete the work. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.2.1.2 Measurement

The measurement for clearing and grubbing will be per acreage.

1.2.1.3 Unit of Measure

Unit of Measure: Acre (AC)

1.2.2 Flap Gate (Base Bid Item 0010)

1.2.2.1 Payment

Payment will be made for all material, fabrication, delivery, installation, testing procedures, and disposal associated with the installation of the flap gates as shown on the contract drawings and as described in Section 33 61 13.19 VALVES, PIPING, SUMP PUMPS, AND EQUIPMENT IN VALVE MANHOLES. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.2.2.2 Measurement

The measurement will be per each flap gates installed and accepted at locations shown on drawings.

1.2.2.3 Unit of Measure

Unit of Measure: Each (EA)

1.2.3 Duckbill Valve (Base Bid Item 0011)

1.2.3.1 Payment

Payment will be made for all material, fabrication, delivery, installation, testing procedures, and disposal associated with the installation of the duckbill valve as shown on the contract drawings and

as described in Section 33 61 13.19 VALVES, PIPING, SUMP PUMPS, AND EQUIPMENT IN VALVE MANHOLES. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.2.3.2 Measurement

The measurement will be per each duckbill valve installed and accepted at locations shown on drawings.

1.2.3.3 Unit of Measure

Unit of Measure: Each (EA)

1.2.4 5 Foot by 5 Foot Culvert (Base Bid Item 0016)

1.2.4.1 Payment

Payment will be made for costs associated with construction of the 5 foot by 5 foot culvert as shown on the drawings, including all excavation and backfill and structural connections to existing structures. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.2.4.2 Measurement

The payment will be per linear foot of work completed and accepted at locations shown on drawings.

1.2.4.3 Unit of Measure

Unit of Measure: Linear Feet (LF)

1.2.5 6 Foot by 4 Foot Culvert (Base Bid Item 0018 and Option Bid Item 0023)

1.2.5.1 Payment

Payment will be made for costs associated with construction of the 6 foot by 4 foot culvert as shown on the drawings, including all excavation and backfill and structural connections to existing structures. Payment constitutes full compensation for all plant, labor, materials, equipment, tools, and incidentals necessary to complete the work.

1.2.5.2 Measurement

The payment will be per linear foot of work completed and accepted at locations shown on drawings.

1.2.5.3 Unit of Measure

Unit of Measure: Linear Feet (LF)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONTRACT COST BREAKDOWN

The Contractor must furnish within 30 calendar days after the date of Notice to Proceed, and prior to the submission of its first partial payment estimate, a breakdown of its single job pay item or items which will be reviewed by the Contracting Officer as to propriety of distribution of the total cost to the various accounts. Any unbalanced items as between early and late payment items or other discrepancies will be revised by the Contracting Officer to agree with a reasonable cost of the work included in the various items. This contract cost breakdown will then be utilized as the basis for progress payments to the Contractor.

-- End of Section --

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SECTION 01 33 00

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SECTION 01 33 00

SUBMITTAL PROCEDURES
08/18

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Submittal Information

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Contractors to check and approve all items prior to submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; Operation and Maintenance (O&M) manuals (including parts list); certifications; warranties; and other such required submittals.

1.1.2 Project Type

1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work. Some typical Preconstruction Submittals are listed below:

Certificates Of Insurance

Surety Bonds

List Of Proposed Subcontractors

List Of Proposed Products

Construction Progress Schedule

Baseline Network Analysis Schedule (NAS)

Submittal Register

Schedule Of Prices Or Earned Value Report

Work Plan

Quality Control (QC) Plan

Accident Prevention Plan

Environmental Protection Plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (SDS) concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and

state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction contract (e.g., record drawings and as-built drawings). Submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.2.2 Approving Authority

Office or designated person authorized to approve the submittal.

1.2.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register; G, CN

1.4 SUBMITTAL CLASSIFICATION

1.4.1 Government Approved (G)

Government approval is required for any variations from the Solicitation or the Accepted Proposal and for other items as designated by the Government.

Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings".

1.4.2 For Information Only

Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings".

1.5 PREPARATION

1.5.1 Transmittal Form (ENG FORM 4025)

Use the attached sample transmittal form (ENG Form 4025) for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms are included in the RMS CM software that the Contractor is required to use for this contract. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

1.5.2 Submittal Format

1.5.2.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.2.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 inches by 11 inches nor more than 30 inches by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.

b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

1.5.2.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

1.5.2.3 Format of SD-03 Product Data

Present product data submittals for each section. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

1.5.2.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

1.5.2.3.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.5.2.4 Format of SD-04 Samples

1.5.2.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than Two Inches by Three Inches: Built up to 8 1/2 inches by 11 inches.

c. Sample of Materials Exceeding 8 1/2 Inches by 11 Inches: Cut down to 8 1/2 inches by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.

f. Color Selection Samples: Two inches by four inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: Four feet by four feet.

h. Sample Installation: 100 square feet.

1.5.2.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

1.5.2.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.2.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 inches by 11 inches paper.

1.5.2.6 Format of SD-06 Test Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 inches by 11 inches paper.

1.5.2.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.5.2.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.9 Format of SD-09 Manufacturer's Field Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.10 Format of SD-10 Operation and Maintenance Data (O&M)

When O&M data submittals are required, their format shall comply with the requirements specified in the respective section where the submittal requirement is made.

1.5.2.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.3 Source Drawings for Shop Drawings

1.5.3.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.5.3.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

1.5.4 Electronic File Format

Provide submittals other than material samples in electronic format. The Transmittal Form described in the above paragraph shall be completed in RMS. The electronic submittal files must be compiled as a single, complete document submitted with the Transmittal Form in RMS. The electronic submittal file must be named specifically according to its contents (e.g., 01 45 00.00-1.2_Quality Control Plan.pdf).

Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or

a scan of a signature.

Electronic submittal documents larger than 150MB cannot be uploaded into RMS and shall be sent through an electronic file sharing system such as the Department of Defence Secure Access File Exchange (DoD SAFE) Web Application located at the following website: https://safe.apps.mil.

1.6 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment will be made for nay materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.7 DELIVERABLES

1.7.1 Quantity of SD-04 Samples

Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

Submit one sample installation, where directed.

Submit one sample of nonsolid materials.

1.7.2 Address

Submittals designated for hard-copy submission must be sent to the following address in the number of copies specified:

U.S. Army Corps of Engineers
Northern Area Office
620 Barry Road
Building No. 158
Great Lakes, Illinois 60088.

1.8 SUBMITTAL REGISTER

At the end of this section is a submittal register showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM).

1.8.1 Maintain Submittal Register

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the specifications is

provided as an attachment. This list may not be all inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM). The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

1.8.2 Use of Submittal Register

Submit submittal register. Submit with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.8.3 Contractor Use of Submittal Register

Update the following fields with each submittal throughout contract.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.8.4 Approving Authority Use of Submittal Register

Update the following fields.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (l) List date of submittal receipt.

Column (m) through (p) List Date related to review actions.

Column (q) List date returned to Contractor.

1.8.5 Preconstruction Use of Submittal Register

Input the submittal register electronically using RMS. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals.

1.8.6 Action Codes

1.8.6.1 Government Review Action Codes

"A" - "Approved as submitted"; "Completed"

"B" - "Approved, except as noted on drawings"; "Completed"

"C" - "Approved, except as noted on drawings; resubmission required"; "Resubmit"

"D" - "Returned by separate correspondence"; "Completed"

"E" - "Disapproved (See attached)"; "Resubmit"

"F" - "Receipt acknowledged"; "Completed"

"G" - "Other (Specify)"; "Resubmit"

"X" - "Receipt acknowledged, does not comply with contract requirements"; "Resubmit"

1.8.7 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted or as required by the COR.

1.9 SCHEDULING

Submittals covering component items forming a system or items that are interrelated must be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings must be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) must be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

Schedule and submit concurrent submittals covering component items forming

a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.

b. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A".

c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.

d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register".

1.10 DEVIATIONS

Submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 must be checked. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.11 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being coded in RMS. If rejected the Government will provide a comment sheet in RMS detailing the deficiencies.

1.12 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.13 VARIATIONS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

1.13.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation that results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

1.13.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government, including the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals which include proposed deviations requested by the Contractor. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.13.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.13.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 10 business days will be allowed for the Government to consider submittals with variations.

1.14 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

a. Note the date on which the submittal was received.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in

paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval, code submittals in RMS. Coded submittals can be accessed by the Contractor in RMS-CM.

1.15 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.16 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained with in each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.17 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the

right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Contracting Officer does not relieve the Contractor of his responsibilities under the contract.

1.18 STAMPS

Stamps on the submittal data to certify that the submittal meets contract requirements are to be similar to the following:

CONTRACTOR

(Firm Name)

_____ Approved

_____ Approved with corrections as noted on submittal data and/or attached sheet (s)

SIGNATURE: _____

TITLE: _____

DATE: _____

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

For use of this form, see ER 415-1-10; the proponent agency is CECW-CE.

DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (*This section will be initiated by the contractor*)

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____

SPECIFICATION SEC. NO. (*Cover only one section with each transmittal*)	PROJECT TITLE AND LOCATION	THIS TRANSMITTAL IS FOR: (*Check one*) ☐ FIO ☐ GA ☐ DA ☐ CR ☐ DA/CR ☐ DA/GA

ITEM NO. (*See Note 3*) a.	DESCRIPTION OF SUBMITTAL ITEM (*Type size, model number/etc.*) b.	SUBMITTAL TYPE CODE (*See Note 8*) c.	NO. OF COPIES d.	CONTRACT DOCUMENT REFERENCE SPEC. PARA. NO. e.	CONTRACT DOCUMENT REFERENCE DRAWING SHEET NO. f.	CONTRACTOR REVIEW CODE g.	VARIATION Enter "Y" if requesting a variation (*See Note 6*) h.	USACE ACTION CODE (*Note 9*) i.

REMARKS	I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.	
	NAME OF CONTRACTOR	SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (*List by item No.*)	NAME AND TITLE OF APPROVING AUTHORITY	SIGNATURE OF APPROVING AUTHORITY	DATE

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.

2. Each Transmittal shall be numbered consecutively. The Transmittal Number typically includes two parts separated by a dash (-). The first part is the specification section number. The second part is a sequential number for the submittals under that spec section. If the Transmittal is a resubmittal, then add a decimal point to the end of the original Transmittal Number and begin numbering the resubmittal packages sequentially after the decimal.

3. The "Item No." for each entry on this form will be the same "Item No." as indicated on ENG FORM 4288-R.

4. Submittals requiring expeditious handling will be submitted on a separate ENG Form 4025-R.

5. Items transmitted on each transmittal form will be from the same specification section. Do not combine submittal information from different specification sections in a single transmittal.

6. If the data submitted are intentionally in variance with the contract requirements, indicate a variation in column h, and enter a statement in the Remarks block describing he detailed reason for the variation.

7. ENG Form 4025-R is self-transmitting - a letter of transmittal is not required.

8. When submittal items are transmitted, indicate the "Submittal Type" (*SD-01 through SD-11*) in column c of Section I.
   Submittal types are the following:
   SD-01 - Preconstruction SD-02 - Shop Drawings SD-03 - Product Data SD-04 - Samples SD-05 - Design Data SD-06 - Test Reports
   SD-07 - Certificates SD-08 - Manufacturer's Instructions SD-09 - Manufacturer's Field Reports SD-10 - O&M Data SD-11 - Closeout

9. For each submittal item, the Contractor will assign Submittal Action Codes in column g of Section I. The U.S. Army Corps of Engineers approving authority will assign Submittal Action Codes in column i of Section I. The Submittal Action Codes are:
   A -- Approved as submitted.
   B -- Approved, except as noted on drawings. Resubmission not required.
   C -- Approved, except as noted on drawings. Refer to attached comments. Resubmission required.
   D -- Will be returned by separate correspondence.
   E -- Disapproved. Refer to attached comments.
   F -- Receipt acknowledged.
   X -- Receipt acknowledged, does not comply with contract requirements, as noted.
   G -- Other action required *(Specify)*
   K -- Government concurs with intermediate design. (*For D-B contracts*)
   R -- Design submittal is acceptable for release for construction. (*For D-B contracts*)

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract.

SUBMITTAL REGISTER

CONTRACT NO.
W912P620B0002

TITLE AND LOCATION
Levee 37 Pump Station Upgrade, Village of Mount Prospect

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 10 00	SD-01 Preconstruction Submittals															
			Construction Schedule	1.7	G	CN												
			Condition of Existing Structures	1.10														
			Coordination with Others	1.15	G	CN												
			Drug Free Workplace	1.5														
			List of E-Verified/Eligible	1.25.2	G	GSE												
			Candidates															
			SD-06 Test Reports															
			Construction Progress	1.8	G	CN												
			Photographs															
			SD-11 Closeout Submittals															
			Construction Complete	1.8.2	G	CN												
			Photographs															
		01 33 00	SD-01 Preconstruction Submittals															
			Submittal Register	1.8	G	CN												
		01 35 26	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.7	G	CN	SO											
			SD-06 Test Reports															
			Monthly Exposure Reports	1.4														
			Notifications and Reports	1.12														
			Accident Reports	1.12.2	G	CN	SO											
			LHE Inspection Reports	1.12.3														
			SD-07 Certificates															
			Crane Operators/Riggers	1.6.1.5														
			Standard Lift Plan	1.7.2.2	G	CN												
			Critical Lift Plan	1.7.2.3	G	CN												

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							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 35 26	Naval Architecture Analysis	1.7.2.4	G	CN												
			Activity Hazard Analysis (AHA)	1.8	G	CN												
			Confined Space Entry Permit	1.9.1	G	CN												
			Hot Work Permit	1.9.1														
			Certificate of Compliance	1.12.4														
			License Certificates	1.14														
			Radiography Operation Planning	1.14.1														
			Work Sheet															
			Portable Gauge Operations	1.14.1														
			Planning Worksheet															
		01 45 00.10 20	SD-01 Preconstruction Submittals															
			Quality Control Plan (QCP)	1.6	G	CN												
		01 50 00	SD-01 Preconstruction Submittals															
			Construction Site Plan	1.3	G	CN												
			Traffic Control Plan	3.4.1	G	CN												
		01 57 20.01 03	SD-01 Preconstruction Submittals															
			Environmental Protection Plan	1.7	G	DH												
		01 58 00	SD-02 Shop Drawings															
			Sign Legend Orders	1.3.1	G	CN												
		01 78 00	SD-03 Product Data															
			As-Built Record of Equipment	1.9.1														
			and Materials															
			Warranty Management Plan	1.12.1														
			Warranty Tags	1.12.5														
			Final Cleaning	1.14														
			Spare Parts Data	1.10														

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							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 78 00	SD-08 Manufacturer's Instructions															
			Preventative Maintenance	1.11														
			Condition Monitoring (Predictive	1.11														
			Testing)															
			Inspection	1.11														
			Instructions	1.12.1														
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	1.13	G	CN												
			Manuals															
			SD-11 Closeout Submittals															
			Intermediate Working CAD	1.6														
			Drawing Submittal															
			Final CAD Drawing Submittal	1.7.1														
			Final CAD Drawing Backcheck	1.7.2	G	CN												
			Submittal															
			Final Approved Shop Drawings	1.7.4	G	CN												
			Final Approved Specifications	1.7.4.1	G	CN												
		02 41 00	SD-01 Preconstruction Submittals															
			Demolition Plan	1.2.2	G	CN												
			Existing Conditions	1.9														
			SD-07 Certificates															
			Notification	1.6	G	CN												
		03 30 53	SD-02 Shop Drawings															
			Installation Drawings	1.4	G	DT												
			SD-03 Product Data															

SUBMITTAL REGISTER

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							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03 30 53	Air-Entraining Admixture	2.2.3.1														
			Water-Reducing or Retarding	2.2.3.2														
			Admixture															
			Curing Materials	2.2.11														
			Expansion Joint Filler Strips,	2.2.6														
			Premolded															
			Joint Sealants - Field Molded	2.2.7	G DT													
			Sealants															
			Waterstops	2.4.1														
			Chemical Floor Hardener	2.4.2														
			Batching and Mixing Equipment	3.1.5.3														
			Conveying and Placing Concrete	3.2														
			Formwork	2.2.8														
			Mix Design Data	2.3	G DT													
			Ready-Mix Concrete	2.3														
			Curing Compound	2.4.3														
			Mechanical Reinforcing Bar	2.2.5														
			Connectors															
			Non-Shrink Grout	2.2.13														
			SD-06 Test Reports															
			Aggregates	2.2.2														
			Concrete Mixture Proportions	2.1.3	G DT													
			Measurement of Floor Tolerances	3.4.4.3														
			Compressive Strength Testing	3.10.3	G DT													
			Slump	3.10.3	G DT													
			Air Content	3.10.3														

SUBMITTAL REGISTER

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		03 30 53	Water	2.2.4														
			SD-07 Certificates															
			Cementitious Materials	2.2.1														
			Pozzolan	2.2.1.2														
			CPG	2.2.1														
			Aggregates	2.2.2														
			Delivery Tickets	2.3														
			SD-08 Manufacturer's Instructions															
			Chemical Floor Hardener	2.4.2														
			Curing Compound	2.4.3														
		05 50 15	SD-01 Preconstruction Submittals															
			Trash Rack Design Deliverables	2.2.7	G DT													
			SD-02 Shop Drawings															
			Gratings	2.1.7	G DT													
			Ladders	2.2.5	G DT													
			Handrails	2.1.6	G DT													
			Shop Fabricated Metal Items	2.2	G DT													
			Trash Rack	2.2.7	G DT													
			SD-03 Product Data															
			Expansion Anchors	3.2	G DT													
			Gratings	2.1.7														
			Stairs	2.2.3														
			Ladders	2.2.5														
			Shop Fabricated Metal Items	2.2	G DT													
			SD-04 Samples															
			Shop Fabricated Metal Items	2.2	G DT													

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		05 50 15	SD-06 Test Reports															
			Rotational Capacity	2.1.5.1	G	DT												
			SD-07 Certificates															
			Welder Certifications	1.3														
		26 05 00.00 40	SD-02 Shop Drawings															
			Marking Strips	3.2.10.1	G	RO												
			SD-03 Product Data															
			Conduits and Raceways	2.1.1	G	RO												
			Wire and Cable	2.2.1	G	RO												
			Splices and Connectors	3.2.9	G	RO												
			Switches	2.2.3	G	RO												
			Receptacles	2.2.5	G	RO												
			Outlet Boxes, Pull Boxes and	2.1.2	G	RO												
			Junction Boxes															
			Circuit Breakers	2.1.3.1	G	RO												
			Panelboards	2.1.3	G	RO												
			Device Plates	2.2.2	G	RO												
			SD-06 Test Reports															
			Continuity Test	3.6	G	RO												
			Phase-Rotation Tests	3.6	G	RO												
			Insulation Resistance Test	3.6	G	RO												
			600-Volt Wiring Test	3.6	G	RO												
			Transformer Tests	3.6	G	RO												
			Ground-Fault Receptacle Test	3.6	G	RO												
			SD-08 Manufacturer’s Instructions															
			Manufacturer's Instructions	3.1														

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		26 05 19.10 10	SD-03 Product Data															
			Wire and Cable	2.1.1	G	RO												
			Conductors	2.1.3.1	G	RO												
			Cable Manufacturing Data	3.1														
			SD-06 Test Reports															
			Test Report(s), Inspection	3.2	G	RO												
			Report(s), and Verification															
			Report(s)															
		26 05 48.00 10	SD-02 Shop Drawings															
			Lighting Fixtures	2.1														
			Equipment Requirements	1.3														
			SD-03 Product Data															
			Lighting Fixtures	2.1	G	RO												
			Equipment Requirements	1.3	G	RO												
			Contractor Designed Bracing	1.2.4	G	RO												
		26 12 19.10	SD-02 Shop Drawings															
			Pad-mounted Transformer	1.4.1	G	RO												
			Drawings															
			SD-03 Product Data															
			Pad-mounted Transformers	2.2	G	RO												
			SD-06 Test Reports															
			Acceptance Checks and Tests	3.7.1	G	RO												
			SD-07 Certificates															
			Transformer Efficiencies	2.2.2.1	G	RO												
			SD-09 Manufacturer's Field															
			Reports															

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		26 12 19.10	Transformer Test Schedule	2.7.1	G	RO												
			Design Tests	2.7.2	G	RO												
			Routine and Other Tests	2.7.3	G	RO												
			SD-10 Operation and Maintenance															
			Data															
			Transformer(s)	1.5.1	G	RO												
		26 28 00.00 10	SD-02 Shop Drawings															
			Drawings	2.6.2	G	RO												
			Shop Drawings	2.4.1	G	RO												
			Motor Control Centers	2.8	G	RO												
			Panelboards	2.9	G	RO												
			Dimensioned Outline Drawings	2.1.3	G	RO												
			Schematic Diagrams	2.1.3	G	RO												
			Power and Control Connection	2.1.3	G	RO												
			Diagrams															
			SD-03 Product Data															
			Equipment	1.4	G	RO												
			Factory Tests	2.10														
			Harmonic Analysis	3.4.2														
			SD-05 Design Data															
			Request For Settings	3.4	G	RO												
			SD-06 Test Reports															
			Factory Tests	2.10														
			Acceptance Checks And Tests	3.4.1	G	RO												
			SD-07 Certificates															
			Motor Control Centers	2.8														

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		26 28 01.00 10	SD-03 Product Data															
			Equipment	2.1														
			Protective Relays	3.3.5														
			Installation	3.2														
			SD-06 Test Reports															
			Field Testing	3.3														
			SD-07 Certificates															
			Devices and Equipment	2.1														
		31 00 00	SD-01 Preconstruction Submittals															
			Shoring	3.3	G	DG												
			SD-03 Product Data															
			Utilization of Excavated Materials	3.6	G	DG												
			SD-06 Test Reports															
			Testing	3.11														
			SD-07 Certificates															
			Testing	3.11														
		31 23 19	SD-01 Preconstruction Submittals															
			Dewatering Plan	2.1	G	DT	DH											
			Dewatering Structures	2.2	G	DT												
		31 37 16.00 03	SD-01 Preconstruction Submittals															
			Sources and Evaluation Testing	1.3	G	DG												
			SD-06 Test Reports															
			Bedding for Riprap Material	2.3	G	DG												
			Riprap Gradation	2.2.1	G	DG												
			Bedding Material Gradation	2.3.1	G	DG												
		32 31 13	SD-02 Shop Drawings															

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		32 31 13	Fence Assembly	2.1	G	DT												
			Location of Gate, Corner, End,	3.2.1.1	G	DT												
			and Pull Posts															
			Gate Assembly	2.1	G	DT												
			Gate Hardware and Accessories	2.2.13	G	DT												
			Erection/Installation Drawings	Part 3	G	DT												
			SD-03 Product Data															
			Fence Assembly	2.1	G	DT												
			Gate Assembly	2.1	G	DT												
			Gate Hardware and Accessories	2.2.13	G	DT												
			Zinc Coating	2.3.1	G	DT												
			Stretcher Bars	2.2.8	G	CN												
			SD-04 Samples															
			Posts	2.2.2														
			Braces	2.2.2														
			Line Posts	2.2.3														
			Sleeves															
			Top Rail	2.2.5														
			Bottom Rail	2.2.6														
			Tension Wire	2.3.2														
			Stretcher Bars	2.2.8														
			Gate Posts	2.2.11														
			Gate Hardware and Accessories	2.2.13														
			Padlocks	2.2.16	G	CN												
			Wire Ties	2.2.15														
			SD-07 Certificates															

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		32 31 13	Certificates of Compliance	1.3.1														
			SD-08 Manufacturer's Instructions															
			Fence Assembly	2.1														
			Gate Assembly	2.1														
			Hardware Assembly	2.1														
			Accessories	2.1														
			SD-11 Closeout Submittals															
			Recycled Material Content	3.3														
		32 92 19	SD-03 Product Data															
			Fertilizer	2.2														
			Seed Mixes	2.1.2	G	CN												
			Delivery Schedule	1.3.1														
			SD-06 Test Reports															
			Seed	2.1.2														
			Fertilizer	2.2														
			SD-08 Manufacturer's Instructions															
			Erosion Control Material	3.4														
			SD-10 Operation and Maintenance															
			Data															
			Maintenance Instructions	3.2.3.1														
		33 40 00	SD-04 Samples															
			Pipe for Culverts and Storm	2.1														
			Drains															
			SD-07 Certificates															
			Leakage Test	3.3.1.2														

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		33 40 00	Hydrostatic Test on Watertight	3.3.1.1														
			Joints															
			Determination of Density	3.3.1.3														
		33 61 13.19	SD-02 Shop Drawings															
			Detail Drawings	1.3.1	G	DT												
			SD-03 Product Data															
			Support of the Equipment	2.1														
			Piping and Fittings	2.5														
			Valves	2.7														
			Sump Pumps	2.10														
			Expansion Joints	2.11														
			Waste Water Disposal	3.3														
			Flexible Check Valves (Duckbill)	2.8	G	DT												
			Flap Gates	2.9	G	DT												
			Pump Field Tests	3.4.2	G	DT												
			Air Vent	2.10.9	G	DT												
			Coating	2.12.1	G	DT												
			Cole Tar Epoxy Painting System	2.12														
			SD-06 Test Reports															
			Hydrostatic and Leakage Tests	3.12.2	G	DT												
			Valve Testing	3.12.3														
			Field Test Report	3.4.5	G	DT												
			Impeller Balancing	2.10.7.6														
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		33 61 13.19	SD-10 Operation and Maintenance															
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			Operating And Maintenance	3.4.5														
			Instructions															
		33 71 02	SD-02 Shop Drawings															
			Precast Underground Structures	1.4.1	G	RO												
			SD-03 Product Data															
			Medium Voltage Cable	2.5	G	RO												
			Medium Voltage Cable Joints	2.7	G	RO												
			Medium Voltage Cable	2.6	G	RO												
			Terminations															
			Precast Concrete Structures	2.13.2.1	G	RO												
			Sealing Material	2.13.2.4														
			SD-06 Test Reports															
			Medium Voltage Cable	2.17.2	G	RO												
			Qualification and Production Tests															
			Field Acceptance Checks and	3.16.1	G	RO												
			Tests															
			Arc-proofing Test	2.17.1	G	RO												
			SD-07 Certificates															
			Cable Splicer/Terminator	1.4.2	G	RO												
			Cable Installer Qualifications	1.4.3	G	RO												
		35 45 02.00 10	SD-02 Shop Drawings															
			Detail Drawings	1.4.3	G	DT												
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		35 45 02.00 10	Materials	2.2	G	DT												
			Equipment	2.1.8	G	DT												
			Installation Instruction Manual	3.1	G	CN												
			Propeller Balancing	2.4.3.6														
			Factory Tests	2.10														
			Pump Field Tests	3.3	G	DT												
			Spare Parts	1.6	G	DT												
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			Formed Suction Intake (FSI)	2.7.2	G	DT												
			Variable Frequency Drives	2.6	G	DT												
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			SD-07 Certificates															
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			SD-10 Operation and Maintenance															
			Data															
			Operating and Maintenance	3.3.3	G	DT												
			Instructions															
		40 95 00	SD-02 Shop Drawings															
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			Wiring	3.1.1	G	RO												
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		40 95 00	Standard Products	2.1.1	G	RO												
			Sensors and Meters	2.1.3	G	RO												
			Performance Verification Test	3.6.2	G	RO												
			(PVT)															
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			Control Drawings	3.5	G	RO												
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			Commissioning															
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			(PVT)															
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			Ground Rods	3.6.1	G	RO												
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			Documentation															
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			Data															
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.22	(2007; R 2012) Safety Requirements for Rope-Guided and Non-Guided Workers' Hoists
ASSE/SAFE A10.34	(2001; R 2012) Protection of the Public on or Adjacent to Construction Sites
ASSE/SAFE A10.44	(2014) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ASSE/SAFE Z244.1	(2003; R 2014) Control of Hazardous Energy Lockout/Tagout and Alternative Methods
ASSE/SAFE Z359.0	(2012) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ASSE/SAFE Z359.1	(2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components
ASSE/SAFE Z359.11	(2014) Safety Requirements for Full Body Harnesses
ASSE/SAFE Z359.12	(2009) Connecting Components for Personal Fall Arrest Systems
ASSE/SAFE Z359.13	(2013) Personal Energy Absorbers and Energy Absorbing Lanyards
ASSE/SAFE Z359.14	(2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
ASSE/SAFE Z359.15	(2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
ASSE/SAFE Z359.2	(2007) Minimum Requirements for a Comprehensive Managed Fall Protection Program
ASSE/SAFE Z359.3	(2007) Safety Requirements for Positioning

	and Travel Restraint Systems
ASSE/SAFE Z359.4	(2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
ASSE/SAFE Z359.6	(2009) Specifications and Design Requirements for Active Fall Protection Systems
ASSE/SAFE Z359.7	(2011) Qualification and Verification Testing of Fall Protection Products

ASME INTERNATIONAL (ASME)

ASME B30.20	(2013; INT Oct 2010 - May 2012) Below-the-Hook Lifting Devices
ASME B30.22	(2016) Articulating Boom Cranes
ASME B30.23	(2011) Personnel Lifting Systems Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
ASME B30.26	(2015; INT Jun 2010 - Jun 2014) Rigging Hardware
ASME B30.3	(2016) Tower Cranes
ASME B30.5	(2014) Mobile and Locomotive Cranes
ASME B30.7	(2011) Winches
ASME B30.8	(2015) Floating Cranes and Floating Derricks
ASME B30.9	(2014; INT Feb 2011 - Nov 2013) Slings

ASTM INTERNATIONAL (ASTM)

ASTM F855	(2015) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1048	(2003) Guide for Protective Grounding of Power Lines
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2013) Standard for Portable Fire Extinguishers
NFPA 241	(2019) Standard for Safeguarding

	Construction, Alteration, and Demolition Operations
NFPA 51B	(2014) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 70E	(2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-1019	(2012; R 2016) Standard for Installation, Alteration and Maintenance of Antenna Supporting Structures and Antennas
TIA-222	(2005G; Add 1 2007; Add 2 2009; Add 3 2014; Add 4 2014; R 2014; R 2016) Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.333	Selection and Use of Work Practices
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1915.89	Control of Hazardous Energy (Lockout/Tags-Plus)
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.1400	Cranes and Derricks in Construction
29 CFR 1926.16	Rules of Construction

29 CFR 1926.450	Scaffolds
29 CFR 1926.500	Fall Protection
29 CFR 1926.552	Material Hoists, Personal Hoists, and Elevators
29 CFR 1926.553	Base-Mounted Drum Hoists
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
CPL 02-01-056	(2014) Inspection Procedures for Accessing Communication Towers by Hoist
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

1.2.1 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures with regards to such hazards.

1.2.2 Competent Person, Confined Space

The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA’s Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.3 Competent Person, Cranes and Rigging

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.4 Competent Person, Excavation/Trenching

A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing

existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.5 Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSE/SAFE Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.6 Competent Person, Scaffolding

The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q, and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and also has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented and include experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented, minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g., mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

1.2.7 Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

1.2.8 High Risk Activities

High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

1.2.9 High Visibility Accident

A High Visibility Accident is any mishap which may generate publicity or high visibility.

1.2.10 Load Handling Equipment (LHE)

LHE is a term used to describe cranes, hoists and all other hoisting

equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

1.2.11 Medical Treatment

Medical Treatment is treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.2.12 Near Miss

A Near Miss is a mishap resulting in no personal injury and zero property damage, but given a shift in time or position, damage or injury may have occurred (e.g., a worker falls off a scaffold and is not injured; a crane swings around to move the load and narrowly misses a parked vehicle).

1.2.13 Operating Envelope

The Operating Envelope is the area surrounding any crane or load handling equipment. Inside this "envelope" is the crane, the operator, riggers and crane walkers, other personnel involved in the operation, rigging gear between the hook, the load, the crane's supporting structure (i.e., ground or rail), the load's rigging path, the lift and rigging procedure.

1.2.14 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

1.2.15 Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the requirements of EM 385-1-1 Appendix Q, and ASSE/SAFE Z359.0, with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

1.2.16 USACE Property and Equipment

Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

1.2.17 Load Handling Equipment (LHE) Accident or Load Handling Equipment Mishap

A LHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents, even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an

accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, or roll over). Document an LHE mishap using the Crane High Hazard working group mishap reporting form.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G,CN,SO

SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G,CN,SO

LHE Inspection Reports

SD-07 Certificates

Crane Operators/Riggers

Standard Lift Plan; G, CN

Critical Lift Plan ; G, CN

Naval Architecture Analysis; G, CN

Activity Hazard Analysis (AHA); G, CN

Confined Space Entry Permit; G, CN

Hot Work Permit

Certificate of Compliance

License Certificates

Radiography Operation Planning Work Sheet

Portable Gauge Operations Planning Worksheet

1.4 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1, and the following federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.6 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

Provide an SSHO that meets the requirements of EM 385-1-1 Section 1. The SSHO must ensure that the requirements of 29 CFR 1926.16 are met for the project. Provide a Safety oversight team that includes a minimum of one person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO or an equally-qualified Alternate SSHO must be at the work site at all times to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. The SSHO and Alternate SSHO must have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs.

If the SSHO is off-site for a period longer than 24 hours, an equally-qualified alternate SSHO must be provided and must fulfill the same roles and responsibilities as the primary SSHO. When the SSHO is temporarily (up to 24 hours) off-site, a Designated Representative (DR), as identified in the AHA may be used in lieu of an Alternate SSHO, and must be on the project site at all times when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full time occupation.

1.6.1.1.1 Additional Site Safety and Health Officer (SSHO) Requirements and Duties

The SSHO may not serve as the Quality Control Manager. The SSHO may serve as the Superintendent.

1.6.1.2 Competent Person Qualifications

Provide Competent Persons in accordance with EM 385-1-1, Appendix Q and herein. Competent Persons for high risk activities include confined space, cranes and rigging, excavation/trenching, fall protection, and electrical work. The CP for these activities must be designated in writing, and meet the requirements for the specific activity (i.e., competent person, fall protection).

The Competent Person identified in the Contractor's Safety and Health Program and accepted Accident Prevention Plan, must be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the the Contracting Officer for information in consultation with the Safety Office.

1.6.1.2.1 Competent Person for Confined Space Entry

Provide a Confined Space (CP) Competent Person who meets the requirements of EM 385-1-1, Appendix Q, and herein. The CP for Confined Space Entry must supervise the entry into each confined space in accordance with EM 385-1-1, Section 34.

1.6.1.2.2 Competent Person for Scaffolding

Provide a Competent Person for Scaffolding who meets the requirements of EM 385-1-1, Section 22.B.02 and herein.

1.6.1.2.3 Competent Person for Fall Protection

Provide a Competent Person for Fall Protection who meets the requirements of EM 385-1-1, Section 21.C.04 and herein.

1.6.1.3 Qualified Trainer Requirements

Individuals qualified to instruct the 40-hour contract safety awareness course, or portions thereof, must meet the definition of a Competent Person Trainer, and, at a minimum, possess a working knowledge of the following subject areas: EM 385-1-1, Electrical Standards,Lockout/Tagout, Fall Protection, Confined Space Entry for Construction; Excavation, Trenching and Soil Mechanics, and Scaffolds in accordance with 29 CFR 1926.450, Subpart L.

Instructors are required to:

a. Prepare class presentations that cover construction-related safety requirements.

b. Ensure that all attendees attend all sessions by using a class roster signed daily by each attendee. Maintain copies of the roster for at least five years. This is a certification class and must be attended 100 percent. In cases of emergency where an attendee cannot make it to a session, the attendee can make it up in another class session for the same subject.

c. Update training course materials whenever an update of the EM 385-1-1 becomes available.

d. Provide a written exam of at least 50 questions. Students are required to answer 80 percent correctly to pass.

e. Request, review and incorporate student feedback into a continuous course improvement program.

1.6.1.4 Dredging Contract Requirements

1.6.1.4.1 Dredging Safety Personnel Requirements

Dredging safety personnel requirements are as follows:

a. Provide a minimum of one full time SSHO assigned per project site for the primary working shift.

b. For a project involving multiple work shifts, provide one full-time SSHO for each additional shift.

c. For individual dredging projects or sites with a dredge crew and fill crew on watch of eight employees or less, a CDSO must be appointed, instead of an SSHO. The CDSO assumes the same responsibilities as a full-time SSHO.

d. An example of one dredging project site is reflected in each of the following:

(1) a mechanical dredge, tug(s) and scow(s), scow route, and material placement site; or

(2) a hydraulic pipeline dredge, attendant plant, and material placement site; or

(3) a hopper dredge (include land-based material placement site - if applicable).

e. For Hopper Dredges with the United States Coast Guard (USCG), documented crews may designate an officer as a Collateral Duty Safety Officer (CDSO) instead of having a full-time SSHO onboard if the officer meets the SSHO training and experience requirements.

1.6.1.4.2 SSHO Requirements for Dredging

In addition to requirements stated elsewhere in this specification, an individual serving as a SSHO must be present at the project site, located so that they have full mobility and reasonable access to all major work operations, for at least one shift in each 24 hour period when work is being performed. The SSHO must be available during their shift for immediate verbal consultation and notification, either by phone or radio.

The SSHO is a full-time, dedicated position, except as noted above, who must report to a senior project (or corporate) official. When the SSHO is permitted to be a collateral duty, the SSHO is not permitted to be in another position requiring continuous mechanical or equipment operations, such as equipment operators.

The SSHO must inspect all work areas and operations during initial set-up and at least monthly observe and provide personal oversight on each shift during dredging operations for projects with many work sites, more often for those with less work sites.

If the SSHO is off-site for a period longer than 24 hours, another qualified SSHO must be provided and fulfill the same roles and responsibilities as the SSHO during their absence.

1.6.1.4.3 Collateral Duty Safety Officer (CDSO) Requirements for Dredging

A CDSO is an individual who is assigned collateral duty safety responsibilities in addition to their full-time occupation, and who supports and supplements the SSHO efforts in managing, implementing and enforcing the Contractor's Safety and Health Program. The assigned CDSO must be an individual(s) with work oversight responsibilities, such as master, mate, fill foreman, or superintendent. A CDSO must not be an employee responsible for continuous mechanical or equipment operations, such as an equipment operator.

A CDSO performs safety program tasks as assigned by the SSHO and must

report safety findings to the SSHO. The SSHO must document results of safety findings and provide information for inclusion in the CQC reports to the Contracting Officer.

1.6.1.4.4 Safety Personnel Training Requirements for Dredging

A SSHO and a CDSO for dredging contracts must take either a formal classroom or online OSHA 30-hour Construction Safety Course, or an equivalent 30 hours of formal classroom or online safety and health training covering the subjects of the OSHA 30-hour Course in accordance with EM 385-1-1 Appendix A, paragraph 3.d.(3), applicable to dredging work, and given by qualified instructors. In exception to EM 385-1-1, Section 01.A.17, comply with the following:

a. The SSHO must maintain competency through having taken eigh hours of formal classroom or online safety and health related coursework every year. Hours spent as an instructor in such courses will be considered the same as attending them, but each course only gets credit once (for example, instructing a one-hour asbestos awareness course five times in a year provides one hour credit for training).

b. The SSHO and a CDSO must have a minimum of three years of experience within the past five years in one of the following:

(1) Supervising/managing dredging activities,

(2) Supervising/managing marine construction activities,

(3) Supervising/managing land-based construction activities,

(4) Work managing safety programs or processes, or

(5) Conducting hazard analyses and developing controls in activities or environments with similar hazards.

1.6.1.5 Crane Operators/Riggers

Provide Operators, Signal Persons, and Riggers meeting the requirements in EM 385-1-1, Section 15.B for Riggers and Section 16.B for Crane Operators and Signal Persons. Provide proof of current qualification.

1.6.2 Personnel Duties

1.6.2.1 Duties of the Site Safety and Health Officer (SSHO)

The SSHO must:

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.

b. Conduct mishap investigations and complete required accident reports. Report mishaps and near misses.

c. Use and maintain OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors, and make available to the Contracting Officer upon

request. Post and maintain the Form 300A on the site Safety Bulletin Board.

d. Maintain applicable safety reference material on the job site.

e. Attend the pre-construction conference, pre-work meetings including preparatory meetings, and periodic in-progress meetings.

f. Review the APP and AHAs for compliance with EM 385-1-1, and approve, sign, implement and enforce them.

g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.

h. Ensure subcontractor compliance with safety and health requirements.

i. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).

j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.

k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, subcontractor employees, and site visitors.

Superintendent, QC Manager, and SSHO are subject to dismissal if the above duties are not being effectively carried out. If Superintendent, QC Manager, or SSHO are dismissed, project work will be stopped and will not be allowed to resume until a suitable replacement is approved and the above duties are again being effectively carried out.

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction conference. This includes the project superintendent, Site Safety and Occupational Health officer, quality control manager, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHAs to preclude project delays.

Deficiencies in the submitted APP, identified during the Contracting Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin work until an APP is established that is acceptable to the Contracting Officer.

The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting.

1.6.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings seven calendar days in advance.

1.7 ACCIDENT PREVENTION PLAN (APP)

A qualified person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, Appendix A, and as supplemented herein. Cover all paragraph and subparagraph elements in EM 385-1-1, Appendix A. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed by an officer of the firm (Prime Contractor senior person), the individual preparing the APP, the on-site superintendent, the designated SSHO, the Contractor Quality Control Manager, and any designated Certified Safety Professional (CSP) or Certified Health Physicist (CIH). The SSHO must provide and maintain the APP and a log of signatures by each subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Continuously review and amend the APP, as necessary, throughout the life of the contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and

Quality Control Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e., imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34), and the environment.

1.7.1 Names and Qualifications

Provide plans in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated Site Safety and Health Officer and other competent and qualified personnel to be used. Specify the duties of each position.

b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance.

1.7.2 Plans

Provide plans in the APP in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

1.7.2.1 Confined Space Entry Plan

Develop a confined or enclosed space entry plan in accordance with EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. If there is no confined space work, include a statement that no confined space work exists and none will be created.

1.7.2.2 Standard Lift Plan (SLP)

Plan lifts to avoid situations where the operator cannot maintain safe control of the lift. Prepare a written SLP in accordance with EM 385-1-1, Section 16.A.03, using Form 16-2 for every lift or series of lifts (if duty cycle or routine lifts are being performed). The SLP must be developed, reviewed and accepted by all personnel involved in the lift in conjunction with the associated AHA. Signature on the AHA constitutes acceptance of the plan. Maintain the SLP on the LHE for the current lift(s) being made. Maintain historical SLPs for a minimum of three months.

1.7.2.3 Critical Lift Plan - Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Section 16.H.01, using Form 16-3. In addition, Critical Lift Plans are required for the following:

a. Lifts over 50 percent of the capacity of barge mounted mobile crane's hoist.

b. When working around energized power lines where the work will get closer than the minimum clearance distance in EM 385-1-1 Table 16-1.

c. For lifts with anticipated binding conditions.

d. When erecting cranes.

1.7.2.3.1 Critical Lift Plan Planning and Schedule

Critical lifts require detailed planning and additional or unusual safety precautions. Develop and submit a critical lift plan to the Contracting Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

1.7.2.3.2 Lifts of Personnel

In addition to the requirements of EM 385-1-1, Section 16.H.02, for lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1, Section 16.T.

1.7.2.4 Barge Mounted Mobile Crane Lift Plan

Provide a Naval Architecture Analysis and include an LHE Manufacturer's Floating Service Load Chart in accordance with EM 385-1-1, Section 16.L.03.

1.7.2.5 Multi-Purpose Machines, Material Handling Equipment, and Construction Equipment Lift Plan

Multi-purpose machines, material handling equipment, and construction equipment used to lift loads that are suspended by rigging gear, require proof of authorization from the machine OEM that the machine is capable of making lifts of loads suspended by rigging equipment. Written approval from a qualified registered professional engineer, after a safety analysis is performed, is allowed in lieu of the OEM's approval. Demonstrate that the operator is properly trained and that the equipment is properly configured to make such lifts and is equipped with a load chart.

1.7.2.6 Fall Protection and Prevention (FP&P) Plan

The plan must comply with the requirements of EM 385-1-1, Section 21.D and ASSE/SAFE Z359.2, be site specific, and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above six feet. A competent person or qualified person for fall protection must prepare and sign the plan documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, roles and responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Review and revise, as necessary, the FP&P Plan documentation as conditions change, but at a minimum every six months, for

lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted FP&P Plan documentation at the job site for the duration of the project. Include the FP&P Plan documentation in the APP.

1.7.2.7 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and ASSE/SAFE Z359.2, and include in the FP&P Plan and as part of the APP. Include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

1.7.2.8 Hazardous Energy Control Program (HECP)

Develop a HECP in accordance with EM 385-1-1 Section 12, 29 CFR 1910.147, 29 CFR 1910.333, 29 CFR 1915.89, ASSE/SAFE Z244.1, and ASSE/SAFE A10.44. Submit this HECP as part of the Accident Prevention Plan (APP). Conduct a preparatory meeting and inspection with all effected personnel to coordinate all HECP activities. Document this meeting and inspection in accordance with EM 385-1-1, Section 12.A.02. Ensure that each employee is familiar with and complies with these procedures.

1.7.2.9 Excavation Plan

Identify the safety and health aspects of excavation, and provide and prepare the plan in accordance with EM 385-1-1, Section 25.A.

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1, Section 1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 business days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

1.8.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

1.8.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOW must review the AHA for that work and sign a signature log specifically maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

1.9 DISPLAY OF SAFETY INFORMATION

1.9.1 Safety Bulletin Board

Within one calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, may be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, Section 01.A.07. Additional items required to be posted include:

a. Confined space entry permit.

b. Hot work permit.

1.9.2 Safety and Occupational Health (SOH) Deficiency Tracking System

Establish a SOH deficiency tracking system that lists and monitors the status of SOH deficiencies in chronological order. Use the tracking system to evaluate the effectiveness of the APP. A monthly evaluation of the data must be discussed in the QC or SOH meeting with everyone on the project. The list must be posted on the project bulletin board and updated daily, and provide the following information:

a. Date deficiency identified;

b. Description of deficiency;

c. Name of person responsible for correcting deficiency;

d. Projected resolution date; and

e. Date actually resolved.

1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.12 NOTIFICATIONS AND REPORTS

1.12.1 Mishap Notification

Notify the Contracting Officer as soon as practical, but no more than twenty-four hours, after any mishaps, including recordable accidents, incidents, and near misses, as defined in EM 385-1-1 Appendix Q, any report of injury, illness, or any property damage. For LHE or rigging mishaps, notify the Contracting Officer as soon as practical but not more than four hours after mishap. The Contractor is responsible for obtaining appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies. Immediate reporting is required for electrical mishaps, to include Arc Flash; shock; uncontrolled release of hazardous energy (includes electrical and non-electrical); load handling equipment or rigging; fall from height (any level other than same surface); and underwater diving. These mishaps must be investigated in depth to identify all causes and to recommend hazard control measures.

Within notification include Contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (e.g., type of construction equipment used and PPE used). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any mishap.

1.12.2 Accident Reports

General: Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable USACE Accident Report Form 3394, and provide the report to the Contracting Officer within five calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.

Near Misses: For Army projects, report all "Near Misses" to the GDA, using local mishap reporting procedures, within 24 hours. The Contracting Officer will provide the Contractor the required forms. Near miss reports are considered positive and proactive Contractor safety management actions.

Load Handling Equipment Accident: Conduct an accident investigation for any load handling equipment accident (including rigging accidents) to establish the root cause(s) of the accident. Complete the LHE Accident Report (Crane and Rigging Accident Report) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the Contracting Officer. The Contracting Officer will provide a blank copy of the accident report form.

1.12.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

1.12.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

Provide a FORM 16-1 Certificate of Compliance for LHE entering an activity under this contract and in accordance with EM 385-1-1. Post certifications on the crane.

Develop a Standard Lift Plan (SLP) in accordance with EM 385-1-1, Section 16.H.03 using Form 16-2 Standard Pre-Lift Crane Plan/Checklist for each lift planned. Submit SLP to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

1.13 HOT WORK

1.13.1 Permit and Personnel Requirements

Submit and obtain a written permit prior to performing "Hot Work" (i.e., welding or cutting) or operating other flame-producing/spark producing devices, from the City of DesPlaines Fire Department. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two 20 pound 4A:20 BC rated extinguishers for normal "Hot Work". The extinguishers must be current inspection tagged, and contain an approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch must be trained in accordance with NFPA 51B and remain on-site for a minimum of one hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency City of DesPlaines Fire Department phone number. REPORT ANY FIRE, NO MATTER HOW SMALL, TO THE RESPONSIBLE CITY OF DES PLAINES FIRE DEPARTMENT IMMEDIATELY.

1.13.2 Work Around Flammable Materials

Obtain permit approval from a NFPA Certified Marine Chemist for "HOT WORK" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in EM 385-1-1, Section 06.H

1.14 RADIATION SAFETY REQUIREMENTS

Submit License Certificates, employee training records, and Leak Test Reports for radiation materials and equipment to the Contracting Officer and Radiation Safety Office (RSO) for all specialized and licensed material and equipment proposed for use on the construction project (excludes portable machine sources of ionizing radiation including moisture density and X-Ray Fluorescence (XRF)). Maintain on-site records

whenever licensed radiological materials or ionizing equipment are on government property.

Protect workers from radiation exposure in accordance with 10 CFR 20, ensuring any personnel exposures are maintained As Low As Reasonably Achievable.

1.14.1 Radiography Operation Planning Work Sheet

Submit a Gamma and X-Ray Radiography Operation Planning Work Sheet to Contracting Officer 14 calendar days prior to commencement of operations involving radioactive materials or radiation generating devices. For portable machine sources of ionizing radiation, including moisture density and XRF, use and submit the Portable Gauge Operations Planning Worksheet instead. The Contracting Officer will review the submitted worksheet and provide questions and comments.

Contractors must use primary dosimeters process by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

1.14.2 Site Access and Security

Coordinate site access and security requirements with the Contracting Officer for all radiological materials and equipment containing ionizing radiation that are proposed for use on a government facility. For gamma radiography materials and equipment, a Government escort is required for any travels on the Installation. The Government authorized representative will meet the Contractor at a designated location outside the Installation, ensure safety of the materials being transported, and will escort the Contractor for gamma sources onto the Installation, to the job site, and off the Installation. For portable machine sources of ionizing radiation, including moisture density and XRF, the Government authorized representative will meet the Contractor at the job site.

Provide a copy of all calibration records, and utilization records for radiological operations performed on the site.

1.14.3 Loss or Release and Unplanned Personnel Exposure

Loss or release of radioactive materials, and unplanned personnel exposures must be reported immediately to the Contracting Officer, RSO, and Base Security Department Emergency Number.

1.14.4 Site Demarcation and Barricade

Properly demark and barricade an area surrounding radiological operations to preclude personnel entrance, in accordance with EM 385-1-1, Nuclear Regulatory Commission, and Applicable State regulations and license requirements, and in accordance with requirements established in the accepted Radiography Operation Planning Work Sheet.

Do not close or obstruct streets, walks, and other facilities occupied and used by the Government without written permission from the Contracting Officer.

1.14.5 Security of Material and Equipment

Properly secure the radiological material and ionizing radiation equipment at all times, including keeping the devices in a properly marked and

locked container, and secondarily locking the container to a secure point in the Contractor's vehicle or other approved storage location during transportation and while not in use. While in use, maintain a continuous visual observation on the radiological material and ionizing radiation equipment. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, make no assumptions as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, position a fully instructed employee inside the building or area to prevent exiting while external radiographic operations are in process.

1.14.6 Transportation of Material

Comply with 49 CFR 173 for Transportation of Regulated Amounts of Radioactive Material. Notify Local Fire authorities and the site Radiation Safety officer (RSO) of any Radioactive Material use.

1.14.7 Schedule for Exposure or Unshielding

Actual exposure of the radiographic film or unshielding the source must not be initiated until after 5 P.M. on weekdays.

1.14.8 Transmitter Requirements

Adhere to the base policy concerning the use of transmitters, such as radios and cell phones. Obey Emissions control (EMCON) restrictions.

1.15 CONFINED SPACE ENTRY REQUIREMENTS

Confined space entry must comply with Section 34 of EM 385-1-1, OSHA 29 CFR 1926, OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, and OSHA Directive CPL 2.100. Any potential for a hazard in the confined space requires a permit system to be used.

1.15.1 Entry Procedures

Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. Comply with EM 385-1-1, Section 34 for entry procedures. Hazards pertaining to the space must be reviewed with each employee during review of the AHA.

1.15.2 Forced Air Ventilation

Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its action level.

1.15.3 Sewer Wet Wells

Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

1.15.4 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

1.16 DIVE SAFETY REQUIREMENTS

Develop a Dive Operations Plan, AHA, emergency management plan, and personnel list that includes qualifications, for each separate diving operation. Submit these documents to the District Dive Coordinator (DDC) for review and acceptance at least 15 business days prior to commencement of diving operations. These documents must be at the diving location at all times. Provide each of these documents as a part of the project file.

1.17 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must:

a. Secure outside equipment and materials and place materials that could be damaged in protected areas.

b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

c. Ensure that temporary erosion controls are adequate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

Comply with EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be worn or carried/available on each person. Mandatory PPE includes:

a. Hard Hat,

b. Long Pants,

c. Appropriate Safety Shoes, and

d. Appropriate Class Reflective Vests.

3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e.,

cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment. An employee check-in/check-out communication procedure must be developed to ensure employee safety.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

3.1.3 Unforeseen Hazardous Material

Contract documents identify materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e., 29 CFR Part 1910.1000). If material(s) that may be hazardous to human health upon disturbance are encountered during construction operations, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to FAR 52.243-4, "Changes" and FAR 52.236-2, "Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Apply for utility outages at least 15 business days in advance. As a minimum, the request must include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1 Section 12, 29 CFR 1910.333, 29 CFR 1915.89, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

3.4 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy,

identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with ASSE/SAFE Z359.2 and EM 385-1-1, Sections 21.A and 21.D.

3.4.1 Training

Institute a fall protection training program. As part of the Fall Protection Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection in accordance with EM 385-1-1, Section 21.C. Document training and practical application of the competent person in accordance with EM 385-1-1, Section 21.C.04 and ASSE/SAFE Z359.2 in the AHA.

3.4.2 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific Fall Protection and Prevention Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 Section 21.I, 29 CFR 1926.500 Subpart M,ASSE/SAFE Z359.0, ASSE/SAFE Z359.1, ASSE/SAFE Z359.2, ASSE/SAFE Z359.3, ASSE/SAFE Z359.4, ASSE/SAFE Z359.6, ASSE/SAFE Z359.7, ASSE/SAFE Z359.11, ASSE/SAFE Z359.12, ASSE/SAFE Z359.13, ASSE/SAFE Z359.14, and ASSE/SAFE Z359.15.

3.4.2.1 Additional Personal Fall Protection

In addition to the required fall protection systems, other protection such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1, Sections 21.O through 21.O.06. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

3.4.2.2 Personal Fall Protection Harnesses

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabiners must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 pounds in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed six feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. All full body harnesses must be equipped with Suspension

Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1, Section 21.I.06.

3.4.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

(1) For work within six feet of an edge, on a roof having a slope less than or equal to 4:12 (vertical to horizontal), protect personnel from falling by use of personal fall arrest/restraint systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized. Provide in accordance with 29 CFR 1926.500.

(2) For work greater than six feet from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and EM 385-1-1, Section L.

b. Steep-Sloped Roofs: Work on a roof having a slope greater than 4:12 (vertical to horizontal) requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also applies to residential or housing type construction.

3.4.4 Horizontal Lifelines (HLL)

Provide HLL in accordance with EM 385-1-1, Section 21.I.08.d.2. Commercially manufactured horizontal lifelines (HLL) must be designed, installed, certified and used, under the supervision of a qualified person, for fall protection as part of a complete fall arrest system which maintains a safety factor of two (29 CFR 1926.500). The competent person for fall protection may (if deemed appropriate by the qualified person) supervise the assembly, disassembly, use and inspection of the HLL system under the direction of the qualified person. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a Registered Professional Engineer who is qualified in designing HLL systems.

3.4.5 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1, Section 21.F.01 and 29 CFR 1926 Subpart M.

3.4.6 Rescue and Evacuation Plan and Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident

Prevention Plan (APP). The plan must comply with the requirements of EM 385-1-1, ASSE/SAFE Z359.2, and ASSE/SAFE Z359.4.

3.5 WORK PLATFORMS

3.5.1 Scaffolding

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Comply with the following requirements:

a. Scaffold platforms greater than 20 feet in height must be accessed by use of a scaffold stair system.

b. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 20 feet maximum in height.

c. An adequate gate is required.

d. Employees performing scaffold erection and dismantling must be qualified.

e. Scaffold must be capable of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan.

f. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.

g. Special care must be given to ensure scaffold systems are not overloaded.

h. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to four times the width of the smallest dimension of the scaffold base.

i. Scaffolding other than suspended types must bear on base plates upon wood mudsills (two inch by 10 inch by eight inch minimum) or other adequate firm foundation.

j. Scaffold or work platform erectors must have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet.

k. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.5.2 Elevated Aerial Work Platforms (AWPs)

Workers must be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the CP). Lanyards used must be sufficiently short to prohibit worker from climbing out of basket. The climbing of rails is prohibited. Lanyards with built-in shock absorbers are acceptable. Self-retracting devices are not acceptable. Tying off to an adjacent pole or structure is not permitted

unless a safe device for 100 percent tie-off is used for the transfer.

Use of AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWPs must be designated as qualified operators by the Prime Contractor. Maintain proof of qualifications on site for review and include in the AHA.

3.6 EQUIPMENT

3.6.1 Material Handling Equipment (MHE)

Material handling equipment such as forklifts must not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions. Material handling equipment fitted with personnel work platform attachments are prohibited from traveling or positioning while personnel are working on the platform.

The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. Material Handling Equipment Operators must be trained in accordance with OSHA 29 CFR 1910, Subpart N.

Operators of forklifts or power industrial trucks must be licensed in accordance with OSHA.

3.6.2 Load Handling Equipment (LHE)

The following requirements apply. In exception, these requirements do not apply to commercial truck mounted and articulating boom cranes used solely to deliver material and supplies (not prefabricated components, structural steel, or components of a systems-engineered metal building) where the lift consists of moving materials and supplies from a truck or trailer to the ground; to cranes installed on mechanics trucks that are used solely in the repair of shore-based equipment; to crane that enter the activity but are not used for lifting; nor to other machines not used to lift loads suspended by rigging equipment. However, LHE accidents occurring during such operations must be reported.

a. Equip cranes and derricks as specified in EM 385-1-1, Section 16.

b. Notify the Contracting Officer 15 working days in advance of any LHE entering the activity, in accordance with EM 385-1-1, Section 16.A.02, so that necessary quality assurance spot checks can be coordinated. Contractor's operator must remain with the crane during the spot check. Rigging gear must comply with OSHA, ASME B30.9 Standards safety standards.

c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, ASME B30.8 for floating cranes and floating derricks, ASME B30.9 for slings, ASME B30.20 for below the hook lifting devices

and ASME B30.26 for rigging hardware.

e. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this special hazard and follow the requirements of EM 385-1-1 Section 11, and ASME B30.5 or ASME B30.22 as applicable.

f. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. Additionally, submit a specific AHA for this work to the Contracting Officer. Ensure the activity and AHA are thoroughly reviewed by all involved personnel.

g. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.

h. All employees must keep clear of loads about to be lifted and of suspended loads, except for employees required to handle the load.

i. Use cribbing when performing lifts on outriggers.

j. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

k. A physical barricade must be positioned to prevent personnel access where accessible areas of the LHE's rotating superstructure poses a risk of striking, pinching or crushing personnel.

l. Maintain inspection records in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected. Records must be available for review by the Contracting Officer.

m. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Section 16.F, listing the load test procedures used along with any repairs or alterations performed on the LHE. Reports must be available for review by the Contracting Officer.

n. Certify that all LHE operators have been trained in proper use of all safety devices (e.g., anti-two block devices).

o. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 20 mph, the operator, rigger and lift supervisor must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.

3.6.3 Machinery and Mechanized Equipment

Proof of qualifications for operator must be kept on the project site for review.

Manufacture specifications or owner's manual for the equipment must be

on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

3.6.4 Base Mounted Drum Hoists

Base mounted drum hoists must conform to the following requirements:

a. Operation of base mounted drum hoists must comply with EM 385-1-1 and ASSE/SAFE A10.22.

b. Rigging gear must comply with applicable ASME/OSHA standards.

c. When used on telecommunication towers, base mounted drum hoists must comply with TIA-1019, TIA-222, ASME B30.7, 29 CFR 1926.552, and 29 CFR 1926.553.

d. When used to hoist personnel, the AHA must include a written standard operating procedure. Operators must have a physical examination in accordance with EM 385-1-1 Section 16.B.05 and trained, at a minimum, in accordance with EM 385-1-1 Section 16.U and 16.T. The base mounted drum hoist must also comply with OSHA Instruction CPL 02-01-056 and ASME B30.23.

e. Material and personnel must not be hoisted simultaneously.

f. Personnel cage must be marked with the capacity (in number of persons) and load limit in pounds.

g. Construction equipment must not be used for hoisting material or personnel or with trolley/tag lines. Construction equipment may be used for towing and assisting with anchoring guy lines.

3.6.5 Use of Explosives

Explosives must not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval does not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, must be only where directed and in approved storage facilities. These facilities must be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

3.7 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1.

3.7.1 Utility Locations

Provide a third party, independent, private utility locating company to positively identify underground utilities in the work area in addition to any station locating service and coordinated with the station utility department.

3.7.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system.

3.7.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company must locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the Contractor from meeting this requirement.

3.8 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Appendix A, Sections 11 and 12.

3.8.1 Conduct of Electrical Work

As delineated in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

3.8.2 Qualifications

Electrical work must be performed by QP personnel with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State, Local requirements applicable to where work is being performed.

3.8.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

3.8.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous and effective path to ground unless otherwise noted by EM 385-1-1.

Check grounding circuits to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.

3.8.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

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SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g., ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: https://www.transportation.org/

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
330 N. Wabash Ave., Suite 2000
Chicago, IL 60611
Ph: 202-367-1155
E-mail: info@americanbearings.org
Internet: https://www.americanbearings.org/

AMERICAN CONCRETE INSTITUTE (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331-3439
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
130 East Randolph, Suite 2000
Chicago, IL 60601
Ph: 312-670-5444
Fax: 312-670-5403
Steel Solutions Center: 866-275-2472
E-mail: solutions@aisc.org
Internet: https://www.aisc.org/

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1899 L Street, NW,11th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: storemanager@ansi.org
Internet: http://www.ansi.org/

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)
1800 East Oakton Street
Des Plaines, IL 60018
Ph: 847-699-2929
Internet: http://www.asse.org

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)
520 N. Northwest Highway
Park Ridge, IL 60068
Ph: 847-699-2929
Internet: https://www.assp.org/

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235-3098
Ph: 303-794-7711
E-mail: distribution@awwa.org
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
13301 NW 47 Ave
Miami, FL 33054

Ph: 888-WELDING, 305-824-1177, 305-826-6192
Fax: 305-826-6195
E-mail: customer.service@awspubs.com
Internet: http://www.aws.org

APA - THE ENGINEERED WOOD ASSOCIATION (APA)
7011 South 19th St.
Tacoma, WA 98466-5333
Ph: 253-565-6600
Fax: 253-565-7265
Internet: https://www.apawood.org/

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Internet: http://www.asme.org

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Ph: 205-257-3839
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ASSOCIATION OF ILLINOIS SOIL AND WATER CONSERVATION DISTRICTS (AISWCD)
4285 N Walnut Street Road
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E-mail: servicedesk.myrisk@fmglobal.com
Internet: http://www.fmglobal.com

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Fax: 973-267-9055
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1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62764-9276
Ph: 217-782-3397
Internet:

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 and 501 Hoes Lane
Piscataway, NJ 08854-4141
Ph: 732-981-0060 or 800-701-4333
Fax: 732-981-9667
E-mail: onlinesupport@ieee.org
Internet: https://www.ieee.org/

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 493
Miamitown, OH 45041-9998
E-mail: info@icea.net
Internet: https://www.icea.net/

INTERNATIONAL CODE COUNCIL (ICC)
500 New Jersey Avenue, NW
6th Floor, Washington, DC 20001
Ph: 800-786-4452 or 888-422-7233
E-mail: order@iccsafe.org
Internet: www.iccsafe.org

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Old Centre Ave. Suite 101
Portage, MI 49024
Ph: 269-488-6382
Fax: 269-488-6383
Internet: https://www.netaworld.org/

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
3, rue de Varembe, 1st floor
P.O. Box 131
CH-1211 Geneva 20, Switzerland
Ph: 41-22-919-02-11
Fax: 41-22-919-03-00
E-mail: info@iec.ch
Internet: https://www.iec.ch/

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
ISO Central Secretariat
Chemin de Blandonnet 8
CP 401 - 1214 Vernier, Geneva
Switzerland
Ph: 41-22-749-01-11
Fax: 41-22-733-34-30
E-mail: central@iso.ch
Internet: https://www.iso.org/contact-iso.html

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)
67 T.W. Alexander Drive
PO Box 12277
Research Triangle Park, NC 27709
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Fax: 919-549-8288
E-mail: info@isa.org
Internet: https://www.isa.org/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
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Ph: 703-281-6613
E-mail: info@msshq.org
Internet: http://msshq.org

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
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Internet: http://www.naamm.org

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
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Ph: 703-841-3200
Internet: https://www.nema.org

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
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Fax: 800-593-6372
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Obtain Unified Facilities Criteria (UFC) from:
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National Institute of Building Sciences (NIBS)
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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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QUALITY CONTROL FOR MINOR CONSTRUCTION

02/10

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QUALITY CONTROL FOR MINOR CONSTRUCTION
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D3740	(2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E329	(2018) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E543	(2015) Standard Practice for Agencies Performing Non-Destructive Testing

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan (QCP); G, CN

1.3 INFORMATION FOR THE CONTRACTING OFFICER (KO)

Prior to commencing work on construction, the Contractor can obtain a single copy set of the current report forms from the KO. The report forms

will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor Quality Control (CQC) Report, CQC Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, and Testing Plan and Log.

Deliver the following to the KO:

a. CQC Report: Original and one copy, by 10:00 AM the next working day after each week that work is performed;

b. Contractor Production Report: Original and one copy by 10:00 AM the next working day after each week that work is performed;

c. Preparatory Phase Checklist: Original attached to the original CQC Report and one copy attached to each copy;

d. Initial Phase Checklist: Original attached to the original CQC Report and one copy attached to each copy;

e. Field Test Reports: One copy, within two working days after the test is performed, attached to the CQC Report;

f. Quality Control (QC) Meeting Minutes: One copy, within two working days after the meeting; and

g. QC Certifications: As required by the paragraph entitled "QC Certifications".

1.4 QUALITY CONTROL PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Manager, a QC Plan (QCP), a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No work or testing may be performed unless the QC Manager is on the work site.

1.4.1 Preliminary Work Authorized Prior to Acceptance

The only work that is authorized to proceed prior to the acceptance of the QCP is mobilization of storage and office trailers, temporary utilities, and surveying.

1.4.2 Acceptance

Acceptance of the QCP is required prior to the start of construction. The KO reserves the right to require changes in the QCP and operations as necessary, including removal of personnel, to ensure the specified quality of work. The KO reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications.

1.4.3 Notification of Changes

Notify the KO, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of seven calendar days prior to a proposed change. Proposed changes shall be subject to the acceptance by

the KO.

1.5 QUALITY CONTROL ORGANIZATION

1.5.1 Quality Control Manager

1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. The QC Manager is required to attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by others.

1.5.1.2 Qualifications

An individual with a minimum of five years combined experience as a superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts which included the major trades that are part of this contract. The individual must be familiar with the requirements of the EM 385-1-1 and have experience in the areas of hazard identification and safety compliance.

1.5.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager shall have completed the course Construction Quality Management for Contractors and will have a current certificate.

1.5.2 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be the same as for the QC Manager.

1.6 QUALITY CONTROL PLAN (QCP)

1.6.1 Requirements

Submit a QCP within 15 calendar days after receipt of Notice of Award.

Provide, for acceptance by the KO, a QCP submitted in a three-ring binder that covers both on-site and off-site work and includes the following with a table of contents listing the major sections identified with tabs.

I. QC ORGANIZATION: A chart showing the QC organizational structure and its relationship to the production side of the organization.

II. NAMES AND QUALIFICATIONS: In resume format, for each person in the QC organization. Include the CQM for Contractors course certification required by the paragraph entitled "Construction Quality Management Training".

III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONAL: Of each person in the QC organization.

IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations such as architectural and consulting engineering firms that will be employed by the Contractor and a description of the services these firms will provide.

V. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.

VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.

VII. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs "Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.

VIII. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

IX. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track and complete rework items.

X. DOCUMENTATION PROCEDURES: Use Government formats.

XI. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task, which is separate and distinct from other tasks, has the same control requirements and work crews. The list shall be cross-referenced to the Contractor's Construction Schedule and the specification sections. For projects requiring a Progress Chart, the list of definable features of work shall include but not be limited to all items of work on the schedule. For projects requiring a Network Analysis Schedule, the list of definable features of work shall include but not be limited to all critical path activities.

XII. PROCEDURES FOR PERFORMING THREE PHASES OF CONTROL: For each DFOW provide Preparatory and Initial Phase Checklists. Each list shall include a breakdown of quality checks that will be used when performing the quality control functions, inspections, and tests required by the contract documents. The preparatory and initial phases shall be conducted with a view towards obtaining quality construction by planning ahead and identifying potential problems.

XIII. PERSONNEL MATRIX: Not Applicable.

XIV. PROCEDURES FOR COMPLETION INSPECTION: See the paragraph entitled "COMPLETION INSPECTIONS".

XV. TRAINING PROCEDURES AND TRAINING LOG: Not Applicable.

1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

During the Pre-Construction conference and prior to the start of construction, discuss the QC program required by this contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production and the QC personnel. At the meeting, the Contractor will be required to explain how three phases of control will be implemented for each DFOW. Contractor's personnel required to attend shall include the QC Manager, project manager, and superintendent. Minutes of the meeting will be prepared by the QC Manager and signed by both the Contractor and the KO. The Contractor shall provide a copy of the signed minutes to all attendees. Repeat the coordination and mutual understanding meeting when a new QC Manager is appointed.

1.8 QUALITY CONTROL MEETINGS

After the start of construction, the QC Manager shall conduct QC meetings once every two weeks at the work site with the superintendent and the foreman responsible for the ongoing and upcoming work. The QC Manager shall prepare the minutes of the meeting and provide a copy to the KO within two working days after the meeting. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work and rework;

c. Review the status of submittals;

d. Review the work to be accomplished in the next two weeks and documentation required;

e. Resolve QC and production problems (Requests for Information (RFIs), etc.);

f. Address items that may require revising the QCP; and

g. Review Accident Prevention Plan (APP).

1.9 THREE PHASES OF CONTROL

The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each DFOW.

1.9.1 Preparatory Phase

Notify the KO at least two work days in advance of each preparatory phase. Conduct the preparatory phase with the superintendent and the foreman responsible for the definable feature of work. Document the results of the preparatory phase actions in the daily CQC Report and in the QC checklist. Perform the following prior to beginning work on each definable feature of work:

a. Review each paragraph of the applicable specification sections;

b. Review the contract drawings;

c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;

d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

e. Examine the work area to ensure that the required preliminary work has been completed;

f. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

g. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Safety Data Sheets (SDS) are submitted; and

h. Discuss specific controls used and the construction methods and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW.

1.9.2 Initial Phase

Notify the KO at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the Initial Phase with the foreman responsible for that DFOW. Observe the initial segment of the work to ensure that it complies with contract requirements. Document the results of the Initial Phase in the daily CQC Report and in the QC checklist. Perform the following for each DFOW:

a. Establish the quality of workmanship required,

b. Resolve conflicts,

c. Ensure that testing is performed by the approved laboratory, and

d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.

1.9.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report and in the QC checklist:

a. Ensure the work is in compliance with contract requirements,

b. Maintain the quality of workmanship required,

c. Ensure that testing is performed by the approved laboratory,

d. Ensure that rework items are being corrected, and

e. Assure manufacturers representatives have performed necessary inspections, if required.

1.9.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

1.9.5 Notification of Three Phases of Control for Off-Site Work

Notify the KO at least two weeks prior to the start of the preparatory and initial phases.

1.10 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review, and approval of submittals are described in the submittal section of the specification.

1.11 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this contract.

1.11.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e., ASTM E329, ASTM C1077, ASTM D3666, ASTM D3740, ASTM E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office".

1.11.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology, the American Association of State Highway and Transportation Officials (AASHTO), International Accreditation Services, Inc. (IAS), U. S. Army Corps of Engineers Materials Testing Center (MTC), the American Association for Laboratory Accreditation (A2LA), the Washington Association of Building Officials (WABO) (Approval authority for WABO is limited to projects within Washington State), and the Washington Area Council of Engineering Laboratories (WACEL) (Approval authority by WACEL is limited to projects within the NAVFAC WASH and Public Works Center Washington geographical area).

1.11.3 Capability Check

The KO retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this contract.

1.11.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures

used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the KO immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the KO.

1.12 QC CERTIFICATIONS

1.12.1 Contractor Quality Control Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report."

1.12.2 Invoice Certification

Furnish a certificate to the KO with each payment request, signed by the QC Manager, attesting that as-built drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.12.3 Completion Certification

Upon completion of work under this contract, the QC Manager shall furnish a certificate to the KO attesting that "the work has been completed, inspected, tested and is in compliance with the contract".

1.13 COMPLETION INSPECTIONS

1.13.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Contract clause "Commencement, Prosecution, and Completion of Work", or stated elsewhere in the specifications, the QC Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Include in the punch list any remaining items of the "Rework Items List", which were not corrected prior to the Punch-Out inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. A copy of the punch list shall be provided to the KO. The QC Manager or staff shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.13.2 Pre-Final Inspection

The Government and QC Manager will perform this inspection to verify that the facility is complete and ready to be occupied. A Government pre-final punch list may be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the customer can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner and shall be accomplished before the contract

completion date for the work or any particular increment thereof if the project is divided into increments by separate completion dates.

1.13.3 Final Acceptance Inspection

The QC Manager, the superintendent, or other Contractor management personnel and the KO will be in attendance at this inspection. Additional Government personnel may be in attendance. The final acceptance inspection will be formally scheduled by the KO based upon results of the "Pre-Final Inspection". Notice shall be given to the KO at least 14 calendar days prior to the final inspection. The notice shall state that all specific items previously identified to the Contractor as being unacceptable will be complete by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the KO to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause "Inspection of Construction".

1.14 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER (KO)" shall be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site. For each remark given, identify the Schedule Activity No. that is associated with the remark.

1.14.1 Quality Control Validation

Establish and maintain the following in a series of three ring binders. Binders shall be divided and tabbed as shown below. These binders shall be readily available to the Government's Quality Assurance Team during all business hours.

a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.

b. All milestone inspections, arranged by Activity/Event Number.

c. A current up-to-date copy of the Testing and Plan Log with supporting field test reports, arranged by specification section.

d. Copies of all contract modifications, arranged in numerical order. Include documentation that modified work was accomplished.

e. A current up-to-date copy of the Rework Items List.

f. Maintain up-to-date copies of all punch lists issued by the QC Staff on the Contractor and Sub-Contractors and all punch lists

issued by the Government.

1.14.2 As-Built Drawings

The QC Manager is required to review the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS, are kept current on a daily basis and marked to show deviations, which have been made from the Contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g., PC number, modification number, RFI number). The QC Manager shall initial each deviation or revision. Upon completion of work, the QC Manager shall submit a certificate attesting to the accuracy of the as-built drawings prior to submission to the KO.

1.15 NOTIFICATION ON NON-COMPLIANCE

The KO will notify the Contractor of any detected non-compliance with the foregoing requirements. The Contractor shall take immediate corrective action. If the contractor fails or refuses to correct the non-compliant work, the KO will issue a non compliance notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the KO may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall make no part of the time lost due to such stop orders the subject of claim for extension of time, for excess costs, or damages.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

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RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)

11/16

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RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)
11/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 MEASUREMENT AND PAYMENT

The work of this section is not measured for payment. The Contractor is responsible for the work of this section, without any direct compensation other than the payment received for contract items.

1.3 CONTRACT ADMINISTRATION

The Government will use the Resident Management System (RMS) to assist in its monitoring and administration of this contract. The Government accesses the system using the Government Mode of RMS (RMS GM) and the Contractor accesses the system using the Contractor Mode (RMS CM). The term RMS will be used in the remainder of this section for both RMS GM and RMS CM. The Contractor mode user manuals, updates, and training information can be downloaded from the RMS web site (http://rms.usace.army.mil). The joint Government-Contractor use of RMS facilitates electronic exchange of information and overall management of the contract. The Contractor accesses RMS to record, maintain, input, track, and electronically share information with the Government throughout the contract period in the following areas:

Administration
Finances
Quality Control
Submittal Monitoring
Scheduling
Closeout
Import/Export of Data

1.3.1 Correspondence and Electronic Communications

For ease and speed of communications, exchange correspondence and other documents in electronic format to the maximum extent feasible. Some correspondence, including pay requests and payrolls, are also to be provided in paper format with original signatures. Paper documents will govern, in the event of discrepancy with the electronic version.

1.3.2 Other Factors

Other portions of this document have a direct relationship to the reporting accomplished through RMS. Particular attention is directed to Contract Clause, 52.236-15 "Schedules for Construction Contracts"; Contract Clause, 52.232-27 "Prompt Payment for Construction Contracts"; Contract Clause, 52.232-15 "Payments Under Fixed-Priced Construction Contracts"; Section 01 33 00 SUBMITTAL PROCEDURES; Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS; and Section 01 45 00.10 20 QUALITY CONTROL.

1.4 RMS SOFTWARE

RMS is a Windows-based program that can be run on a Windows-based PC meeting the requirements as specified in paragraph SYSTEM REQUIREMENTS. Download, install and be able to utilize the latest version of the RMS software within seven calendar days of receipt of the Notice to Proceed. RMS software, user manuals, access and installation instructions, program updates and training information are available from the RMS website (http://rmsdocumentation.com). The Government and the Contractor will have different access authorities to the same contract database through RMS. The common database will be updated automatically each time a user finalizes an entry or change.

1.5 SYSTEM REQUIREMENTS

The following is the recommended system configuration to run the Contractor Mode RMS for full utilization of all features for all types and sizes of contracts. Smaller, less complicated, projects may not require the configuration levels described below. Required configuration also noted below.

RECOMMENDED RMS SYSTEM REQUIREMENTS	
HARDWARE	
Windows-based PC	1.7 GHz i3; AMD A6 3650 GHz or higher processor (REQUIRED)
RAM	8 GB
Hard drive disk	100 GB space for sole use by RMS system
Monitor	Screen resolution 1366 x 768
Mouse or other pointing device	
Windows compatible printer	Laser printer must have 4 MB+ of RAM
Connection to the Internet	minimum 4 Mbs per user
SOFTWARE	

RECOMMENDED RMS SYSTEM REQUIREMENTS	
MS Windows	Windows 7 x 64 bit (RMS requires 64 bit O/S) or newer (REQUIRED)
Word Processing software	Viewer for MS Word 2013, MS Excel 2013 or newer (REQUIRED)
E-mail	MAPI compatible (REQUIRED)
Virus protection software	Regularly upgraded with all issued Manufacturer's updates and is able to detect most zero day viruses (REQUIRED)

1.6 CONTRACT DATABASE - GOVERNMENT

The Government will enter the basic contract award data in RMS prior to granting the Contractor access. The Government entries into RMS will generally be related to submittal reviews, correspondence status, and Quality Assurance (QA) comments, as well as other miscellaneous administrative information.

1.7 CONTRACT DATABASE - CONTRACTOR

Contractor entries into RMS establish, maintain, and update data throughout the duration of the contract. Contractor entries generally include prime and subcontractor information, daily reports, submittals, RFI's, schedule updates and payment requests. RMS includes the ability to import attachments and export reports in many of the modules, including submittals. The Contractor responsibilities for entries in RMS typically include the following items:

1.7.1 Administration

1.7.1.1 Contractor Information

Enter all current Contractor administrative data and information into RMS within seven calendar days of receiving access to the contract in RMS. This includes, but is not limited to, Contractor's name, address, telephone numbers, management staff, and other required items.

1.7.1.2 Subcontractor Information

Enter all missing subcontractor administrative data and information into RMS CM within seven calendar days of receiving access to the contract in RMS or within seven calendar days of the signing of the subcontractor agreement for agreements signed at a later date. This includes name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor is listed separately for each trade to be performed.

1.7.1.3 Correspondence

Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office with "S". Prefix letters initiated by the Contractor's home (main) office with "H". Letters are numbered starting from 0001 (e.g., H-0001 or

S-0001). The Government's letters to the Contractor will be prefixed with "C" or "RFP".

1.7.1.4 Equipment

Enter and maintain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.7.1.5 Reports

Track the status of the project utilizing the reports available in RMS. The value of these reports is reflective of the quality of the data input. These reports include the Progress Payment Request worksheet, Quality Control (QC) comments, Submittal Register Status, and Three-Phase Control worksheets.

1.7.1.6 Request For Information (RFI)

Create and track all Requests For Information (RFI) in the RMS Administration Module for Government review and response.

1.7.2 Finances

1.7.2.1 Pay Activity Data

Develop and enter a list of pay activities in conjunction with the project schedule. The sum of pay activities equals the total contract amount, including modifications. Each pay activity must be assigned to a Contract Line Item Number (CLIN). The sum of the activities assigned to a CLIN equals the amount of each CLIN.

1.7.2.2 Payment Requests

Prepare all progress payment requests using RMS. Update the work completed under the contract at least monthly, measured as percent or as specific quantities. After the update, generate a payment request and prompt payment certification using RMS. Submit the signed prompt payment certification and payment request as well as supporting data either electronically or by hard copy. Unless waived by the Contracting Officer, a signed paper copy of the approved payment certification and request is also required and will govern in the event of discrepancy with the electronic version.

1.7.3 Quality Control)

Enter and track implementation of the three-phase Quality Control System, QC testing, transferred and installed property and warranties in RMS. Prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements in RMS. Maintain all data on a daily basis. Insure that RMS reflects all quality control methods, tests and actions contained within the Contractor Quality Control (CQC) Plan and Government review comments of same within seven calendar days of Government acceptance of the CQC Plan.

1.7.3.1 Quality Control (QC) Reports

The Contractor's QC Daily Report in RMS is the official report. The Contractor can use other supplemental formats to record QC data, but

information from any supplemental formats are to be consolidated and entered into the RMS QC Daily Report. Any supplemental information may be entered into RMS as an attachment to the report. QC Daily Reports must be finalized and signed in RMS within 24 hours after the date covered by the report. Provide the Government a printed signed copy of the QC Daily Report, unless waived by the Contracting Officer.

1.7.3.2 Deficiency Tracking.

Use the QC Daily Report Module to enter and track deficiencies. Deficiencies identified and entered into RMS by the Contractor or the Government will be sequentially numbered with a QC or QA prefix for tracking purposes. Enter each deficiency into RMS the same day that the deficiency is identified. Monitor, track and resolve all QC and QA entered deficiencies. A deficiency is not considered to be corrected until the Government indicates concurrence in RMS.

1.7.3.3 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in RMS. Worksheets for the three-phase control meetings are generated within RMS.

1.7.3.4 Labor and Equipment Hours

Enter labor and equipment exposure hours on a daily basis. Roll up the labor and equipment exposure data into a monthly exposure report.

1.7.3.5 Accident/Safety Reporting

Both the Contractor and the Government enter safety related comments in RMS as a deficiency. The Contractor must monitor, track and show resolution for safety issues in the QC Daily Report area of the RMS QC Module. In addition, follow all reporting requirements for accidents and incidents as required in EM 385-1-1, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and as required by any other applicable Federal, State or local agencies.

1.7.3.6 Definable Features of Work

Enter each feature of work, as defined in the approved CQC Plan, into the RMS QC Module. A feature of work may be associated with a single or multiple pay activities, however a pay activity is only to be linked to a single feature of work.

1.7.3.7 Activity Hazard Analysis

Import activity hazard analysis electronic document files into the RMS QC Module utilizing the document package manager.

1.7.4 Submittal Management

Enter all current submittal register data and information into RMS within seven calendar days of receiving access to the contract in RMS. The information shown on the submittal register following the specification Section 01 33 00 SUBMITTAL PROCEDURES will already be entered into the RMS database when access is granted. Group electronic submittal documents into transmittal packages to send to the Government, except very large electronic files, samples, spare parts, mock ups, color boards, or where

hard copies are specifically required. Track transmittals and update the submittal register in RMS on a daily basis throughout the duration of the contract. Submit hard copies of all submittals unless waived by the Contracting Officer.

1.7.5 Schedule

Enter and update the contract project schedule in RMS by either manually entering all schedule data.

1.7.6 Closeout

Closeout documents, processes and forms are managed and tracked in RMS by both the Contractor and the Government. Ensure that all closeout documents are entered, completed and documented within RMS.

1.8 IMPLEMENTATION

Use of RMS as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain contract data within the RMS system. RMS is an integral part of the Contractor's required management of quality control.

1.9 NOTIFICATION OF NONCOMPLIANCE

Take corrective action within seven calendar days after receipt of notice of RMS non-compliance by the Contracting Officer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
05/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 241	(2019) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2015; Rev L) Obstruction Marking and Lighting

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2015) Manual on Uniform Traffic Control Devices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G, CN

Traffic Control Plan; G, CN

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.4 DOD CONDITION OF READINESS

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (60 mph or 95 km/hr) or greater. Contact the Contracting Officer for the current COR setting.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the aproved Emergency Plan in the accepted Accident Prevention Plan, EM 385-1-1 Section 01 Emergency Planning and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards.

b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.

c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours): Curtail or cease routine activities until securing operation is complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas.

d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Within one calendar day of mobilization on site and prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 inches by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 Section 01 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

2.1.2 Project Identification Signs

The requirements for the signs, their content, and location are as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs within 15 business days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.1.3 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1 Section 04. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of contruction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. Specific fencing requirements are as described herein. All fencing will meet the requirements of EM 385-1-1.

2.3.1 Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of two inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid

and taut with a minimum of 200 pounds of force exerted on it from any direction with less than four inches of deflection.

2.3.2 Chain Link Panel Fencing

Temporary panel fencing must be galvanized steel chain link panels six feet high. Multiple fencing panels may be linked together at the bases toform long spens as needed. Each panel base must be weighted down using sand bags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than four inches of deflection.

2.3.3 Post-Driven Chain Link Fencing

Temporary post-driven fencing must be galvanized chain link fencing six feet high supported by an tightly secured to galvanized steel posts driven below grade. Fence posts must be located on minimum 10 foot centers. Posts may be set in various sufaces such as sand, soil, ashpalt or concrete as necessary. Chain link fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than four inches of deflection. Fencing and posts must be completely removed at the completion of construction and any surfaces disturbed or damaged must be restored to its original condition. Underground utilities must be located and identified prior to setting fence posts. Fence must be equipped with a lockable gate. Gate must remain locked when construction personnel are not present.

2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1 Section 11, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Construction contract employees will park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Employee parking must not interfere with existing and established parking requirements of the government installation.

3.2 TEMPORARY BULLETIN BOARD

Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

3.3 AVAILABILITY AND USE OF UTILITY SERVICES

3.3.1 Temporary Utilities

Provide temporary utilities as required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.3.2 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

3.3.3 Obstruction Lighting of Cranes

Provide a minimum of two aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

3.3.4 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials weekly to minimize potential hazards.

3.4 TRAFFIC PROVISIONS

3.4.1 Maintenance of Traffic

Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan must be in accordance with Illinois Department of Transportation permit which will be obtained by the contractor, and local regulations and the MUTCD, Part VI. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

Provide, erect, and maintain, at contractors expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

3.4.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of

lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

3.4.3 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 20.01 03ENVIRONMENTAL PROTECTION FOR ILLINOIS.

3.5 CONTRACTOR'S TEMPORARY FACILITIES

Contractor-owned or -leased trailers are not required but may be provided by the Contrator if desired. Temporary facilities will meet requirements as identified in EM 385-1-1 Section 04.

3.5.1 Maintenance of Storage Area

Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, and will be traversed with construction equipment or other vehicles, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.

3.5.2 Security Provisions

Provide adequate outside security lighting at the temporary facilities. The Contractor will be responsible for the security of its own equipment.

3.5.3 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.5.3.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.6 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 business days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, removefrom the work site.

3.7 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store any salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.8 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

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SECTION 01 57 20.01 03

ENVIRONMENTAL PROTECTION FOR ILLINOIS
06/2015

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual
WETLAND MANUAL	Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

33 CFR 328	Definitions of Waters of the United States
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
40 CFR 68	Chemical Accident Prevention Provisions
49 CFR 171 - 178	Hazardous Materials Regulations

ASSOCIATION OF ILLINOIS SOIL AND WATER CONSERVATION DISTRICTS (AISWCD)

IUM	(2010) Illinois Urban Manual

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA)

35 IAC 900-901	Title 35 of Illinois Administrative Code, Subtitle H: Noise, Chapter I: Pollution Control Board

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is 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 humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e., methyl ethyl ketone and toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Clean Construction and Demolition Debris (CCDD)

As defined by the Illinois Environmental Protection Agency, CCDD is uncontaminated broken concrete without protruding metal bars, bricks, rock, stone, or reclaimed asphalt pavement generated from construction or demolition activities. When uncontaminated soil is mixed with any of these materials, the uncontaminated soil is considered CCDD.

1.2.5 Hazardous Waste

Wastes designated by the U.S. Environmental Protection Agency as hazardous, as defined in 40 CFR 261.

1.2.6 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor must discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land application must be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.7 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm

sewers, creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency. All projects with land disturbances greater than or equal to one acre in total area must have a National Pollution Discharge Elimination System (NPDES) Construction Site Activity Storm Water Permit to discharge surface water from a construction site, issued by the Illinois Environmental Protection Agency. All projects with discharge of dredged or fill material to waters of the United States must have a Section 401 Water Quality Permit issued by the Illinois Environmental Protection Agency.

1.2.8 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

1.2.9 Wetlands

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLAND MANUAL.

1.3 GENERAL REQUIREMENTS

Minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work must be protected during the entire duration of this contract. Comply with all applicable environmental Federal, State, and local laws and regulations and be responsible for any delays resulting from failure to comply with environmental laws and regulations.

1.4 SUBCONTRACTORS

Ensure compliance with this section by subcontractors.

1.5 PAYMENT

No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. All costs associated with this section shall be included in the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following must be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

1.7 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction site activities or delivery of materials to the site, submit an Environmental Protection Plan (EPP) for review and approval by the Contracting Officer. The purpose of the EPP is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern must be defined within the EPP as outlined in this section. Address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but which the Contractor considers necessary, must be identified and discussed after those items formally identified in this section. Prior to submittal of the EPP, meet with the Contracting Officer for the purpose of discussing the implementation of the initial EPP; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's EPP. The EPP must be current and maintained onsite by the Contractor. Approval of the Contractor's EPP will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures.

Provide a complete copy of the submittal, including all graphis, attachments, and figures, electronically in pdf format.

1.7.1 NPDES Procedure and Compliance

The EPP must include a Stormwater Pollution Prevention Plan (SWPPP). The Government will review the EPP, including the Stormwater Pollution Prevention Plan, and then will submit the Notice of Intent (NOI) to the Illinois Environmental Protection Agency after the plan has been approved (if there is more than one acre of land disturbing activity). No construction will take place before the submission of the NOI; approval of the NPDES permit requires 30 calendar days after the submission of the NOI. The Contractor may NOT begin earthmoving activities until 30 calendar days after the submission of the NOI. Approval of the Contractor's plan by the Government will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures. Address all comments to the SWPPP generated by the Illinois Environmental Protection Agency within seven calendar days of receipt of comments. Certify, in writing, that all recommended changes have been made to the SWPPP, and must submit certification to the Contracting Officer's Representative (COR). Post at the project site, in a visible location accessible for public viewing, the IEPA response letter to be provided by the Goverment and ILR10.

1.7.2 Environmental Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the EPP.

1.7.3 Environmental Protection Plan Contents

The EPP must include, but not limited to, the following:

a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the EPP.

b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.

c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

d. Description of the Contractor's environmental protection personnel training program, including training for subcontractors.

e. A map of the site, showing site boundaries, waterways on or adjacent to the site, 100-year flood plains, soil types, location of vegetative cover, location and dimensions of storm water drainage systems and natural drainage patterns on and adjacent to the site, locations of utilities structures and roads, site topography (existing and planned), and any potential areas where point sources may enter the groundwater.

f. A Stormwater Pollution Prevention Plan which identifies the type and location of the erosion and sediment controls to be provided. The plan must meet the requirements of the Illinois NPDES Permit No. ILR10. ILR10 is issued by the Illinois Environmental Protection Agency and may be found at http://www.epa.illinois.gov. The management practices, controls, and other provisions contained in the plan must be as protective as the requirements in the Illinois Urban Manual (IUM). The contents of the plan must address all items listed in Part IV of the permit, including but not limited to:

(1) Site description, controls, maintenance, inspections, and non-stormwater discharges.

(2) A map of the final site conditions.

(3) A site construction plan that includes the locations and dimensions of land disturbing activities, locations of soil stockpiles, locations and dimensions of erosion control measures, and a schedule with the start and finish dates of each land disturbing activity, including the installation of erosion control measures. Provisions and a schedule for maintenance of the erosion control measures during construction must also be included in the plan.

(4) Name and qualifications of the person(s) responsible for inspecting the site in accordance with the requirements given in ILR10.

(5) A copy of the blank inspection checklist that will be used during ILR10 site inspections.

(6) The plan must contain the certification statement contained in Part IV(F) of the NPDES Permit No. ILR10.

g. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.

h. Measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan must include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff. Should mud or dirt be transported onto paved public roads by vehicles or runoff, as needed or directed by the Contracting Officer, remove the mud or dirt from the pavement using commercial street cleaning equipment, such as a "street sweeper", or other equipment approved by the Contracting Officer's Representative.

i. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

j. Drawing showing the location of proposed borrow areas.

k. The Spill Control Plan must include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan must include as a minimum:

(1) The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual must immediately notify the Contracting Officer and the local fire department or emergency response agency in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan must contain a list of the required reporting channels and telephone numbers.

(2) The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

(3) Training requirements for Contractor's personnel and any subcontractors, and methods of accomplishing the training.

(4) A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

(5) The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

(6) The methods and procedures to be used for expeditious contaminant cleanup.

l. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal, including clearing and demolition debris. The solid waste disposal plan must include schedules for disposal. Identify any subcontractors responsible for the transportation and disposal of waste. The Contractor must include the

name and location of disposal site(s). Evidence of the disposal facility's acceptance of the waste must be attached to this plan during the construction. Attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. The report must indicate the total amount of waste generated and total amount of waste diverted in cubic yards or tons along with the percent that was diverted.

m. A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. The plan must detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source.

n. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site. The air pollution control plan must include a dust control plan.

o. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Safety Data Sheets (SDS) and the maximum quantity of each hazardous material to be on site at any given time must be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan must be updated.

p. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan must include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, the plan must include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented. If surface discharge will be the method of disposal, a copy of the permit and associated documents must be included as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, the plan must include documentation that the Waste Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge.

q. A historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. The plan must include methods to assure the protection of known or discovered resources and must identify lines of communication between Contractor personnel and the Contracting Officer.

r. The Contractor must identify the current quarantine areas, the specific pests, and the method(s) for compliance with all quarantines. The Contractor is responsible for obtaining any permits or approvals necessary for plant purchase, movement, or disposal within a quarantine area, and must have a plan for any plant (including trees, roots, vegetation) material and other regulated materials that will be removed from within or associated with a quarantined area.

s. The Contractor must comply with the Unuited States Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) Vessel General Permit for Discharges Incidental to the Normal Operation of a Vessel (VGP) for all regulated vessels to be used on the project. For each vessel that meets the requirements in the permit, include in the Environmental Protection Plan a copy of the Notice of Intent (NOI) and associated documentation or verification from the United States Environmental Protection Agency that the vessel is in compliance with the permit. The Contractor is responsible for permit compliance.

1.7.4 Appendix

Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents must be attached, as an appendix, to the EPP.

1.8 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to the start of any onsite construction activities, the Contractor and the Contracting Officer must make a joint condition survey. Immediately following the survey, prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report must be signed by both the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.9 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.10 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or

regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

This paragraph supplements the Contractor's responsibility under the contract clause "PERMITS AND RESPONSIBILITIES" to the extent that the Government has obtained the Section 401 Water Quality Certification. Contractor shall comply with the conditions of Regional Permit 7 (RP7 - Temporary Construction Activities), Regional Permit 8 (RP8 - Utility Line Projects), and the 401 water quality certification for the regional permit program attached at the end of this section. Contractor shall limit disruptions to the Des Plaines River sediment bed during construction of the outfall structure in accordance with RP8. Contractor shall comply with restrictions for temporary fill ativity impacting the Des Plaines River below ordinary high water, including temporary coffering, specified in RP7 - Temporary Construction Activities.

3.2 LAND RESOURCES

Confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, soil, or other materials displaced into uncleared areas must be removed by the Contractor.

3.2.1 Work Area Limits

Prior to commencing construction activities mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed must be marked or fenced. Monuments and markers must be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. The Contractor's personnel must be knowledgeable of the purpose for marking and/or protecting particular objects.

3.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features

indicated and defined on the drawings to be preserved must be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.2.3 Erosion and Sediment Controls

Provide erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor must be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. Construct or install temporary and permanent erosion and sediment control best management practices (BMPs). BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. The Contractor's best management practices must also be in accordance with the State of Illinois National Pollutant Discharge Elimination System (NPDES) Storm Water Pollution Prevention requirements. Any temporary measures must be removed after the area has been stabilized.

3.2.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings must be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities must be made only when approved. Erosion and sediment controls must be provided for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas must be controlled to protect adjacent areas.

3.3 WATER RESOURCES

Monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals must not be applied to soil or vegetation unless otherwise indicated. All water areas affected by construction activities must be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor must be capable of quantifying sediment or pollutant loading to that surface water when required by a Clean Water Act permit.

3.3.1 Cofferdams, Diversions, and Dewatering Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be controlled at all times to maintain compliance with existing State water quality standards and designated uses of the surface water body. The Contractors diversions and dewatering operations must comply with the state of Illinois water quality standards and anti-degradation provisions, and Sections 401 and 404 of the Clean Water Act. If the Contractor proposes diversions and dewatering operations not shown on the project drawings, or authorized under an existing regional ornationwide permit, the Contractor must submit to the Government the design details of the proposed diversions and dewatering operations in advance of installing the Contractor-proposed feature. The Government will coordinate the Contractor-proposed features with the

appropriate regulatory agencies to determine if additional permits are required. If additional permits will be required, the Government will obtain the additional permit coverage. It is the responsibility of the Contractor to allow sufficient time in the schedule to accommodate this review and compliance process, and to provide the Contracting Officer with any and all information that the Contracting Officer deems necessary to facilitate the process. The review and compliance process requires a minimum time frame of 90 calendar days, but could take substantially longer, possibly up to one year or, in unusual circumstances, even longer than one year, to complete. Any delays caused by the need to obtain additional permits must be solely the responsibility of the Contractor, at no additional cost to the Government. Do not install Contractor-proposed features not shown on the project drawings, without receiving written approval, and permits, from the Government.

3.3.2 Stream Crossings

Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the Federal, State, and local governments. Comply with the State of Illinois water quality standards and anti-degradation provisions, and Section 401 and 404 of the Clean Water Act. If the Contractor proposes stream crossings not shown on the project drawings, or authorized under an existing regional or nationwidepermit, the Contractor must submit to the Government the design details of the proposed stream crossing in advance of installing the Contractor-proposed feature. The Government will coordinate the Contractor-proposed features with the appropriate regulatory agencies to determine if additional permits are required. If additional permits will be required, the Government will obtain the additional permit coverage. It is the responsibility of the Contractor to allow sufficient time in the schedule to accommodate this review and compliance process, and to provide the Contracting Officer with any and all information that the Contracting Officer deems necessary to facilitate the process. The review and compliance process requires a minimum time frame of 90 calendar days, but could take substantially longer, possibly up to one year or, in unusual circumstances, even longer than one year, to complete. Any delays caused by the need to obtain additional permits shall be solely the responsibility of the Contractor, at no additional cost to the Government. Do not install Contractor-proposed features, not shown on the project drawings, without receiving written approval, and permits, from the Government.

3.3.3 Wetlands

Do not enter, disturb, destroy, or allow discharge of contaminants into any wetlands. Protect wetlands shown on the drawings in accordance with paragraph ENVIRONMENTAL PERMITS AND COMMITMENTS. Authorization to enter specific wetlands identified shall not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries.

3.3.4 Control of Aquatic Nuisance Species

Conduct operating practices to prevent the spread of Aquatic Nuisance Species (ANS). Such practices must include, but not be limited to, cleaning equipment to prevent the spread of seeds, eggs, larvae, or other dispersal vectors; and discharging or exchanging ballast water, or other water, from a vessel of any type to prevent transfer of water from one water body into another. Contractor remove all plants, sediment, and

organisms from the vessel and must thoroughly clean all equipment before being used on the project site.

3.4 AIR RESOURCES

Equipment operation, activities, or processes performed must be in accordance with all Federal, State, and local air emission and performance laws and standards.

3.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; must be controlled at all times, including weekends, holidays and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control must be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with all State and local visibility regulations.

3.4.2 Odors

Odors from construction activities must be controlled at all times. The odors must not cause a health hazard and must be in compliance with State regulations and/or local ordinances.

3.4.3 Sound Intrusions

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of Illinois rules given in 35 IAC 900-901.

3.4.4 Burning

Burning will not be allowed on the project site unless specified in other sections of the specifications or authorized in writing by the Contracting Officer. The specific time, location, and manner of burning must be subject to approval.

3.5 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes must be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.5.1 Solid Wastes (Excluding CCDD)

Solid wastes (excluding CCDD) must be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal must be conducted to prevent contamination. Segregation measures must be employed so that no hazardous or toxic waste will become co-mingled with solid waste. Transport solid waste off Government property and dispose of it in

compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill must be the minimum acceptable off-site solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Comply with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

3.5.2 Clean Construction and Demolition Debris

Contractor shall dispose of clean construction and demolition debris (CCDD) in accordance with Illinois Public Act 96-1416. Contractor shall prepare and attach to the solid waste diversion reports all documentation required under 415 ILCS 5/3.160 for the disposal of CCDD, including hauling information, soil certification, and visual inspections. The Contractor is responsible for, but not limited to, classifying materials for disposal, conducting analytical testing, collecting and paying any fees, and obtaining permits associated with managing CCDD materials, for the specific disposal site selected.

3.5.3 Chemicals and Chemical Wastes

Chemicals must be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action must be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste must be collected in corrosion resistant, compatible containers. Collection drums must be monitored and removed to a staging or storage area when contents are within six inches of the top. Wastes must be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.5.4 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. Manage and store hazardous waste in compliance with 40 CFR 262. Take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. Segregate hazardous waste from other materials and wastes, must protect it from the weather by placing it in a safe covered location, and must take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations. Transport Contractor generated hazardous waste off Government property within 60 calendar days in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. Dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials must be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills must be the Contractor's responsibility. The disposition of Contractor generated hazardous waste and excess hazardous materials are the Contractor's responsibility.

3.5.5 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles must be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil must be managed and stored in

accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded must be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. Storage of fuel on the project site must be accordance with all Federal, State, and local laws and regulations, and must have the approval of the Contracting Officer.

3.5.6 Waste Water

Disposal of waste water must be as specified below.

a. Waste water from construction activities, such as onsite material processing (including sediment dewatering), concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. must not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction related waste water off-Government property in accordance with all Federal, State, Regional and Local laws and regulations.

b. For discharge of ground water obtain a State or Federal permit specific for pumping and discharging ground water prior to surface discharging. All surface discharge must be done in accordance with the requirements of the NPDES Construction Site Activity Storm Water Permit. Land application must be in accordance with all Federal, State, Regional, and/or Local laws and regulations for pumping and land applying ground water.

3.6 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

Maintain an inventory of non-hazardous solid waste diversion and disposal of clearing and demolition debris. Submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that non-hazardous solid waste has been generated. The following must be included in the report:

a. Clearing and Demolition (C&D) Debris Disposed = _____ in cubic yards or tons, as appropriate.

b. Clearing and Demolition (C&D) Debris Recycled = _____ in cubic yards or tons, as appropriate.

c. Total C&D Debris Generated = _____ in cubic yards or tons, as appropriate.

d. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) = _____ in cubic yards or tons, as appropriate.

3.7 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Any identified existing historical, archaeological, and cultural resources within the Contractor's work area are shown on the drawings. Protect these resources and be responsible for their preservation during the life of the Contract. If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources must be temporarily suspended. Resources

covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.8 BIOLOGICAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. Protect threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

3.9 PREVIOUSLY USED EQUIPMENT

Clean all previously used construction equipment prior to bringing it onto the project site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds.

3.10 MAINTENANCE OF POLLUTION FACILITIES

Maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.11 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel and subcontractor personnel must be trained in all phases of environmental protection and pollution control. Conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Additional meetings must be conducted for new personnel and when site conditions change. The training and meeting agenda must include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3.12 POST CONSTRUCTION CLEANUP

Clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". Obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area must be graded, filled and the entire area seeded unless otherwise indicated.

-- End of Section --

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
BRUCE RAUNER, GOVERNOR ALEC MESSINA, ACTING DIRECTOR

217/782-3362

FEB 16 2017

Chicago District
Corps of Engineers
231 S. LaSalle Street
Suite 1500
Chicago, IL 60604

Re: IEPA Log # C-0194-16
Chicago Regional Permits and Conditions for Proposed Regional Permits:

1. Residential, Commercial and Institutional Developments
2. Recreation Projects
3. Transportation Projects
4. Minor Discharges and Dredging
5. Wetland and Stream Restoration and Enhancement
6. Completed Enforcement Actions
7. Temporary Construction Activities
8. Utility Line Projects
9. Maintenance
10. Bank Stabilization
11. Marine Structures and Activities
12. Bridge Scour Protection
13. Cleanup of Toxic and Hazardous Materials

Dear Sir or Madam:

This Agency has reviewed the proposed Regional Permits and Conditions for the above referenced projects public noticed by the Chicago District on August 1, 2016. The following comments are provided for your use and information.

This Agency hereby issues certification under Section 401 of the Clean Water Act (PL 95-217) for the proposed regional permits subject to the attached conditions.

The Agency has modified the set of previous 401 certification conditions issued in 2012 to apply to the proposed Chicago District Regional Permit Program. These changes include modified conditions 3, 5, 7 and 14 and new conditions 15, 16 and 17.

The determination to include the attached conditions was made with respect to the cause of water pollution as defined in the Illinois Environmental Protection Act. These comments are directed at the effect on water quality of the construction procedures involved in the project and are not an approval of any discharge resulting from the completed facility, nor an approval of the design of the facility. These comments do not supplant any permit responsibilities of the applicant toward the Agency.

If you have any questions concerning this letter, please contact Darren Gove at 217-782-3362.

Sincerely,

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

SAK:DRG:C-0194-16.docx

Attachment

cc: IEPA, Records Unit
IDNR, OWR, Bartlett
USEPA, Region 5
CoE, Louisville District (Newburgh)
CoE, Louisville District (Indianapolis)
CoE, Memphis District
CoE, Rock Island District
CoE, St. Louis District

Illinois Environmental Protection Agency
February 16, 2017
Section 401 Water Quality Certification Conditions for Regional Permits regarding:

1. Residential, Commercial and Institutional Developments
2. Recreation Projects
3. Transportation Projects
4. Minor Discharges and Dredging
5. Wetland and Stream Restoration and Enhancement
6. Completed Enforcement Actions
7. Temporary Construction Activities
8. Utility Line Projects
9. Maintenance
10. Bank Stabilization
11. Marine Structures and Activities
12. Bridge Scour Protection
13. Cleanup of Toxic and Hazardous Materials

1. The applicant shall not cause:

   a. a violation of applicable water quality standards of the Illinois Pollution Control Board, Title 35, Subtitle C: Water Pollution Rules and Regulations;

   b. water pollution defined and prohibited by the Illinois Environmental Protection Act;

   c. interference with water use practices near public recreation areas or water supply intakes;

   d. a violation of applicable provisions of the Illinois Environmental Protection Act.

2. The applicant shall provide adequate planning and supervision during the project construction period for implementing construction methods, processes and cleanup procedures necessary to prevent water pollution and control erosion.

3. Except as allowed under condition 7, 9 and 10, any spoil material excavated, dredged or otherwise produced must not be returned to the waterway but must be deposited in a self-contained area in compliance with all state statutes, regulations and permit requirements with no discharge to waters of the State unless a permit has been issued by this Agency. Any backfilling must be done with clean material and placed in a manner to prevent violation of applicable water quality standards.

4. All areas affected by construction shall be mulched and seeded as soon after construction as possible. The applicant shall undertake necessary measures and procedures to reduce erosion during construction. Interim measures to prevent erosion during construction shall be taken and may include the installation of staked straw bales, sedimentation basins and temporary mulching. All construction within the waterway shall be constructed during zero or low flow conditions. The applicant shall be responsible for obtaining an NPDES Storm Water Permit prior to initiating construction if the construction activity associated with the project will result in the disturbance of 1 (one) or more acres, total land area. An NPDES Storm Water Permit may be obtained by submitting a properly completed Notice of Intent (NOI) form by certified mail to the Agency's Division of Water Pollution Control, Permit Section.

5. The applicant shall implement erosion control measures consistent with the "Illinois Urban Manual" (IEPA/USDA, NRCS; 2016).

6. The applicant is advised that the following permit(s) must be obtained from the Agency: The applicant must obtain permits to construct sanitary sewers, water mains and related facilities prior to construction.

7. Backfill used in stream crossing trenches shall be predominantly sand or larger size material, with less than 20% passing a #230 U.S. sieve.

8. Any channel relocation shall be constructed under dry conditions and stabilized to prevent erosion prior to the diversion of flow.

9. Backfill used within trenches passing through surface waters of the State, except wetland areas, shall be clean coarse aggregate, gravel or other material which will not cause siltation, pipe damage during placement, or chemical corrosion in place. Excavated material may be used only if:
   a) particle size analysis is conducted and demonstrates the material to be at least 80% sand or larger size material, using #230 U.S. sieve; or
   b) excavation and backfilling are done under dry conditions.

10. Backfill used within trenches passing through wetland areas shall consist of clean material which will not cause siltation, pipe damage during placement, or chemical corrosion in place. Excavated material shall be used to the

extent practicable, with the upper six (6) to twelve (12) inches backfilled with the topsoil obtained during trench excavation.

11. Any applicant proposing activities in a mined area or previously mined area shall provide to the IEPA a written determination regarding the sediment and materials used which are considered "acid-producing material" as defined in 35 Il. Adm. Code, Subtitle D. If considered "acid-producing material," the applicant shall obtain a permit to construct pursuant to 35 Il. Adm. Code 404.101.

12. Asphalt, bituminous material and concrete with protruding material such as reinforcing bar or mesh shall not be 1) used for backfill, 2) placed on shorelines/stream banks, or 3) placed in waters of the State.

13. Applicants that use site dewatering techniques in order to perform work in waterways for construction activities approved under Regional Permits 1 (Residential, Commercial and Institutional Developments), 2 (Recreation Projects), 3 (Transportation Projects), 7 (Temporary Construction Activities), 9 (Maintenance) or 12 (Bridge Scour Protection) shall maintain flow in the stream during such construction activity by utilizing dam and pumping, fluming, culverts or other such techniques.

14. In addition to any action required of the Regional Permit 13 (Cleanup of Toxic and Hazardous Materials Projects) with respect to the "Notification" General Condition 23, the applicant shall notify the Illinois EPA Bureau of Water, of the specific activity. This notification shall include information concerning the orders and approvals that have been or will be obtained from the Illinois EPA Bureau of Land (BOL) for all cleanup activities under BOL jurisdiction, or for which authorization or approval is sought from BOL for no further remediation. This Regional Permit is not valid for activities that do not require or will not receive authorization or approval from the BOL.

15. The applicant shall implement Best Management Practices (BMPs) to protect water quality, preserve natural hydrology and minimize the overall impacts to aquatic resources during and after construction. If the project involves a water with an approved Total Maximum Daily Load (TMDL) allocation for any parameter, measures which ensure consistency with the assumption and requirements of the TMDL shall be included. TMDL program information and water listings are available at http://www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/index. If the project involves an impaired water listed on the Illinois Environmental Protection Agency's Section 303(d) list for suspended solids, turbidity, or siltation, measures designed for at least a 25-year, 24-hour rainfall event shall be incorporated. Impaired waters are identified at http://www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/303d-list/index.

16. Earthen granular fill used for construction of temporary structures in waters of the State shall have less than 20% passing a #230 U.S. sieve.

17. The use of directional drilling to install utility pipelines below surface waters of the State is hereby certified provided that:
    a) All pits and other construction necessary for the directional drilling process are located outside of surface waters of the State;
    b) All drilling fluids shall be adequately contained such that they cannot cause a discharge to surface waters of the State. Such fluids shall be managed such that they are not discharged to waters of the State and disposed of appropriately in accordance with the regulations at 35 Il. Adm. Code Subtitle G.
    c) Erosion and sediment control is provided in accordance with Conditions 2, 4, and 5.

CHICAGO DISTRICT
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7. TEMPORARY CONSTRUCTION ACTIVITIES

RP7 authorizes temporary structures and discharges necessary for construction activities, access fills and dewatering of construction sites. Authorization under RP7 is subject to the General Conditions of the Regional Permit Program beginning on page 6 of this document. In addition, the following requirements must be addressed in writing and submitted with the notification:

a. All projects will be processed under Category I.

b. The temporary fill to waters of the U.S. must be limited to the minimum necessary to complete the activity. The acreage and purpose of each temporary fill must be specified.

c. Fill must be composed of non-erodible materials and be constructed to withstand expected high flows.

d. Low ground-pressure equipment is required for work in wetlands. However, after careful consideration, if the District accepts a proposal to use heavy equipment to accomplish the work, the placement of timber mats or other protective measures must be utilized to minimize soil disturbance. Lumber to be used for temporary construction activities must be free of all chemical treatment.

e. All materials used for temporary construction activities must be moved to an upland area immediately following completion of the construction activity.

f. The permittee is required to restore the construction area to pre-construction conditions, including grading to original contours and revegetating disturbed areas with appropriate native vegetation immediately upon completion of the project. A restoration plan must be submitted with the notification. A 1-foot contour topographic map of the project area may be required on a case-by-case basis.

g. For projects that require installation and operation of a cofferdam, the cofferdam method and a detailed construction sequence must be specified in the project narrative and clearly labeled on the construction plans. The following requirements will be adhered to for any project requiring in-stream work and must be incorporated into the soil erosion and sediment control plans for the project:

    1) Work in the waterway should be timed to take place during low or no-flow conditions. Low flow conditions are at or below the normal water elevation.

    2) The plan must be designed to allow for the conveyance of the 2-year peak flow past the work area without overtopping the cofferdam. The Corps has the discretion to reduce this requirement if documented by the applicant to be infeasible or unnecessary.

3) Water must be isolated from the in-stream work area using a cofferdam constructed of non-erodible materials (steel sheets, aqua barriers, rip rap and geotextile liner, etc.). Earthen cofferdams are not permissible.

4) The cofferdam must be constructed from the upland area and no equipment may enter the water at any time. If the installation of the cofferdam cannot be completed from shore and access is needed to reach the area to be coffered, other measures, such as the construction of a causeway, will be necessary to ensure that equipment does not enter the water. Once the cofferdam is in place and the isolated area is dewatered, equipment may enter the coffered area to perform the required work.

5) If bypass pumping is necessary, the intake hose must be placed on a stable surface or floated to prevent sediment from entering the hose. The bypass discharge must be released onto a non-erodible, energy dissipating surface prior to rejoining the stream flow and must not cause erosion. Filtering of bypass water is not necessary unless the bypass water has become sediment-laden as a result of the current construction activities.

6) During dewatering of the coffered work area, all sediment-laden water must be filtered to remove sediment. Possible options for sediment removal include baffle systems, anionic polymers systems, dewatering bags, or other appropriate methods. Water must have sediment removed prior to being re-introduced to the downstream waterway. A stabilized conveyance from the dewatering device to the waterway must be identified in the plan. Discharge water may not result in a visually identifiable degradation of water clarity.

7) The area from the toe to the top of the side slope must be temporarily stabilized during construction to reduce the potential for erosion. All areas disturbed due to construction activities must be restored to proposed conditions and fully stabilized prior to accepting flows.

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Chicago District

CHICAGO DISTRICT
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8. UTILITY LINE PROJECTS

RP8 authorizes the construction, maintenance and repair of utility line activities and associated facilities in waters of the United States.

This includes trenching and backfilling activities for utility lines and fill activities for construction of substations and related appurtenances (temporary and permanent access roads, construction pads, stormwater management facilities, fencing, parking lots, etc.), poles, pads, anchors, outfall structures, and foundations for overhead utility line towers, utility lines under (e.g., through directional drilling) or over navigable waters (regulated under Section 10 waters only), and outfalls and associated intakes which are authorized, conditionally authorized, specifically exempted, or are otherwise in compliance with the National Pollutant Discharge Elimination System program (Section 402 of the Clean Water Act).

Pipes or pipelines used to transport gaseous, liquid, liquescent, or slurry substances over navigable waters of the United States are considered to be bridges, not utility lines, and may require a permit from the U.S. Coast Guard pursuant to Section 9 of the Rivers and Harbors Act of 1899. However, any discharges of dredged or fill material into waters of the United States associated with such pipelines will require a section 404 permit.

Utility lines constructed in, over, or under Section 10 waters, and without a discharge of dredged or fill material, require a Section 10 permit if the proposed activity has the potential to affect the course, condition or capacity of navigation. The construction of utility lines through a Section 10 water with a discharge of dredged or fill material requires a Section 404 permit in addition to a Section 10 permit. For purposes of a Section 10 permit, a tunnel or other structure or work under or over a navigable water of the United States is considered to have an impact on the navigable capacity of the waterbody.

Authorization under RP8 is subject to the General Conditions of the Regional Permit Program beginning on page 6 of this document. In addition, the following requirements must be addressed in writing and submitted with the notification:

a. The impact to waters of the U.S. must not exceed 1.0 acre. For projects that impact over 0.10 acres of waters of the U.S., the permittee is required to provide compensatory mitigation.

b. Projects that impact no more than 0.5 acres of waters of the U.S., and do not impact a high-quality aquatic resource, will be processed under Category I.

c. Projects that impact over 0.5 acres and up to 1.0 acre of waters of the U.S., or impact a high-quality aquatic resource, will be processed under Category II.

d. Authorization under RP8 pursuant to Section 404 of the Clean Water Act is subject to individual water quality certification under Section 401 of the Clean Water Act when there is a discharge of dredged and/or fill material to the waters listed below. Return flows from dredging operations to the waters listed below are considered Section 404 discharges. However, as determined on a case-by-

case basis by the District, individual water quality certification may not be required for the installation of outfall structures in the following waters if there will be no more than minimal disturbance to the sediment and substrate during construction activities.

1) Chicago Sanitary and Ship Canal
2) Calumet-Sag Channel
3) Little Calumet River
4) Grand Calumet River
5) Calumet River
6) Chicago River (main stem)
7) South Branch of the Chicago River (including South Fork)
8) North Branch of the Chicago River (including East and West Forks and Skokie Lagoons)
9) Lake Calumet
10) Des Plaines River
11) Fox River (including the Fox Chain of Lakes)
12) Lake Michigan
13) Pettibone Creek
14) Kankakee River

e. For a project site adjacent to a conservation area, the permittee must request a letter from the organization responsible for management of the area. The response letter must identify recommended measures to protect the area from impacts that may occur as a result of the development. A copy of the request and any response received from the organization must be submitted to the District with the notification.

f. Stormwater management facilities may not be constructed in a linear body of water such as a river, or perennial, intermittent or ephemeral stream or creek, unless there is substantial evidence that the project will provide a benefit to the aquatic system. Potential benefits could include water quality improvements at headwaters of the watershed, or promotion of wildlife habitat, feeding and breeding areas.

g. The project must employ permanent, post-construction Best Management Practices (BMPs) to protect water quality, preserve natural hydrology and minimize the overall impacts of the project on aquatic resources. BMPs must be considered at the earliest planning stages of the project. Please note that temporary soil erosion and sediment control (SESC) measures are not considered permanent BMPs.

   To the greatest extent practicable, the activity should be designed such that stormwater does not directly discharge into waters of the U.S. For each location where stormwater discharges towards a jurisdictional wetland or stream, provide a written narrative discussing opportunities to implement permanent BMPs. The type of BMPs proposed should be based on the scope of work, the change in impervious surface runoff discharging to the waters of the U.S., and the overall direct impacts to waters of the U.S. resulting from the proposed work.

h. The permittee must establish and/or enhance an upland buffer of appropriate native plants adjacent to all created, restored, enhanced or preserved waters of the U.S., including but not limited to: wetlands, rivers, streams, creeks, ponds and lakes. However, the construction or installation of the support towers, poles, footing, anchors and appurtenant structures for overhead and/or underground utility lines are exempt from this upland buffer requirement.

i. The discharge of dredged or fill material may not consist of unsuitable material. Material discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

Unsuitable materials include but are not limited to: trash, debris, asphalt, and creosote treated wood (i.e. for support poles and towers).

j. The permittee is required to restore the construction area to pre-construction conditions, including grading the disturbed areas to the original contours and revegetating with appropriate native vegetation immediately upon completion of the project. The restoration plan must be submitted with the notification. A 1-foot contour topographic map of the project area may be required on a case-by-case basis.

k. The construction zone for linear utility line projects must be limited to a width of 50 feet. All designated work area(s), including construction staging areas, must be drawn onto the submitted construction plans and clearly labeled. Equipment storage or staging areas may not occur in wetlands or waters of the U.S.

l. Mechanized clearing of vegetation in the utility corridor must be conducted no more than seven (7) calendar days preceding installation of the utility line in that segment of the corridor. Vegetation may not be cleared along the entire corridor prior to installation of the utility line.

m. For utility line projects, directional drilling (regulated in Section 10 waters only) or dry crossing techniques, such as fluming, must be used for utility line projects if the waterbody to be crossed contains perennial flow. The construction drawings and project narrative must depict the location of all construction access areas, dewatering pits, jacking and receiving pit locations. Steps must be taken for the removal and disposal of bentonite slurry, a by-product of installation.

n. Notification must include a contingency plan when the project involves directional boring or horizontal directional drilling (HDD) beneath waters of the U.S., including wetlands. The contingency plan must discuss actions to stabilize the work area (prior, during and post-construction), to employ alternative construction methods, and the process to obtain additional permits necessary to complete the project. The contractor must closely monitor the project for the unintentional discharges of drilling fluids. Monitoring activities during drilling operations must include visual inspection along the drill path, fluid return pit(s), and wetland/waterbody surfaces for evidence of a release, as well as documentation of all drilling fluid products. Any discharge of drilling material into waters of the U.S. must be reported to the Corps within 24 hours. You must implement the approved contingency plan immediately upon discovery of an unauthorized discharge. Restoration and/or mitigation may be required as result of any unintended discharge.

o. This RP authorizes, to the extent that DA authorization is required, temporary structures, fills, and work necessary for the remediation of inadvertent returns of drilling muds to waters of the United States through sub-soil fissures or fractures (i.e., frac-outs) that might occur during horizontal directional drilling activities to install or replace utility lines. These remediation activities must be done as soon as practicable to restore the affected waterbody. District engineers may add special conditions to this RP to require a remediation plan for addressing inadvertent returns of drilling muds to waters of the United States during horizontal directional drilling activities for the installation or replacement of utility lines.

p. Material resulting from trench excavation may be temporarily (up to 30 days) sidecast into wetlands provided that the material is contained using appropriate soil erosion and sediment control measures. Excavated materials may not be temporarily sidecast in waterways. Revegetation of all disturbed areas is required.

q. Utility lines must not adversely alter the existing hydrology of waters of the U.S., including wetlands. In wetland areas, utility line trenches must be lined with clay or other impervious materials or structures (such as cut-off walls) to ensure that the utility trench does not alter the hydrology nor drain waters of the U.S. In order to prevent a French drain effect, gravel bedding cannot be used as backfill material in the trench. The method chosen to prevent the draining of wetlands must be drawn onto the construction plans and clearly labeled.

r. In wetland areas, the trench must be backfilled with topsoil excavated from the trench in the same stratification in which it was removed. For example, the upper horizon of the wetland soil must be placed back at the ground surface to allow for successful revegetation of wetland plants.

s. All disturbed areas of the project (i.e. utility corridor, construction access and storage areas, disturbed slopes and streambanks, etc.) must be stabilized (e.g., blanketed and seeded) immediately upon completion of construction activities in any one segment of the project. In no case may soil stabilization be delayed until the project is completed.

t. All temporary construction activities must adhere to the requirements of items c through g of Regional Permit 7 (Temporary Construction Activities) and must be addressed in writing and submitted with the notification.

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PROJECT IDENTIFICATION
10/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 310-1-6a	(2006) Sign Standards Manual, VOL 1
EP 310-1-6b	(2006) Sign Standards Manual, VOL 2, Appendices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sign Legend Orders; G, CN

1.3 CONSTRUCTION PROJECT SIGNS (USACE)

1.3.1 Construction Project Signs

Construction project signs must be coordinated with the Contracting Officer. The signs include one Project Identification Sign and one Safety Performance Sign.

The construction project sign panels will each be electronically printed as a single decal and mounted on single sided vinyl faced White Board as described in Paragraph "MATERIALS" below.

The layout of all signs must be in accordance with the standards specified in the USACE graphics and sign standards manuals referenced above. Relevant portions of the manuals will be provided to the Contractor upon request. Examples of generic signs are shown on Plates 01 58 00.00 03-1 and 01 58 00.00 03-2 included at the end of this specification section.

Furnish the construction project sign package, maintain the signs during construction, and remove the signs from the job site upon completion of the project. The construction project sign package consists of two signs: one for project identification and the other to show the on-the-job safety performance of the contractor. Ensure that the package conforms to the requirements of EP 310-1-6a and EP 310-1-6b, specifically Section 16. Submit the sign legend orders as described in Section 16 of EP 310-1-6a

before erecting the signs.

PART 2 PRODUCTS

2.1 PROJECT IDENTIFICATION LABEL

The two plates at the end of the section are generic because the project identification is not included. For this particular project, the project identification label must be identified as the following on both signs:

FOR LINE 1, LEVEE 37 PUMP STATION UPGRADES
FOR LINE 2, VILLAGE OF MOUNT PROSPECT, ILLINOIS

2.2 PLACEMENT OF SPONSOR AND ARMY LOGO DECALS

2.2.1 Sponsor and Army Decal Placement

Placement of an Army logo decal is shown on Plate 01 58-00-1. If a Sponsor logo decal is to be used, it is to be affixed to the sign in lieu of the Army logal decal.

2.2.2 Placemant of Decal

A 10-1/2 inch by 7.875 inch Army decal shall be provided by the Contracting Officer's Representative.

Align the decal with the same left margin as the Corps Signature (three inches from edge of sign).

Vertically center the decal between the last text and the bottom of the sign (so that the space above and below the decal are the same).

2.2.3 Application Instructions

Clean the surface of the sign.

Place the decal in the desired location using masking tape.

With scissors, cut half the backing.

Rub from the decal’s center outward, a little bit at a time, being careful not to trap bubbles.

When the first half has completely adhered to the sign face, remove the remaining backing and finish applying.

When you are sure that the decal is firmly placed onto the sign, slowly remove the white cloudy transfer paper on the decal’s face.

Check for bubbles and gently work them out to the outer edges.

2.3 MATERIALS

The following are requirements for all of the construction project signs.

a. The sign faces must be electronically printed on white non-reflective vinyl decals four mil thick.

b. The sign face decals must be mounted on panels of 1/2-inch thick White Board with single-sided vinyl facing. The entire circumference of the sign panels will be sealed and protected with white vinyl trim cap.

c. Apply protective overlaminate film over the sign face decals capable of minimizing the deteriorating effects of ultraviolet radiation and providing additional protection against weathering and application of graffiti.

d. Provide two inch by four inch struts between the four inch by four inch support posts to reinforce the top and bottom edges of the sign panels.

e. Wood material for the posts must be preservative treated, structural grade Douglas Fir or No. 1 Southern Pine, or better. All other wood members must be of well seasoned, kiln dried, clear redwood, bald cypress, red cedar, Douglas fir, spruce, tulip poplar, or white pine. The lumber materials must be free of splits, wane, and loose knots or pitch pockets. Fasten all members of the sign with screws or bolts of type, size, number, and spacing to provide rigid construction and neat appearance. If the vertical supports system does not rigidly support the sign due to local soil conditions or wind loading, provide additional bracing of the sign supports. Additional bracing must be composed of two inch by four inch bracing bolted to the inside face of each four inch by four inch support post and firmly anchored to the ground behind the sign. Additional bracing is not required to be preservative treated lumber.

f. All bolts must be 0.375-inch diameter and four-inch long Allen head bolts, threaded to match T-nuts.

PART 3 EXECUTION

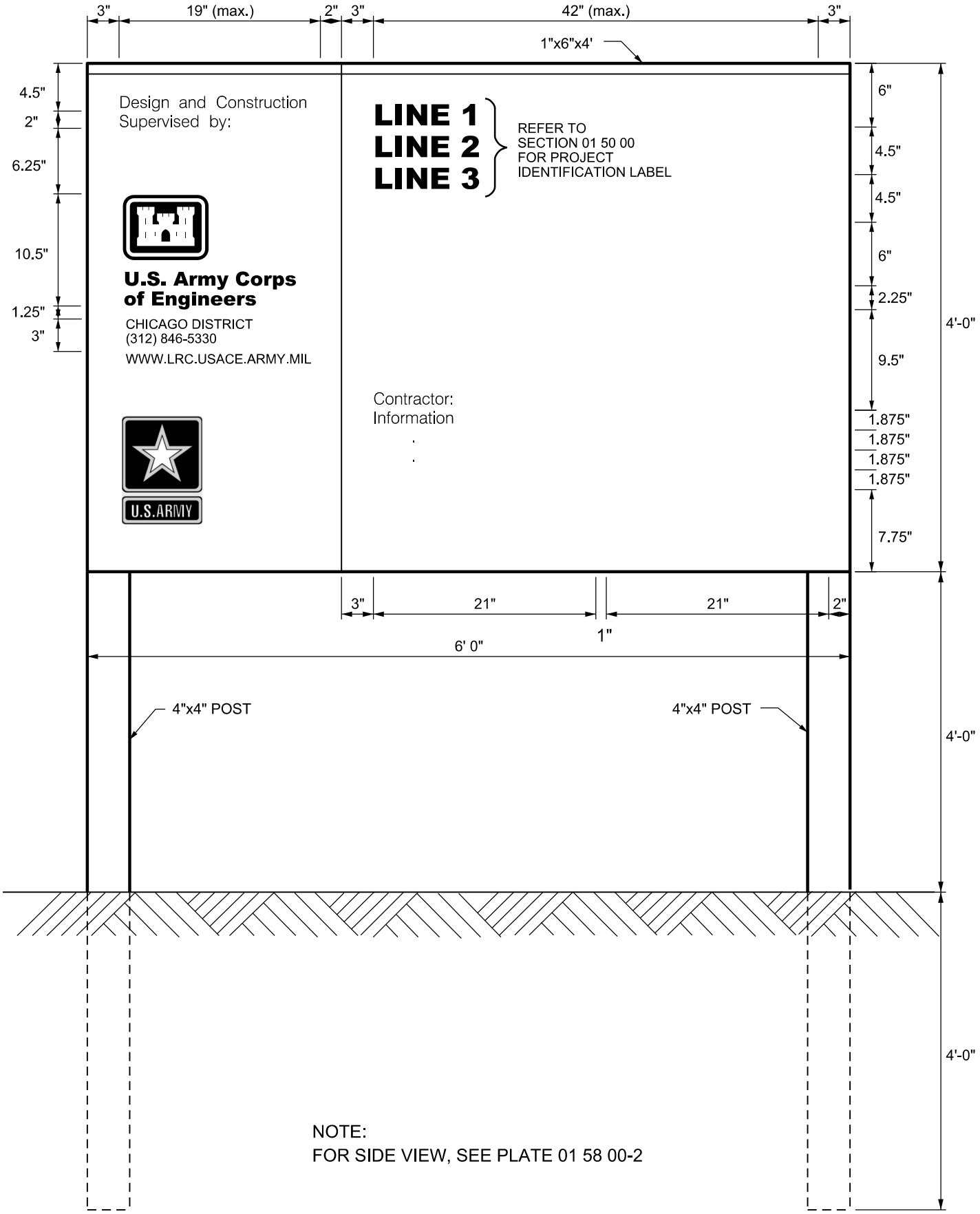
3.1 INSTALLATION

Affix the panels to the posts with the allen head bolts prior to erection of the signs, including drilling counter-sunk 0.375-inch diameter holes in the posts to match the T-nut locations. Take all precautions necessary to protect the faces of the signs from damage during assembly and construction. Install signs upon commencement of the work under this contract. Each sign location must be clear and level to facilitate the installation, and provide easy visual contact. Install and position the sign plate and posts as indicated on 01 58 00_Sign Graphics , attached at the end of this section. Install signs plumb and level.

3.2 MAINTENANCE

Maintain the signs and sites in good condition throughout the construction period.

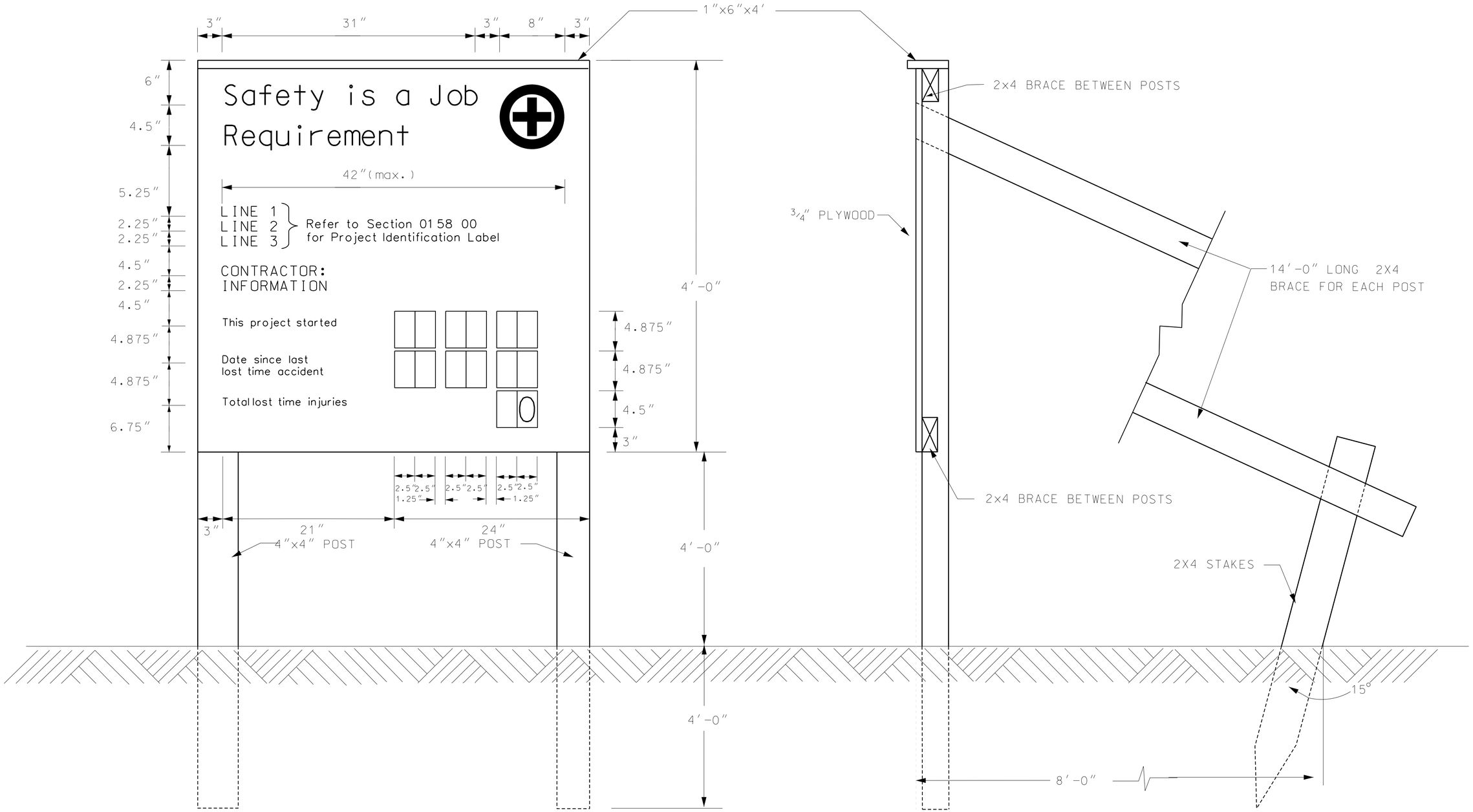
-- End of Section --



NOTE:
FOR SIDE VIEW, SEE PLATE 01 58 00-2

GENERIC PROJECT IDENTIFICATION SIGN

NOT TO SCALE



GENERIC SAFETY PERFORMANCE SIGN

NOT TO SCALE

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-- End of Section Table of Contents --

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CLOSEOUT SUBMITTALS
02/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2012) Cleaning Products for Industrial and Institutional Use

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials

Warranty Management Plan

Warranty Tags

Final Cleaning

Spare Parts Data

SD-08 Manufacturer's Instructions

Preventative Maintenance

Condition Monitoring (Predictive Testing)

Inspection

Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G, CN

SD-11 Closeout Submittals

Intermediate Working CAD Drawing Submittal

Final CAD Drawing Submittal

Final CAD Drawing Backcheck Submittal; G, CN

Final Approved Shop Drawings; G, CN

Final Approved Specifications; G, CN

1.3 DEFINITIONS

1.3.1 Contract Documents

The contract documents consist of the drawings and specifications. After the contract has been awarded, all amendments issued during solicitation are incorporated into the contract documents. The government will provide the contract documents on an optical disc (CD or DVD) and two sets of full size hard copies of the drawings, to the Contractor at the preconstruction meeting. The hard copies of the drawings will become the Contractor's "Working Hardcopy Drawings" and the pdf of the drawings shall become the Working Electronic Redlines Drawing PDFs. The Drawings were developed using Bentley Systems Microstation. The drawings will be provided in the native CAD format and pdf format. The specifications were developed in SpecsIntact and only the pdf file will be provided. The contract documents provided to the contractor are typically referred to as the Contract Set.

1.3.2 Survey Files

Survey data that is collected during construction by the contractor shall be provided to the Goverment as completed at the Intermediate Working CAD Drawing Submittal and the Final CAD Drawing Submittal. Data includes both the ASCI point code file and the Survey CADD File. Both files shall contain the following minimum meta data: Surveyor Name, Date of Survey, Horiztonal and Vertical Datumns. The Final CAD Drawings Subittal should be updated based on any field surveys completed during construction.

1.3.3 Working Hardcopy Drawings

Hard Copy Drawings from the Contract Set provided by the government, may be used by the Contractor to record any revisions that were uncovered during construction but will not replace "Working Electronic Redlines Drawing PDFs" described below. Working Hardcopy drawings are the printed, hardcopy sets of drawings that can be revised by markup during the execution of the project to show the current as-built conditions.

1.3.3.1 Working Electronic Redlines Drawing PDFs

A PDF of the drawings is provided of the as-awarded provided by the government, shall be used by the Contractor to record any revisions that were uncovered during construction. Electronic redlines are revised by markup during the execution of the project to show the current as-built conditions.

1.3.4 Working CAD Drawings

Electronic Computer Aided Drawings (CAD) Drawings from the Contract Set provided by the government is the basis that will be used by the Contractor to record any revisions that were uncovered during construction. Working CAD Drawings are the electronic CAD Files that are revised in tandem with the Working Electronic Redlines Drawing PDFs during execution of the project to show current as-built conditions.

1.3.5 Shop Drawings

Shop drawings as defined by the FAR, are drawings showing fabrication, assembly, or installation, as well as diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data. The shop drawing typically shows more detail than the Contract Documents. It is drawn to explain the fabrication and/or installation of the items.

1.3.6 Final Hardcopy Drawings

The Final Hardcopy Drawings are the completed Working Electronic Redlines Drawing PDFs including all markup revisions which reflect final as-built conditions. The drawings included all of the hand written markups that have occurred, since the contract set was provided to the contractor.

1.3.7 Final CAD Drawings

The Final CAD Drawings are the completed Working CAD Drawings that incorporate all changes shown on the Final Hardcopy Drawings and reflect the final as-built conditions of the project.

1.3.8 Plotted Final CAD Drawings

The Plotted Final CAD Drawings are plotted from the Final CAD Drawings. The Plotted Final CAD Drawings should reflect the all of the revisions shown in the Final Hardcopy Drawings.

1.3.9 As-built Drawings

The as-built Drawings consist of the Final CAD Drawings and Final Hardcopy Drawings, which include modifications during construction, field requested changes, and Contractor designs required during construction. If the Working CAD Drawings and Working Electronic Redlines Drawing PDFs are properly maintained during construction, when project construction is complete, the as-built Drawings should be near completion.

1.3.10 Record Drawings

The Record Drawings are the final as-built drawings accepted by the government. The final submittal from the contractor include the Final CAD Drawings, Final Hardcopy Drawings, and Plotted Final CAD Drawings.

1.4 DRAWING PREPARATION

It may be necessary to revise the Working CAD Drawings and Working Electronic Redlines Drawing PDFs to correctly show the features of the project as it has been constructed. These Working Electronic Redlines Drawing PDFs must be neat, legible and accurate. The Working CAD Drawings must follow AEC CADD standards. These drawings are part of the permanent

records of this project and must be submitted to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

For additional guidance and support developing Asbuilts to USACE standards, please see the following:

http://www.lrc.usace.army.mil/BusinessWithUs.aspx

1.4.1 Working Hardcopy Drawing and Working CAD Drawing Preparation

Revise the Working Electronic Redlines Drawing PDFs by the red-line process to show the as-built conditions during the construction of the project. Keep the Working Electronic Redlines Drawing PDFs current and at least one set available on the jobsite at all times. Changes from the contract drawings, which are made during the course of construction must be accurately and neatly recorded as they occur by means of details and notes. The Working Electronic Redlines Drawing PDFs must be updated in tandem with Working CAD Drawings. Routine updates, must occur at the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working hard copy drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working CAD drawings and Working Electronic Redlines Drawing PDFs as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of Working CAD drawings and Working Electronic Redlines Drawing PDFs. Show on the Working CAD and Hardcopy drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or provideed by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed

or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, provide a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.

k. Follow directions in the modification for posting descriptive changes.

l. Place a Modification at the location of each deletion.

m. For new details or sections which are added to a drawing, place a Modification by the detail or section title.

n. For minor changes, place a Modification by the area changed on the drawing (each location).

o. For major changes to a drawing, place a Modification by the title of the affected plan, section, or detail at each location.

p. For changes to schedules or drawings, place a Modification either by the schedule heading or by the change in the schedule.

q. The Modification size must be 1/2 inch diameter unless the area where the delta is to be placed is crowded. Smaller size delta must be used for crowded areas.

1.4.1.1 Working Electronic Redlines Drawing PDFs

The Working Hard Copy Drawings are defined above. The following "base" colors must be used in the markups: red, green, and blue:

a. Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

b. Additions (Green) - Added items, lettering in notes and leaders.

c. Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

1.4.1.2 Working CAD Drawings

Only employ personnel proficient in the preparation of CAD drawings to modify the contract drawings or prepare additional new drawings. Additions and corrections must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors,

line weights, lettering, layering conventions, and symbols. If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Any additional sheets added to Working Electronic Redlines Drawing PDFs must be developed and contained in the Working CAD Drawings. Accomplish additions and corrections to the Working CAD Drawings using Microstation V8i. The electronic files will be supplied on optical disc (CD or DVD). Provide all program files and hardware necessary to prepare final record drawings. The Contracting Officer will review final hardcopy drawings and final CAD drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

a. All changes must be made on the layer/level as the original item.

b. When final revisions have been completed, show the wording "RECORD DRAWINGS / AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Mark all other contract drawings either "Record" drawing denoting no revisions on the sheet or "Revised Record" denoting one or more revisions. Date original contract drawings in the revision block.

1.5 CAD DRAWING SUBMITTAL FORMAT

CAD Drawings submitted to the government, must be placed on an optical disc (CD or DVD).

a. Label the optical disc with the following information:

Project Name,

Date optical disc was created,

Contract Number, and

Contractors Name.

b. Use the same directory structure and file names as the contract set provided by the Government.

c. Include the following files:

A list of files in either a Microsoft Word or ASCII text file, containing the electronic file names and sheet titles where applicable,

Microstation *.dgn files for all CADD files,

Survey Point Code File *.txt - for any survey data collected, and

Adobe PDF copy for all CADD files.

1.6 INTERMEDIATE WORKING CAD DRAWING SUBMITTAL

Provide the Working CAD Drawings to the Contracting Officer at two intermediate stages of construction, prior to the end of the Construction. The first will occur when approximately 25 percent of the project has been constructed and the other will occur when approximately

75 percent of the project has been constructed. The Contracting Officer will provide the Contractor with 10 calendar days notice when the Working CAD Drawings are requested. Contractor must attend a meeting with the Government to review the *dgn files, within 15 calendar days after each submission.

1.7 FINAL HARDCOPY DRAWING AND FINAL CAD DRAWING REVIEW AND APPROVAL

1.7.1 Final CAD Drawing Submittal

Within 15 calendar days after the final inspection, submit Final CAD Drawings, Final Working Hardcopy, and Plotted Final CAD Drawings for Government review and approval.

All other documents which may include design analysis, catalog cuts, certification documents that are not available in native electronic format must be scanned and included.

1.7.2 Final CAD Drawing Backcheck Submittal

The Government will submit any necessary revisions within 15 calendar days. Within 15 calendar days the Contractor will incorporate the revisions and resubmit the Plotted Final Hardcopy Drawing and Final CAD Drawing to the Government. All corrections must be included in this submittal.

The Final CAD Drawings must be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CAD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record drawing files and marked prints as specified will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of Final CAD Drawings must be accomplished before final payment is made to the Contractor. Upon approval the drawings, become the Record Drawings.

1.7.3 Special Conditions

For projects where portions of construction are to be occupied or activated before overall project completion, including portions of utility systems, as-built drawings for those portions of the facility being occupied or activated must be supplied at the time the facility is occupied or activated.

In the event the Contractor accomplishes additional work which changes the as-built conditions of the facility, after submission and approval of the final hardcopy and cad drawings, the Contractor must update the drawings.

1.7.4 Final Approved Shop Drawings

Provide final approved project shop drawings 30 calendar days after transfer of the completed facility.

1.7.4.1 Final Approved Specifications

Provide final record construction contract specifications, including

modifications thereto, 30 calendar days after transfer of the completed facility.

1.8 RETAINAGE

The cost of as-built document preparation includes all requirements of this clause:

a. Maintenance of working as-built drawings,

b. Conversion of submittals and other miscellaneous documents into electronic files,

c. Creation of an optical disc containing all required files, and

d. Submittal of as-built documents in the required media forms and numbers of copies.

If the Contractor fails to maintain the Working Electronic Redlines Drawing PDFs and working cad drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount that, in the Contracting Officer's judgment, represents the estimated cost of bringing the as-built documents up to date. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of the working drawings.

b. Retainage for the as-built drawings in the amount of $50,000 or one percent of the present construction value, whichever is the greater, will be withheld from the amounts due to the Contractor when progress under the contract reaches 75 percent completion. This amount will be withheld until the final As-built Drawings are accepted by the Government. If an acceptable as-built drawing submittal is not provided within 45 calendar days from the date the Contractor received the approved working as-built drawings, the Government reserves the right to unilaterally modify the contract to de-obligate the aforementioned amount from the final Contract amount.

No separate payment will be made for providing approved as-built drawings required under this contract. All costs in connection therewith must be considered a subsidiary obligation of the Contractor.

1.9 PROJECT RECORD DOCUMENTS

1.9.1 As-Built Record of Equipment and Materials

Provide one copy of preliminary record of equipment and materials used on the project 15 calendar days prior to final inspection. This preliminary submittal will be reviewed and returned two business days after final inspection with Government comments. Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

1.9.2 Final Approved Shop Drawings

Provide final approved project shop drawings 30 calendar days after transfer of the completed facility.

1.9.3 Real Property Equipment

Provide a list of installed equipment provided under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Provide a draft list at time of transfer. Provide the final list 30 calendar days after transfer of the completed facility.

1.10 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

b. Supply one item of each part for spare parts inventory. Provision of spare parts does not relieve the Contractor of responsibilities listed under the contract guarantee provisions.

1.11 PREVENTATIVE MAINTENANCE

Submit Preventative Maintenance, Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.

a. Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature (e.g., gpm, rpm, psi). Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the

system after acceptance.

1.12 WARRANTY MANAGEMENT

1.12.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the FAR clause 52.246-21 WARRANTY OF CONSTRUCTION. At least 30 calendar days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint four month and nine month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Provide with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

d. A list for each warranted equipment, item, feature of construction or system indicating:

   (1) Name of item.

   (2) Model and serial numbers.

   (3) Location where installed.

   (4) Name and phone numbers of manufacturers or suppliers.

   (5) Names, addresses and telephone numbers of sources of spare parts.

   (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.

(7) Cross-reference to warranty certificates as applicable.

(8) Starting point and duration of warranty period.

(9) Summary of maintenance procedures required to continue the warranty in force.

(10) Cross-reference to specific pertinent Operation and Maintenance manuals.

(11) Organization, names and phone numbers of persons to call for warranty service.

(12) Typical response time and repair time expected for various warranted equipment.

e. The Contractor's plans for attendance at the four and nine month post-construction warranty inspections conducted by the Government.

f. Procedure and status of tagging of all equipment covered by extended warranties.

g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.12.2 Performance Bond

The Contractor's Performance Bond must remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.12.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with

these requirements and at the time of the Contractor's quality control completion inspection, provide the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.12.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within four hours, initiate work within six hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within eight hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within three business days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Life Safety Systems
Fire suppression systems.

Code 1-Electrical
(1) Power Failure (entire area or any building operational after 1600 hours).
(2) Security lights.
(3) Smoke detectors.

Code 3-Electrical
Street lights.

Code 1-Gas
(1) Leaks and breaks.
(2) No gas to family housing unit or cantonment area.

Code 1-Heat
Area power failure affecting heat.

Code 2-Water (Exterior)
No water to facility.

Code 3-All other work not listed above.

1.12.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

TYPE OF PRODUCT/MATERIAL	
Model Number	
Serial Number	
Contract Number	
Warranty Period From/To	
Inspector's Signature	
Construction Contractor	
Address	
Telephone Number	
Warranty Contact	
Address	
Telephone Number	
Warranty Response Time Priority Code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

1.13 OPERATION AND MAINTENANCE MANUALS

Submit six copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

1.13.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are

acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals must have 0.3937-inch holes and be bound in three-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.13.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given seven calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, must be made available to the Contracting Officer.

1.14 CLEANUP

Provide final cleaning in accordance with ASTM E1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean". Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on the project site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

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DIVISION 02 - EXISTING CONDITIONS

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05/10

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SECTION 02 41 00

DEMOLITION
05/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6	(2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 PROJECT DESCRIPTION

1.2.1 Definitions

1.2.1.1 Demolition

Demolition is the process of wrecking or taking out any load-supporting structural member of a facility together with any related handling and disposal operations.

1.2.1.2 Demolition Plan

Demolition Plan is the planned steps and processes for managing demolition activities and identifying the required sequencing activities and disposal mechanisms.

1.2.2 Demolition Plan

Prepare a Demolition Plan and submit proposed demolition, and removal procedures for approval before work is started. Include in the plan coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan in accordance with Section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLINOIS. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.2.3 General Requirements

Do not begin demolition until authorization is received from the

Contracting Officer. The work includes demolition, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements . Provide new supports and reinforcement for existing construction weakened by demolition, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.

1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.3.3 Trees

Protect trees within the project site which might be damaged during demolition, and which are indicated to be left in place, by a six foot high fence. Erect and secure fence a minimum of five feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.4 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition operations.

1.3.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors,

roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Demolition Plan; G, CN

Existing Conditions

SD-07 Certificates

Notification; G, CN

1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities. In addition to the requirements of the "Contract Clauses", conform to the safety requirements contained in ASSP A10.6. Dispose of Clean Construction and Demolition Debris (CCDD) in accordance with section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLINOIS. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.7 PROTECTION

1.7.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic control devices(including but not limited to flaggers and barricades) in accordance with Illinois Department of Transportation (IDOT) standards and permit. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.9 EXISTING CONDITIONS

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized four inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

3.1.1 Structures

Remove existing structures indicated to be removed to base of existing structure, including below-grade sheetpile..

Demolish structures in a systematic manner from the top of the structure to the ground. Complete demolition work above each tier or floor before the supporting members on the lower level are disturbed. Demolish concrete and masonry walls in small sections. Remove structural framing members and lower to ground by means of derricks, platforms hoists, or

other suitable methods as approved by the Contracting Officer.

Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

3.1.3 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching of concrete and masonry shall be as specified and indicated, and shall include completely filling of holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

All materials and equipment removed and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the

Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.4 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations in accordance with Section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLIONIS. Storage of removed materials on the project site is prohibited.

3.5.2 Burning on Government Property

Burning of materials removed from demolished structures will not be permitted on Government property

3.5.3 Removal from Government Property

Transport waste materials removed from demolished structures, except waste soil, from Government property for legal disposal in accrodance with Section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLINOIS. Dispose of waste soil as directed.

-- End of Section --

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SECTION 03 30 53

CAST-IN-PLACE CONCRETE
05/14

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance with ACI 318.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 347R	(2014; Errata 1 2017) Guide to Formwork for Concrete
ACI SP-66	(2004) ACI Detailing Manual

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA PS 1	(2009) Structural Plywood (with Typical APA Trademarks)

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A615/A615M	(2016) Standard Specification for Deformed

	and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C143/C143M	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C1602/C1602M	(2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2018b) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2017) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2017a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685/C685M	(2017) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C881/C881M	(2015) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2018) Standard Specification for Ready-Mixed Concrete
ASTM C1107/C1107M	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
ASTM E1155	(2014) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
ASTM E1155M	(2014) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers (Metric)
ASTM E1643	(2018a) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E1745	(2017) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G, DT

SD-03 Product Data

Air-Entraining Admixture

Water-Reducing or Retarding Admixture

Curing Materials

Expansion Joint Filler Strips, Premolded

Joint Sealants - Field Molded Sealants; G, DT

Waterstops

Chemical Floor Hardener

Batching and Mixing Equipment

Conveying and Placing Concrete

Formwork

Mix Design Data; G, DT

Ready-Mix Concrete

Curing Compound

Mechanical Reinforcing Bar ConnectorsNon-Shrink Grout

SD-06 Test Reports

Aggregates

Concrete Mixture Proportions; G, DT

Measurement of Floor Tolerances

Compressive Strength Testing; G, DT

Slump; G, DT

Air Content

Water

SD-07 Certificates

Cementitious Materials

Pozzolan

CPG

Aggregates

Delivery Tickets

SD-08 Manufacturer's Instructions

Chemical Floor Hardener

Curing Compound

1.4 QUALITY ASSURANCE

Indicate specific locations of Concrete Placement, Forms, Steel Reinforcement, Accessories, Expansion Joints, Construction Joints, Contraction Joints, and Control Joints on installation drawings and include, but not be limited to, square feet of concrete placements, thicknesses and widths, plan dimensions, and arrangement of cast-in-place concrete section.

1.4.1 Flatness and Levelness of Floor Slabs

Conduct floor flatness and levelness test, (FF and FL respectively), on floor slabs in accordance with the provisions set forth in ASTM E1155M or ASTM E1155. Make floor tolerance measurements by the approved laboratory and inspection service within 24 hours after completion of final troweling operation and before forms and shores have been removed. Provide results of floor tolerance tests, including formal notice of acceptance or rejection of the work, to the Contracting Officer within 24 hours after data collection.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The Government retains the option to sample and test waterstop, aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples for strength tests not less than once each batch (minimum) or once each 20 cubic yards (maximum). Provide a minimum of five specimens from each sample; two to be tested at 28 calendar days (90 calendar days if pozzolan is used) for acceptance, two will be tested at seven calendar days for information and one held in reserve.

2.1.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 calendar days (90 calendar days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'c, but not more than 20 percent, and no individual acceptance test result falls below f'c by more than 500 psi.

2.1.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "A" finish. Surface requirements for the classes of finish required are as specified in ACI 117.

2.1.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength f'c is 4000 psi at 28 calendar days (90 calendar days if pozzolan is used). The maximum nominal size coarse aggregate is 3/4 inch, in accordance with ACI 304R. The air content must be between 4.5 and 7.5 percent with a slump between two inches and five inches. The maximum water-cementitious material ratio is 0.45. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten business days prior to placement of concrete.

2.2 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.2.1.1 Portland Cement

ASTM C150/C150M, Type I or II

2.2.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class F, including requirements of Tables 1A and 2A.

2.2.2 Aggregates

Both fine and coarse aggregates shall meet the quality and grading requirements of ASTM C33/C33M Class Designations 4M or better.

2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than six months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.2.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D. High-range water reducing admixture Type F may be used only when approved, approval being contingent upon particular placement requirements as described in the Contractor's Quality Control Plan.

2.2.4 Water

Mixing and curing water in compliance with the requirements of ASTM C1602/C1602M; potable, and free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.Improve workability by adjusting the grading rather than by adding water

2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of ASTM A1064/A1064M. Detail reinforcement not indicated in accordance with ACI 301 and ACI SP-66. Provide mechanical reinforcing bar connectors in accordance with ACI 301 and provide 125 percent minimum yield strength of the reinforcement bar.

2.2.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded of sponge rubber conforming to ASTM D1752, Type I.

2.2.7 Joint Sealants - Field Molded Sealants

Conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as

recommended by the sealant manufacturer or directed.

2.2.8 Formwork

Design and engineer the formwork as well as its construction in accordance with ACI 301 Section 2 and 5 and ACI 347R. Fabricate of wood, steel, or other approved material. Submit formwork design prior to the first concrete placement.

2.2.8.1 Forms for Class A Finish

A Class A finish is required where indicated on the drawings. The form facing material shall be composed of new, well-matched tongue-and-groove lumber or new plywood panels conforming to APA PS 1, Grade B-B concrete form, Class I.

2.2.8.2 Forms for Class C Finish

This class of finish shall apply to all surfaces except those specified to receive a Class A finish. The form facing material shall be composed of tongue-and-groove or shiplap lumber, plywood conforming to APA PS 1, Grade B-B concrete form, tempered concrete form hard board or steel. Steel lining on wood sheathing will not be permitted.

2.2.9 Form Coatings

Provide form coating in accordance with ACI 301.

2.2.10 Vapor Retarder

ASTM E1745 Class C polyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.2.11 Curing Materials

Provide curing materials in accordance with ACI 301, Section 5.

2.2.12 Waterstops

Submit manufacturer's data sheet on waterstop materials and splices

2.2.13 Non-Shrink Grout

Non-shrink grout in accordance with ASTM C1107/C1107M

2.2.14 Epoxy Adhesive Anchoring System

The Epoxy Adhesive Anchoring System shall meet the requirements of ASTM C881/C881M except for linear shrinkage. The system shall be an injectable two-component epoxy adhesive. The two components shall be kept separate by means of a dual-cylinder foil pack attached to a manifold.

2.3 READY-MIX CONCRETE

Ready-Mix Concrete: Provide ready-mix concrete with mix design data

conforming to ACI 301 Part 2. Submit delivery tickets in accordance with ASTM C94/C94M for each ready-mix concrete delivery, include the following additional information:

a. Type and brand cement,

b. Cement content in 94-pound bags per cubic yard of concrete,

c. Maximum size of aggregate,

d. Amount and brand name of admixture, and

e. Total water content expressed by water cementitious material ratio.

Tremie Concrete Mix Design: The Tremie Concrete mix design shall be the same as the normal-weight concrete mix design except the slump requirements are different.

Slump Limit Tremie Concrete: Tremie Concrete shall have a minumum slump of six inches after adding a water-reducing admixture with retarder.

2.4 ACCESSORIES

2.4.1 Waterstops

Waterstops shall be installed as directed by the manufacturer. Waterstops shall be carefully and correctly positioned during installation to eliminate faulty installation that may result in joint leakage. All waterstops shall be installed so as to form a continuous watertight diaphragm in each joint. Adequate provision shall be made to support and protect the waterstops during the progress of work. Any waterstop punctured or damaged shall be replaced or repaired at the Contractor's expense. The concrete shall be thoroughly consolidated in the vicinity of the waterstop. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Waterstops shall not be spliced.

2.4.1.1 PVC Waterstop

Polyvinylchloride waterstops conforming to COE CRD-C 572.

2.4.1.2 Rubber Waterstop

Rubber waterstops conforming to COE CRD-C 513.

2.4.1.3 Thermoplastic Elastomeric Rubber Waterstop

Thermoplastic elastomeric rubber waterstops conforming to ASTM D471.

2.4.1.4 Hydrophilic Waterstop

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water conforming to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Minimum hardness of 50 on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees Fahrenheit (F), three to one minimum.

2.4.2 Chemical Floor Hardener

Provide hardener which is a colorless aqueous solution containing a blend of inorganic silicate or siliconate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufactures instructions for placement of liquid chemical floor hardener.

2.4.3 Curing Compound

Provide curing compound conforming to ASTM C309. Submit manufactures instructions for placing curing compound.

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface must be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Satisfactorily compact earth foundations. Make spare vibrators available. Placement cannot begin until the entire preparation has been accepted by the Government.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than two inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Prepare embedded items so they are be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Provide all equipment needed to place, consolidate, protect, and cure the concrete at the placement site and in good operating condition.

3.1.1.1 Installatin of Epoxy Grout Anchors and Dowels

Before drilling for anchors, the Contractor shall locate all embedded items, such as energized electrical systems, manholes, gate anchorages, seal plates, and other components not to be disturbed in the lock walls and shall avoid damage to such items. Damage to such items shall be corrected as approved by the Contracting Officer by and at the Contractor's responsibility and expense.

Installation procedures shall be as recommended by the epoxy manufacturer and as specified herein. Inject adhesive into holes proceeding from bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets into the adhesive. Follow manufacturer's recommendations to ensure proper mixing of the adhesive components. Sufficient adhesive shall be injected to ensure the annular gap is filled to the surface. Manufacturer's recommended installation temperature shall be observed at all times.

The holes shall be drilled to a minimum of the depth as shown. It is critical that the holes be thoroughly cleaned prior to the insertion of

epoxy. The holes shall be scrubbed with a stiff bristle brush that is larger than the hole to remove all dust, dirt, debris or other bond-inhibiting materials from the drilling procedure. The holes shall be blown clean with oil-free compressed air and brushed and blown clean again, repeating as necessary until the holes are clean and sound. The diameter of the hole shall be in accordance with the recommendations of the epoxy manufacturer. If any holes are diamond bit drilled, ensure epoxy manufacturer allows use of epoxy grout in these holes. The Contractor will be required to drill thru any reinforcement interfering with the anchor locations at no cost to the Government.

3.1.2 Formwork Installation

Forms must be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints, exterior corners and edges 0.75 inches, unless otherwise indicated.

3.1.3 Waterstop Installation

Waterstop installation shall conform to the following:

a. Provide waterstops in construction joints as indicated

b. Install formwork to accommodate waterstop materials. Locate waterstops in joints where indicated in Contract Documents.

c. Install waterstops to form a continuous diaphragm in each joint. Make adequate provisions to support and protect waterstops during progress of work. Protect waterstops protruding from joints from damage.

3.1.4 Vapor Retarder Installation

Install in accordance with ASTM E1643. Apply vapor retarder over gravel fill. Lap edges not less than six inches. Seal all joints with pressure-sensitive adhesive not less than two inches wide. Protect the vapor barrier at all times to prevent injury or displacement prior to and during concrete placement.

3.1.5 Production of Concrete

3.1.5.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

3.1.5.2 Concrete Made by Volumetric Batching and Continuous Mixing

Conform to ASTM C685/C685M.

3.1.5.3 Batching and Mixing Equipment

The option of using an on-site batching and mixing facility is available. The facility must provide sufficient batching and mixing equipment capacity to prevent cold joints. Submit the method of measuring materials, batching operation, and mixer for review, and manufacturer's data for batching and mixing equipment demonstrating compliance with the applicable specifications. Provide an Onsite Plant conforming to the requirements of either ASTM C94/C94M or ASTM C685/C685M.

3.1.6 Waterstops

Install waterstops as directed by the manufacturer.

3.2 CONVEYING AND PLACING CONCRETE

Convey and place concrete in accordance with ACI 301, Section 5.

3.2.1 Cold-Weather Requirements

Place concrete in cold weather in accordance with ACI 306R.

3.2.2 Hot-Weather Requirements

Place concrete in hot weather in accordance with ACI 305R.

3.3 CONSTRUCTION JOINTS

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.3.1 Maximum Allowable Construction Joint Spacing

In walls at not more than 60 feet in any horizontal direction.

In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet.

3.3.2 Construction Joints for Constructability Purposes

Construction joints shall conform to the following:

a. Walls. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.

b. Columns or Piers. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.

c. Midpoint of Spans for Supported Slabs, Beams, and Girders. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.4 FINISHING

3.4.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.4.2 Finishing Formed Surfaces

Remove all fins and loose materials , and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Ream or chip surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete and fill with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. Use a blend of portland cement and white cement in mortar or concrete for repairs to all surfaces permanently exposed to view shall be so that the final color when cured is the same as adjacent concrete.

3.4.3 Filling Holes From Reinforcement

Any reinforcement exposed by the partial demolition of existing structures is to be drilled out to a depth of three inches and the holes filled with nonshrink grout.

3.4.4 Finishing Unformed Surfaces

Finish unformed surfaces in accordance with ACI 301, Section 5.

All unformed surfaces that are not to be covered by additional concrete or backfill shall be float finished to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 3/8 inch for a float finish as determined by a 10 foot straightedge placed on surfaces shown on the plans to be level or having a constant slope. Finishing shall not be performed while there is excess moisture or bleeding water on the surface. No water or cement shall be added to the surface during finishing.

3.4.4.1 Float Finish

Surfaces to be float finished shall be screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete will support a person's weight without deep imprint, floating should be completed. Floating should embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.4.4.2 Broom Finish

A broom finish shall be applied to all horizontal surfaces subject to foot traffic, including the tops of I walls and headwalls. The concrete shall

be screeded and floated to required finish plane with no coarse aggregate visible. After surface moisture disappears, the surface shall be broomed or brushed with a broom or fiber bristle brush in a direction transverse to that of the main traffic or as directed.

3.4.4.3 Measurement of Floor Tolerances

Test floor slabs within 24 hours of the final troweling. Submit test results to Contracting Officer within 12 hours after collecting data. Floor flatness inspector must provide a tolerance report which includes:

a. Name of Project,

b. Name of Contractor,

c. Date of Data Collection,

d. Date of Tolerance Report,

e. A Key Plan Showing Location of Data Collected, and

f. Results Required by ASTM E1155M and ASTM E1155.

3.4.4.4 Standard Smooth Finish

Provide for surfaces around pipe openings a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

3.5 CURING AND PROTECTION

Cure and protect in accordance with ACI 301, Section 5.

3.6 FORM WORK

Provide form work in accordance with ACI 301, Section 2 and Section 5.

3.6.1 Removal of Forms

Remove forms in accordance with ACI 301, Section 2.

3.7 STEEL REINFORCING

Reinforcement must be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.7.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI 318 and ACI SP-66. Provide shop details and bending in accordance with ACI 318 and ACI SP-66.

3.7.2 Splicing

Perform splices in accordance with ACI 318 and ACI SP-66.

3.7.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.8 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.9 CHEMICAL FLOOR HARDENER

Apply Chemical Floor Hardener where indicated, after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. First coat is one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow it to dry 24 hours before applying next coat. Apply proprietary chemical hardeners in accordance with manufacturer's printed directions.

3.10 TESTING AND INSPECTING

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within three days after the end of each weekly reporting period. See Section 01 45 00.10 20 QUALITY CONTROL FOR MINOR CONSTRUCTION.

3.10.1 Field Testing Technicians

The individuals who sample and test concrete must have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.10.2 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement to certify that it is ready to receive concrete.

3.10.3 Sampling and Testing

Obtain samples and test concrete for quality control during placement. Sample fresh concrete for testing in accordance with ASTM C172/C172M. Make six test cylinders.

Test concrete for compressive strength at seven calendar and 28 calendar days for each design mix and for every 100 cubic yards of concrete. Test two cylinders at seven calendar days; two cylinders at 28 calendar days; and hold two cylinders in reserve. Conform test specimens to ASTM C31/C31M. Perform compressive strength testing conforming to ASTM C39/C39M.

Test slump at the site of discharge for each design mix in accordance with ASTM C143/C143M. A minimum of two slump tests shall be made on randomly selected batches of each mixture of concrete during each day's concrete placement or at the direction of Contracting Officer. Additional tests may be required if the results of the specified slump tests do not meet the requirements of this specification. Samples shall be obtained in accordance with ASTM C172/C172M.

Test air content for air-entrained concrete in accordance with

ASTM C231/C231M. Test concrete using lightweight or extremely porous aggregates in accordance with ASTM C173/C173M. Check air content at least once during each shift that concrete is placed and for each 100 cubic yards of concrete produced..

Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M. Check concrete temperature at least once during each shift that concrete is placed and for each 100 cubic yards of concrete produced.

3.10.4 Action Required

3.10.4.1 Placing

Do not begin placement until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Discontinue placing if any lift is inadequately consolidated.

3.10.4.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.10.4.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. Make the adjustments so that the water-cementitious material ratio does not exceed that specified in the submitted concrete mixture proportion and the required concrete strength is still met.

-- End of Section --

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SECTION 05 50 15

CIVIL WORKS FABRICATIONS
08/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(2017) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A240/A240M	(2018) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A572/A572M	(2018) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A653/A653M	(2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2018) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A992/A992M	(2011; R 2015) Standard Specification for Structural Steel Shapes
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F883	(2013) Padlocks
ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F3125/F3125M	(2015a) 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

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(2017) Metal Bar Grating Manual
NAAMM MBG 532	(2009) Heavy Duty Metal Bar Grating Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20	(2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)
SSPC Paint 29	(2002; E 2004) Zinc Dust Sacrificial Primer, Performance-Based

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Trash Rack Design Deliverables; G, DT

SD-02 Shop Drawings

Gratings; G, DT

Ladders; G, DT

Handrails; G, DT

Shop Fabricated Metal Items; G, DT

Trash Rack; G, DT

SD-03 Product Data

Expansion Anchors; G, DT

Gratings

Stairs

Ladders

Shop Fabricated Metal Items; G, DT

SD-04 Samples

Shop Fabricated Metal Items; G, DT

SD-06 Test Reports

Rotational Capacity; G, DT

SD-07 Certificates

Welder Certifications

1.3 QUALITY ASSURANCE

Form miscellaneous metalwork to shape and size, with sharp lines and angles and true curves. Drill and punch producing clean true lines and surfaces. Provide exposed surfaces of work in place with a smooth finish, and unless otherwise approved. Where tight fits are required, mill

joints. Cope or miter corner joints, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

Perform welding continuously along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place. Grind exposed welds smooth.

Qualify welders, perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work. Submit welder certifications for each welder stating the type of welding and position qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than five degrees Fahrenheit (F) above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

PART 2 PRODUCTS

2.1 MISCELLANEOUS METALS AND STANDARD METAL ARTICLES

Conform to the respective specifications and other designated requirements for miscellaneous metal materials and standard metal articles. Size as specified or indicated. Where material requirements are not specified, furnish materials suitable for the intended use and subject to approval. All civil works fabrications should aesthetically match those of the surrounding structures.

2.1.1 Structural Steel

All steel plates must conform to requirements detailed in ASTM A572/A572M Grade 50. Other structural steel will conform to ASTM A992/A992M unless otherwise specified.

2.1.2 Steel Tubing

2.1.2.1 Anchor Bolts

Provide in accordance with ASTM F1554. Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

2.1.2.2 Expansion Anchors

Contractor must provide appropriate diameter expansion anchors with apprpraite embedment depth. Design values listed are as tested in accordance with ASTM E488/E488M.

2.1.2.3 Structural

ASTM A500/A500M, Grade B, and nominal wall thickness as shown.

2.1.3 Steel Pipes and Pipe Fittings

2.1.3.1 Pipes

ASTM A53/A53M, Type E or S, Grade B, nominal size and weight class or outside diameter and nominal wall thickness as shown.

2.1.3.2 Pipe Fittings

Flanged - ASME B16.5, Class 150, faced and drilled

Screwed - ASME B16.3, As per manufacturer's reccomendations or as specified in the plans. Screwed fittings include elbow joints, T-joints, and other miscellaneous joints as specified.

Butt-welding - ASME B16.9

2.1.4 Stainless Steel

2.1.4.1 Plate, Sheet, and Strip

ASTM A240/A240M, UNS S30400. Plate finish must be hot-rolled and annealed or heat treated, and blast cleaned or pickled. Provide No. 1 sheet and strip finish.

2.1.4.2 Bars and Shapes

Conform to the following, as specified or shown, for stainless steel bars and shapes: ASTM A240/A240M, Type 304.

2.1.5 Bolts, Nuts, and Washers

Provide bolts, nuts, and washers of the material, grade, type, class, style and finish indicated or best suited for intended use.

Provide in accordance with ASTM F1554. Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

2.1.5.1 High-Strength Bolts, Nuts, and Washers

ASTM F3125/F3125M hot-dip galvanized

Conduct Rotational-capacity testing for all fastener assemblies in accordance with ASTM F3125/F3125M. Test as an assembly each combination of bolt production lot, nut lot, and washer lot. Assign a rotational-capacity lot number to each combination of lots tested. Test bolts in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device. Submit test report for rotational capacity.

2.1.6 Steel Rails

Steel handrails, including inserts in concrete, provide steel pipe conforming to ASTM A53/A53M. Provide steel railings with two inch nominal size. Hot-dip galvanize railings. Provide pipe collars of hot-dip galvanized steel. Railings and pipe collars must be mill finish. Provide all fasteners of Series 300 stainless steel.

2.1.7 Gratings

Design steel grating and grating covers in accordance with NAAMM MBG 531 and NAAMM MBG 532 for bar type gratings, or in accordance with manufacturer's charts for metal grating. Galvanize steel floor gratings.

Grating covers must be designed to same criteria and grating. Grating cover design shall include a hinge. Grating covers shall be locked with padlock. Padlocks must conform to ASTM F883, with chain if needed.

2.1.8 Anchor Bolts

Provide in accordance with ASTM F1554. Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

2.1.9 Submittals Requirements

This also applies to SHOP FABRICATED METAL ITEMS. Submit the following:

a. Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Include in the drawings catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates.

b. Lists of materials, and records which identify the disposition of approved material and fabricated items in the work.

2.2 SHOP FABRICATED METAL ITEMS

Conform shop fabricated metal items to the requirements and details as specified or shown and to the workmanship provisions and other applicable fabrication requirements.

2.2.1 Railings

Provide railings as type specified and show, furnish, and install complete with all fittings, brackets, fasteners, sleeves, anchors, and other appurtenances as shown and as required for proper installation. Design handrails to resist a minimum concentrated load of 200 lbf in any direction at any point of the top of the rail or 50 lb/ft applied in any direction at the top of the rail, whichever is more severe.

2.2.1.1 Materials

Steel guard handrails, including inserts in concrete, provide structural tubing conforming to ASTM A500/A500M, Grade B. Provide steel guard railings with two inch nominal size. Hot-dip galvanize after fabrication.

2.2.1.2 Fabrication

Rigid joints in railings must be of welded, threaded, or slip-on fittings assembly and be flush-finished. Reinforce welded joints with tight-fitting interior sleeves assembled by welding rails and posts to flush-type fittings, or by mitering and welding joining rails and posts. Exposed threads are not permitted on assembled threaded joints. Use tight fitting slip-on fittings. Provide self-locking, concealed type fasteners for slip-on fittings. Provide aluminum or stainless steel fasteners for aluminum fittings. Provide stainless steel fasteners for steel fittings.

Locate expansion joints in rails near the intersection of rails and posts. Ground welds smooth. Provide railings free of burrs, sharp corners, and sharp edges.

2.2.2 Gratings and Cover Plates

Provide grating and cover plates of the material and size shown, and fabricated in sectional panels of the width and length shown, or as appropriate, to accurately fit within the supporting recess frames. Provide openings through panels as shown or as required. Provide hinged panels with hinges of the type shown or suitable for the application. Galvanize steel gratings and cover plates after fabrication.

2.2.2.1 Grating

Gratings and grating covers are as specified in previous paragraph GRATINGS. Band edges of gratings and openings through gratings which require the cutting of more than one bearing bar. Provide fasteners of the type recommended by the manufacturer and approved.

a. Design floor gratings and grating covers to support a stress live load of 250 pounds per square foot for the spans indicated, with maximum deflection of L/240.

   (1) Grating design and drawings shall be signed by Certified Structural Engineer.

   (2) Drawings shall include and not be limited to dimension (length x wdith, bearing bars and cross bars, bearing angle, bearing bar angle, cross bar spacing, and bolted connection detail.

   (3) Grating suface shall be smooth.

b. In accordance with NAAMM MBG 531, NAAMM MBG 532, band edges of grating with bars of the same size as the bearing bars. Weld banding in accordance with the manufacturer's standard for trim unless otherwise indicated. Design tops of bearing bars, cross or intermediate bars to be in the same plane and to match grating finish.

c. NAAMM MBG 531, NAAMM MBG 532, band ends of gratings with bars of the same or greater thickness than the metal used for grating. Weld banding bars to bearing bars or channels at least every fourth bar or channel and in every corner. Tack weld intervening bars or channels. Band diagonal or round cuts by welding bars of the same or greater thickness as the grating and in accordance with the manufacturer's standard for trim unless otherwise indicated.

d. Anchor gratings to structural members with bolts, toggle bolts, or expansion shields and bolts. Attach grating in accordance with manufacturer's roof attachment system.

2.2.3 Steel Stairs

Provide steel stairs complete with structural or formed channel stringers,utilizing steel plate treads and risers, metal pan cement-filled treads, grating treads, or slip-resistant metallic treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Close exposed ends of stringers . Conform to ASTM A36/A36M for structural steel. Stairs and accessories must be galvanized. Form

risers on stairs with metal pan treads to form a sanitary cove to retain the tread concrete. Integral nosings must have braces extended into the concrete fill. Fabricate stair treads of steel gratings of the type specified in paragraph GRATING. Provide grating treads with slip-resistant nosings. Provide bolts, nuts and other fastenings as shown and as required for proper installation. Use lock washers under all nuts. Anchor railings of the type specified above in paragraph RAILINGS to stairs as shown.

Design stairs to sustain a live load of not less than 250 pounds per square foot, or a concentrated load of 125 lbs applied over and area of two inches by two inches where it is most critical. Conform to AISC 360 with the design and fabrication of steel stairs, other than a commercial product.

2.2.4 Recess Frames

Fabricate recess frames of structural shapes of the type shown. Grind welded joints in frames smooth. Galvanize steel frames after fabrication. Anchor frames to supports in the manner shown and not be continuous across contraction or expansion joints.

2.2.5 Ladders

Provide fixed-rail metal ladders conforming to the requirements of EM 385-1-1 and to details shown. Fabricate ladders of structural steel as shown and be galvanized after fabrication. Fabricate ladders of solid-section rod rungs fitted into holes in bar side rails and weld. Make splices in side rails using full penetration welds and provide a flush and smooth transition between connecting ends. Grind all welds smooth. Weld ladder rails to bent-bar supporting brackets anchored to supporting structure as shown.

2.2.6 Ladder Rungs

Fabricate ladder rungs from steel rods in accordance with the details and be galvanized after fabrication.

2.2.7 Trash Rack

Trash rack must be designed for the load scenario described below and per manufacturer's recommendations. The trash rack must comprised of four independent detachable sections with bolted connection supports. Bolted anchor connections can be located at the slab below the trash rack and the curtain wall. The trashrack must be vertical, not sloped. The bars of the trash rack must have a cross section of 2 inches by 0.5 inches as shown on the plans. The clear spacing between bars must be 2 inches as shown on the plans. The trash rack assembly is to be constructed using stainless steel conforming to ASTM A276/A276M.

The trash rack shall be designed to withstand the loads assuming a 100 percent blockage scenario. This will subject the trash rack to hydrostatic loads of 10 feet of water. The bars, welds, and connections must be provided in sufficient details and include design calculations signed by a licensed structural engineer. The track rack shop drawings, connection designs, and other trash rack design deliverables must submitted for approval prior to fabrication.

2.2.8 Surface Finishes

2.2.8.1 Galvanizing and Zinc Repair

Hot-dip galvanize items specified to be galvanized, when practicable and not indicated otherwise, after fabrication. Galvanize in accordance with ASTM A123/A123M, ASTM A653/A653M, or ASTM A924/A924M, as applicable. Regalvanize areas where zinc coatings are destroyed by cutting, welding or other causes. Regalvanize coatings two ounces or heavier with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Repair coatings less than two ounces in accordance with ASTM A780/A780M.

2.2.8.2 Galvanized

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings must be compatible materials, generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports provide strength and stiffness. Form joints exposed to the weather to exclude water. Items listed below require additional procedures.

3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.3 FINISHES

3.3.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to SSPC Paint 20 or SSPC Paint 29 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

3.3.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

3.4 ATTACHMENT OF HANDRAILS

Set railing posts anchored to concrete surfaces perpendicular to the posts and drill a 1/4 inch drain hole near the bottom of each post. Railing posts anchored to concrete surfaces parallel to the posts must have the sides of posts continuously welded to base plates anchored to concrete with expansion anchors. Railing posts anchored to structural metal must be welded to base plates. Rigidly secure ends of rails anchored to concrete or masonry to flange fittings anchored to concrete or masonry with expansion anchors. Install toeboards and brackets where indicated. Splice, where required, at expansion joints. Install removable sections as indicated.

3.5 COVER PLATES, GRATING AND FRAMES

Install the tops of cover plates, grating, and frames flush with floor.

3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 1/2 inch diameter expansion anchors. Install intermediate clip angles not over 48 inches on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. In no case rest ends of ladders rest upon floor.

3.7 STEEL STAIRS

Provide anchor bolts, grating fasteners, washers, and all parts or devices necessary for proper installation. Provide lock washers under nuts.

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BASIC ELECTRICAL MATERIALS AND METHODS
07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections. This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 12 19.10 THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS

Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 12.8 kV primary, three phase, three wire, 60 Hz, and 480 volts secondary, three phase, four wire. Final connections to the power distribution system at the existing distribution point shall be made by the Contractor as directed by the Contracting Officer.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers

regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than three years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one inch by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of seven inches by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal two inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPSO710D72 or approved equal.

b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 inches by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal three inch high white letters on a red and black field.

1.12 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.13 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (eight hours per day) of instruction furnished shall be as specified in the individual section.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

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COMMON WORK RESULTS FOR ELECTRICAL
08/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	((2014; Errata 2016) Electric Meters - Code for Electricity Metering

ASTM INTERNATIONAL (ASTM)

ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL CODE COUNCIL (ICC)

ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.7	(2014) Requirements for Watthour Meter Sockets
ANSI C80.1	(2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2015) American National Standard for Electrical Metallic Tubing (EMT)
ANSI Z535.1	(2017) Safety Colors

ANSI/NEMA OS 1	(2013) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 3	(2013) Molded Case Circuit Breakers and Their Application
NEMA FB 1	(2014) Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
NEMA FU 1	(2012) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA PB 1	(2011) Panelboards
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2016) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA WD 1	(1999; R 2015) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2016) Wiring Devices Dimensions Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 70E	(2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Aug 2017) UL Standard for

	Safety Flexible Metal Conduit
UL 5	(2016) UL Standard for Safety Surface Metal Raceways and Fittings
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Mar 2019) UL Standard for Safety Panelboards
UL 83	(2017) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 198M	(2018) UL Standard for Mine-Duty Fuses
UL 360	(2013; Reprint Nov 2018) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 486A-486B	(2018) UL Standard for Safety Wire Connectors
UL 486C	(2018) UL Standard for Safety Splicing Wire Connectors
UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2017; Reprint Dec 2018) UL Standard for Safety Attachment Plugs and Receptacles
UL 514A	(2013; Reprint Aug 2017) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint Nov 2014) Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Nov 2018) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(2011; Reprint Nov 2018) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 797	(2007; Reprint Mar 2017) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 869A	(2006) Reference Standard for Service Equipment

UL 943	(2016; Reprint Feb 2018) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 1242	(2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1449	(2014; Reprint Jul 2017) UL Standard for Safety Surge Protective Devices
UL 4248-1	(2017) UL Standard for Safety Fuseholders - Part 1: General Requirements
UL 4248-12	(2018) UL Standard for Safety Fuseholders - Part 12: Class R

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Marking Strips; G, RO

SD-03 Product Data

Conduits and Raceways; G, RO

Wire and Cable; G, RO

Splices and Connectors; G, RO

Switches; G, RO

Receptacles; G, RO

Outlet Boxes, Pull Boxes and Junction Boxes; G, RO

Circuit Breakers; G, RO

Panelboards; G, RO

Device Plates; G, RO

SD-06 Test Reports

Continuity Test; G, RO

Phase-Rotation Tests; G, RO

Insulation Resistance Test; G, RO

600-Volt Wiring Test; G, RO

Transformer Tests; G, RO

Ground-Fault Receptacle Test; G, RO

SD-08 Manufacturer's Instructions

Manufacturer's Instructions

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Ensure equipment, materials, installation, and workmanship are in accordance with the mandatory and advisory provisions of NFPA 70, IEEE C2 unless more stringent requirements are specified or indicated.

1.4.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Provide products which have been in satisfactory commercial or industrial use for two years prior to bid opening. Ensure the two-year period includes applications of equipment and materials under similar circumstances and of similar size. Ensure the product has been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer.

PART 2 PRODUCTS

2.1 EQUIPMENT

Provide the standard cataloged materials and equipment of manufacturers regularly engaged in the manufacture of the products. For material, equipment, and fixture lists submittals, show manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

Provide factory-applied finish on electrical equipment in accordance with the following:

a. Testing: NEMA 250 corrosion-resistance test and the additional requirements as specified herein.

b. Interior and Exterior Steel Surfaces of Equipment Enclosures: Thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.

c. Exterior Surfaces: Free from holes, seams, dents, weld marks, loose scale or other imperfections.

d. Interior Surfaces: Receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.

e. Exterior Surfaces: Primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.

f. Equipment Located Indoors: ANSI Light Gray, and equipment located outdoors: ANSI Light Gray.

g. Manufacturer's Coatings: Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.1.1 Conduits and Raceways

2.1.1.1 Rigid Steel Conduit

Provide hot dipped galvanized rigid steel conduit complying with NEMA RN 1, ANSI C80.1, UL 6 and UL 5 as applicable. Except where installed underground, or in corrosive areas, provide polyvinylchloride (PVC), or protect from corrosion by painting with bitumastic coating or wrapping with corrosion inhibiting tape..

Use threaded fittings for rigid steel conduit.

Use solid gaskets. Ensure conduit fittings with blank covers have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Provide covers with captive screws and are accessible after the work has been completed.

2.1.1.2 Electrical Metallic Tubing (EMT)

Ensure EMT is in accordance with UL 797, UL 5, and ANSI C80.3 and is zinc coated steel. Provide zinc-coated couplings and connectors that are raintight, gland compression type with insulated throat. Crimp, spring, or setscrew type fittings are not acceptable.

2.1.1.3 Flexible Metallic Conduit

Ensure flexible metallic conduit is galvanized steel and complies with UL 1 and UL 360.

Ensure fittings for flexible metallic conduit are specifically designed for such conduit.

Provide liquidtight flexible metallic conduit with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

Ensure fittings for liquidtight flexible metallic conduit are specifically designed for such conduit.

2.1.1.4 Intermediate Metal Conduit

Ensure intermediate metal conduit is galvanized steel and complies with UL 1242, NEMA RN 1, ANSI C80.1, UL 6, and UL 5 as applicable.

2.1.1.5 Rigid Nonmetallic Conduit

Ensure rigid nonmetallic conduit complies with NEMA TC 2, NEMA TC 3, and UL 651 as applicable with a wall thickness not less than Schedule 40.

2.1.1.6 Surface Metal Raceway

Ensure surface metal raceways and multi-outlet assemblies conform to NFPA 70, and have receptacles conforming to NEMA WD 1, Type 5-20R.

2.1.2 Outlet Boxes, Pull Boxes and Junction Boxes

Ensure outlet boxes for use with conduit systems are in accordance with NEMA FB 1 UL 514A, UL 514B, UL 514C, and ANSI/NEMA OS 1 and are not less than 1-1/2 inches deep. Furnish all pull and junction boxes with screw-fastened covers.

2.1.3 Panelboards

Provide panelboards in accordance with NEMA PB 1, UL 67, and UL 50. Ensure panelboards for use as service equipment are also in accordance with UL 869A. Ensure panelboards have current rating, number of phases, and number of wires as indicated or specified herein. Ensure panelboards are rated for 120/208-volt, three-phase, 60-hertz. Ensure each panelboard, as a complete unit, has a short-circuit current rating equal to or greater than the integrated equipment rating indicated, but in no case less than 10,000 amperes symmetrical.

Provide panelboards with bolt-on circuit breakers only. Use of plug-in style breaker is not permitted. Ensure panelboards are designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining required clearance. Provide main lugs or main circuit breakers mounted "above" branch breakers with current ratings as indicated. Use of sub-feed breakers is not acceptable unless specifically indicated otherwise. Where "space only" is indicated, make provisions for future installation of breakers.

Submit detail drawings and manufacturer's standard product data for panelboards. Detail drawings consist of fabrication and assembly drawings for all parts of the work in sufficient detail to verify conformity with all requirements. Ensure drawings for panelboards indicate details of bus layout, overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Provide copper buses of the rating indicated, with main lugs or main circuit breaker. Provide all panelboards for use on grounded ac systems with a separate grounding bus in accordance with UL 67 bonded to the panelboard enclosure. In addition to equipment grounding bus, provide second "isolated" ground bus, where indicated. Provide three-phase, four-wire and single-phase, three-wire panelboards with an isolated

full-capacity bus providing spaces for single-pole circuit breaker switches and spaces indicated as spare.

Provide bus bar connections to the branch circuit breakers that are the "distributed phase" or "phase sequence" type. Ensure single-phase, three-wire panelboard busing is such that when any two adjacent single-pole breakers are connected to opposite phases, two-pole breakers can be installed in any location. Ensure that three-phase, four-wire panelboard busing is such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two- or three-pole breakers can be installed at any location. Ensure current-carrying parts of the bus assembly are plated.

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping.

2.1.3.1 Circuit Breakers

Provide circuit breakers that conform to UL 489 and NEMA AB 3 with frame a trip ratings as indicated.

Provide bolt-on type, molded-case, manually operated, trip-free circuit breakers, with inverse-time thermal-overload protection and instantaneous magnetic short-circuit protection. Completely enclose circuit breakers in a molded case, with a factory-sealed, calibrated sensing element to prevent tampering. Plug-in type, tandem, and half-size circuit breakers are not permitted.

Provide inverse-time-delay thermal-overload protection and instantaneous magnetic short-circuit protection. Provide an instantaneous thermal-magnetic tripping element that is adjustable and accessible from the front of the breaker on frame sizes larger than 250 ampere. Provide circuit breakers with frame sizes 250 ampere and larger with solid-state trip units equipped with adjustable long-time, short-time andground-fault settings in addition to instantaneous.

Provide sufficient interrupting capacity of the panel and lighting branch circuit breakers to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Provide circuit breaker interrupting capacities with a minimum of 10,000 A and that conform to NEMA AB 3. Series rating of circuit breakers or overcurrent protective devices to achieve indicated interrupt rating is not permitted.

Provide the common-trip-type multipole circuit breakers having a single operating handle and a two-position on/off indication. Provide circuit breakers with temperature compensation for operation in an ambient temperature of 40 degrees Centigrade (C). Provide circuit breakers that have root mean square (rms) symmetrical interrupting ratings sufficient to protect the circuit being supplied. Interrupting ratings may have selective-type tripping (time delay, magnetic, thermal, or ground fault).

Provide a phenolic-composition breaker body capable of having such accessories as handle-extension, handle-locking, and padlocking devices attached where required to meet lock-out/tag-out requirements of NFPA 70E.

2.2 MATERIALS

2.2.1 Wire And Cable

Provide wires and cables in accordance applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 12 months prior to date of delivery to site.

Provide minimum conductor size in accordance with the following:

a. Branch Circuits: No. 12 AWG.

b. Class 1 Remote-control and Signal Circuits: No. 14 AWG.

c. Class 2 Low-energy, Remote-control and Signal Circuits: No. 16 AWG.

d. Class 3 Low-energy, Remote-control, Alarm and Signal Circuits: No. 22 AWG.

Ensure connectors used in wire systems comply with UL 486A-486B and UL 486C as applicable.

Ensure conductors installed in plenums are marked plenum rated.

2.2.1.1 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type XHHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits: Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree C conductors, provide only conductors with 90-degree C insulation or better.

2.2.2 Device Plates

Device plates shall conform to the following:

a. UL Listed: One-piece device plates for outlets to suit the devices installed.

b. Metal Outlet Boxes, Plates on Unfinished Walls: Zinc-coated sheet steel or cast metal having round or beveled edges.

c. Nonmetallic Boxes and Fittings: Other suitable plates may be provided.

d. Screws: Machine-type with countersunk heads in color to match finish of plate.

e. Sectional type device plates are not be permitted.

f. Plates Installed in Wet Locations: Gasketed and UL listed for "wet locations".

2.2.3 Switches

2.2.3.1 Safety Switches

Ensure safety switches comply with NEMA KS 1, and are the heavy-duty type

with enclosure, voltage, current rating, number of poles, and fusing as indicated on the drawings. Ensure fused switch fuse holders comply with UL 4248-1. Ensure switch construction is such that, when the switch handle in the "ON" position, the cover or door cannot be opened. Cover release device is coinproof and so constructed that an external tool is used to open the cover. Make provisions to lock the handle in the "OFF" position. Ensure the switch is not capable of being locked in the "ON" position.

Provide switches of the quick-make, quick-break type and terminal lugs for use with copper conductors.

Ensure safety color coding for identification of safety switches conforms to ANSI Z535.1.

2.2.4 Fuses

NEMA FU 1. Provide complete set of fuses for each fusible switch. Coordinate time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices for proper operation. Submit coordination data for approval. Provide fuses with a voltage rating not less than circuit voltage.

2.2.4.1 Fuseholders

Provide in accordance with UL 4248-1.

2.2.4.2 Cartridge, Current Limiting Type (Class R)

UL 198M, Class RK-1. Provide only Class R associated fuseholders in accordance with UL 4248-12.

2.2.4.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 198M, Class J for zero to 600 amperes, Class L for 601 amperes to 6,000 amperes, and Class CC for zero amperes to 30 amperes.

2.2.4.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 198M, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.2.5 Receptacles

Provide the following:

a. UL 498, hard use (also designated heavy-duty), grounding-type.

b. Ratings and Configurations: As indicated.

c. Bodies: Galvanized as per NEMA WD 1.

d. Face and Body: Thermoplastic supported on a metal mounting strap.

e. Dimensional Requirements: Per NEMA WD 6.

f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.

g. Grounding pole connected to mounting strap.

h. The Receptacle: containing triple-wipe power contacts and double or triple-wipe ground contacts.

2.2.5.1 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations". Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, polycarbonate, UV resistant/stabilized cover plate.

2.2.5.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.2.6 Manufacturer's Nameplate

Ensure each item of equipment has a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable.

2.2.7 Warning Signs

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

Enclosure integrity to conform with IEEE C57.12.28, such as for pad-mounted transformers. Provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Provide decal signs with nominal dimensions of seven inches by 10 inches. Print the legend "DANGER HIGH VOLTAGE" in two lines of nominal two inch high letters. Show the word "DANGER" in white letters on a red background and the words "HIGH VOLTAGE" in black letters on a white background.

2.2.8 Firestopping Materials

Provide firestopping around electrical penetrations.

2.2.9 Metering

ANSI C12.1. Provide a self-contained, socket-mounted, electronic programmable outdoor watthour meter. Meter: either programmed at the factory or programmed in the field. Turn field programming device over to the Contracting Officer at completion of project. Coordinate meter to system requirements.

a. Design: Provide watthour meter designed for use on a three-phase, four-wire, 480/277 volt system.

b. Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.

c. Kilowatt-hour Register: five digit electronic programmable type.

d. Demand Register:

(1) Provide solid state.

(2) Meter reading multiplier: Indicate multiplier on the meter face.

e. Socket: ANSI C12.7. Provide NEMA Type 3R, box-mounted socket, ringless, having jaws compatible with requirements of the meter. Provide manufacturers standard enclosure color unless otherwise indicated.

2.2.10 Surge Protective Devices

Provide parallel type surge protective devices (SPD) which comply with UL 1449 at the service entrance and MCCs . Provide surge protectors in a NEMA 3R enclosure per NEMA ICS 6. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS -
Phase to Phase (L-L)
Each Phase to Neutral (L-N)
Neutral to Ground (N-G)
Phase to Ground (L-G)

SPDs at Service Entrance: Provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G) and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs. Maximum L-N, L-G, and N-G Voltage Protection Rating:

700V for 208Y/120V, Three Phase System
1,200V for 480Y/277V, Three Phase System

Maximum L-L Voltage Protection Rating:

1,200V for 208Y/120V, Three Phase System
2,000V for 480Y/277V, Three Phase System

The minimum MCOV (Maximum Continuous Operating Voltage) rating for L-N and L-G modes of operation: 120 percent of nominal voltage for 240 volts and below; 115 percent of nominal voltage above 240 volts to 480 volts.

PART 3 EXECUTION

3.1 PREPARATION

Submit manufacturer's instructions including special provisions required to install equipment components and system packages. Special provisions include impedances, hazards and safety precautions.

Clean and paint conduit, supports, fittings, cabinets, pull boxes, and racks.

Protect metallic materials against corrosion. Provide equipment enclosures with the standard finish by the manufacturer when used for most indoor installations. For harsh indoor environments (any area subjected to chemical and abrasive action), and all outdoor installations. Do not use aluminum when in contact with earth or concrete and, where connected to dissimilar metal, protect by using approved fittings and treatment. Except where other equivalent protective treatment is specifically approved in writing, provide hot-dip galvanized ferrous metals for items such as, anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous items not made of corrosion-resistant steel.

3.2 INSTALLATION

3.2.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

3.2.2 Overhead Service

Overhead service conductors into buildings: terminate at service entrance fittings or weatherhead outside building.

3.2.3 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.2.4 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted by NFPA 70.

3.2.5 Wiring Methods

Provide insulated conductors installed in rigid steel conduit except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of six inches. Firestop conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors.

3.2.5.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at

each end of pull wire.

3.2.6 Conduits, Raceways and Fittings

Ensure that conduit runs between outlet and outlet, between fitting and fitting, or between outlet and fitting does not contain more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting.

Do not install crushed or deformed conduit. Avoid trapped conduit runs where possible. Take care to prevent the lodgment of foreign material in the conduit, boxes, fittings, and equipment during the course of construction. Clear any clogged conduit of obstructions or replace conduit.

Conduit and raceway runs concealed in or behind walls, above ceilings, or exposed on walls and ceilings five feet or more above finished floors and not subject to mechanical damage may be electrical metallic tubing (EMT).

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum six inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.2.6.1 Rigid Steel Conduit

Make field-made bends and offsets with approved Hickey bending tool or conduit bending machine. Use long radius conduit for elbows larger than 2-1/2 inches.

Provide a flush coupling for all conduit stubbed-up through concrete floors for connections to free-standing equipment with the exception of motor-control centers, cubicles, and other such items of equipment, when the floor slab is of sufficient thickness. Otherwise, provide a floor box set flush with the finished floor. For conduits installed for future use, terminate with a coupling and plug; set flush with the floor.

3.2.6.2 Rigid Nonmetallic Conduit

Install a green insulated copper grounding conductor in conduit with conductors and solidly connect to ground at each end. Size grounding wires in accordance with NFPA 70.

3.2.6.3 Underground Conduit

Plastic-coated rigid steel, plastic-coated steel IMC, PVC, Type EPC-40, or fiberglass. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before rising through floor slab. Plastic coating: extend minimum six inches above floor.

3.2.6.4 Conduit for Circuits Rated Greater Than 600 Volts

Rigid metal conduit or IMC only.

3.2.6.5 Conduit Installed Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of

bends to be visible above finished slab.

3.2.6.6 Conduit Installed in Concrete Floor Slabs

Rigid steel; steel IMC; fiberglass, or PVC, Type EPC-40. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits more than two diameters high with minimum vertical separation of seven inches. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends must not be visible above finish slab. Increase slab thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings must allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size: installed parallel with or at right angles to main reinforcement; when at right angles to reinforcement, install conduit close to one of supports of slab. Where nonmetallic conduit is used, convert raceway to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

3.2.6.7 Stub Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used six inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.2.6.8 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.2.6.9 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.2.7 Wiring

Color code feeder and branch circuit conductors as follows:

CONDUCTOR	COLOR AC
Phase A	Black (208VAC); Brown (480VAC)
Phase B	Red (208VAC); Orange (480VAC)
Phase C	Blue (208VAC); Yellow (480VAC)
Neutral	White (208VAC); Natural Gray (480VAC)
Equipment Grounds	Green

Use conductors up to and including No. 2 AWG that are manufactured with colored insulating materials. For conductors larger than No. 2 AWG, have ends identified with color plastic tape in outlet, pull, or junction boxes.

Splice in accordance with the NFPA 70. Provide conductor identification within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Match terminal and conductor identification as indicated.

Where several feeders pass through a common pullbox, tag the feeders to clearly indicate the electrical characteristics, circuit number, and panel designation.

3.2.8 Wiring Devices

3.2.8.1 Device Plates

Ensure device plates for switches are suitably engraved with a description of the loads when not within sight of the loads controlled.

Mark device plates and receptacle cover plates for receptacles other than 125-volt, single-phase, duplex, convenience outlets. Show the circuit number, voltage, frequency, phasing, and amperage available at the receptacle. Use self-adhesive labels having 1/4 inch embossed letters.

Similarly mark device plates for convenience outlets indicating the supply panel and circuit number.

3.2.9 Splices and Connectors

Make all splices in No. 8 AWG and smaller with approved insulated electrical type.

Make all splices in No. 6 AWG and larger with insulated electrical lugs type. Wrap joints with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor.

3.2.10 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with manufacturer's recommendations.

3.2.10.1 Marking Strips

Provide marking strips in accordance with the following:

a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.

b. Use permanent ink for the wire numbers

c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.

d. Size marking strips to accommodate the two sets of wire numbers.

e. Assign a device designation in accordance with NEMA ICS 1 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.

f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.

g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.2.11 Safety Switches

Securely fasten switches to the supporting structure or wall, utilizing a minimum of four 1/4 inch bolts. Do not use sheet metal screws and small machine screws for mounting. Do not mount switches in an inaccessible location or where the passageway to the switch may become obstructed. Mounting height five feet above floor level, when possible.

3.2.12 Boxes and Fittings

Provide pullboxes where necessary in the conduit system to facilitate conductor installation. For conduit runs longer than 100 feet or with more than three right-angle bends, install a pullbox at a convenient

intermediate location.

Securely mount boxes and enclosures to the building structure using supports that are independent of the conduit entering or leaving the boxes.

Select the mounting height of wall-mounted outlet and switch boxes, as measured between the bottom of the box and the finished floor, in accordance with ICC/ANSI A117.1 and as follows, unless otherwise indicated:

LOCATION	MOUNTING HEIGHT (inches)
Receptacles in offices	18
Receptacles in corridors	18
Receptacles in shops and laboratories	48
Receptacles in rest rooms	48
Switches for light control	48

3.2.13 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.2.14 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings.

3.2.15 Panelboards

Securely mount panelboards so that the top operating handle does not exceed 72-inches above the finished floor. Do not mount equipment within 36-inches of the front of the panel. Ensure directory card information is complete and legible.

3.2.16 Dry-Type Distribution Transformers

Connect dry-type transformers with flexible metallic conduit.

3.2.17 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is three feet.

3.2.18 Field Fabricated Nameplates

Ensure nameplates conform to ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device, as specified or as indicated on the drawings. Each nameplate inscription

identifies the function and, when applicable, the position. Provide nameplates that are melamine plastic, 0.125-inch thick, white with black center core and a matte finish surface with square corners. Accurately align lettering and engrave into the core. Minimum size of nameplates is one inch by 2.5 inches. Lettering is a minimum of 0.25-inch high normal block style.

3.2.19 Identification Plates and Warnings

Provide identification plates for lighting and power panelboards, motor control centers, all line voltage heating and ventilating control panels, fire detector and sprinkler alarms, door bells, pilot lights, disconnect switches, manual starting switches, and magnetic starters. Attach identification plates to process control devices and pilot lights.

Install identification plates for all line voltage enclosed circuit breakers, identifying the equipment served, voltage, phase(s) and power source. For circuits 480 volts and above, install conspicuously located warning signs in accordance with OSHA requirements.

3.3 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.5 FIELD APPLIED MOUNTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.6 FIELD QUALITY CONTROL

After completion of the installation and splicing, and prior to energizing the conductors, perform wire and cable continuity and insulation tests as herein specified before the conductors are energized.

Provide all necessary test equipment, labor, and personnel to perform the tests, as herein specified.

Isolate completely all wire and cable from all extraneous electrical connections at cable terminations and joints. Use substation and switchboard feeder breakers, disconnects in combination motor starters, circuit breakers in panel boards, and other disconnecting devices to isolate the circuits under test.

Perform insulation-resistance test on each field-installed conductor with respect to ground and adjacent conductors. Applied potential is 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable.

Take readings after 1 minute and until the reading is constant for 15 seconds. Minimum insulation-resistance values is not less than 25 Megohms for 300 volt rated cable and 100 Megohms for 600 volt rated cable. For circuits with conductor sizes No. 8 AWG and smaller insulation resistance testing is not required.

Perform continuity test to insure correct cable connection end-to-end (i.e., correct phase conductor, grounded conductor, and grounding conductor wiring). Repair and verify any damages to existing or new electrical equipment resulting from mis-wiring. Receive approval for all repairs prior to commencement of the repair.

Conduct phase-rotation tests on all three-phase circuits using a phase-rotation indicating instrument. Perform phase rotation of electrical connections to connected equipment in a clockwise direction, facing the source.

Perform 600-volt wiring test on wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance: 250,000 ohms.

Perform the standard, not optional, transformer tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

Perform ground-fault receptacle test for ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

Submit test reports in accordance with referenced standards in this section.

Final acceptance requires the successful performance of wire and cable under test. Do not energize any conductor until the final test reports are reviewed and approved.

-- End of Section --

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INSULATED WIRE AND CABLE
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1202	(2006; R 2012; CORR 1 2012) Flame-Propagation Testing of Wire and Cable

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-58-679	(2014) Control, Instrumentation and Thermocouple Extension Conductor Identification
ICEA T-30-520	(1986) Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input Rate of 70,000 B.T.U./Hour

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 71/ICEA S-96-659	(2014) Standard for Nonshielded Cables Rated 2001-5000 Volts for use in the Distribution of Electric Energy
NEMA WC 26	(2008) Binational Wire and Cable Packaging Standard
NEMA WC 57	(2014) Standard for Control, Thermocouple Extension, and Instrumentation Cables
NEMA WC 70	(2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658
NEMA WC 74/ICEA S-93-639	(2012) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 1685	(2015) UL Standard for Safety Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
UL 2556	(2015) UL Standard for Safety Wire and Cable Test Methods

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wire and Cable; G, RO

Conductors; G, RO

Cable Manufacturing Data

SD-06 Test Reports

Test Report(s), Inspection Report(s), and Verification Report(s); G, RO

1.3 DELIVERY, STORAGE, AND HANDLING

Furnish cables on reels or coils. Each cable and the outside of each reel or coil, must be plainly marked or tagged to indicate the cable length, voltage rating, conductor size, and manufacturer's lot number and reel number. Each coil or reel of cable must contain only one continuous cable without splices. Cables for exclusively dc applications, as specified in paragraph "High-Voltage Test Source", must be identified as such. Shielded cables rated 2,001 volts and above must be reeled and marked in accordance with NEMA WC 26, as applicable. Reels must remain the property of the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Wire Table

Furnish wire and cable in accordance with the requirements of the wire table below , conforming to the detailed requirements specified herein.

2.1.2 Rated Circuit Voltages

All power wire and cable must have minimum rated circuit voltages in accordance with NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable. Power wire and cable for circuit voltages rated zero volts to 600 volts must be rated not less than 600 volts. Control wire and cable must have minimum rated circuit voltages in accordance with NEMA WC 57, but must be rated 600 volts if routed in raceway with other conductors that are rated 600 volts.

2.1.3 Conductors

2.1.3.1 Material for Conductors

Conductors must conform to all the applicable requirements of NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable. Copper conductors must be annealed copper material and they may be bare, or tin-alloy-coated or lead-alloy-coated, if required by the type of insulation used.

2.1.3.2 Size

Minimum wire size must be No. 12 AWG for power and lighting circuits; No. 10 AWG for current transformer secondary circuits; No. 14 AWG for potential transformer, relaying, and control circuits; No. 16 AWG for annunciator circuits; and No. 19 AWG for alarm circuits. Minimum wire sizes for rated circuit voltages of 2,001 volts and above must not be less than those listed for the applicable voltage in ANSI/NEMA WC 71/ICEA S-96-659 or NEMA WC 74/ICEA S-93-639, as applicable.

2.1.3.3 Stranding

Conductor stranding classes cited herein must be as defined for control conductors in NEMA WC 57 or as defined for zero volts to 2,000 volts power conductors in NEMA WC 70, as applicable. Lighting conductors No. 10 AWG and smaller must be solid or have Class B stranding. Any conductors used between stationary and moving devices, such as hinged doors or panels, must have Class H or K stranding. All other conductors must have Class B or C stranding, except that conductors as shown, or in the schedule, as No. 12 AWG may be 19 strands of No. 25 AWG, and conductors shown as No. 10 AWG may be 19 strands of No. 22 AWG. Conductor stranding classes for circuit voltages 2,001 volts and above must be as defined in ANSI/NEMA WC 71/ICEA S-96-659 and NEMA WC 74/ICEA S-93-639, as applicable.

2.1.3.4 Conductor Shielding

Use conductor shielding conforming to NEMA WC 57 for control wire and cable as applicable. Use conductor shielding conforming to ANSI/NEMA WC 71/ICEA S-96-659 or NEMA WC 74/ICEA S-93-639, as applicable, on power cables having a rated circuit voltage above 2,000 volts.

2.1.3.5 Separator Tape

Where conductor shielding, strand filling, or other special conductor treatment is not required, a separator tape between conductor and insulation is permitted.

2.1.4 Insulation

2.1.4.1 Insulation Material

Unless specified otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type XHHW conforming to UL 44. Insulation for control wire and cable must meet the requirements of NEMA WC 57. Insulation requirements for wire and cable rated less than 2,000 volts must meet the requirements of NEMA WC 70. Insulation requirements for wire and cable rated 2,001 volts to 5,000 volts must meet the requirements of ANSI/NEMA WC 71/ICEA S-96-659. Insulation requirements for wire and cable rated 5,001 volts and greater must meet the requirements of NEMA WC 74/ICEA S-93-639.

For shielded cables of rated circuit voltages above 2,000 volts, the following provisions must also apply:

a. XLPE, if used, must be tree-retardant.

b. Insulation must be chemically bonded to conductor shielding.

c. The insulation material and its manufacturing, handling, extrusion and vulcanizing processes must all be subject to strict procedures to prevent the inclusion of voids, contamination, or other irregularities on or in the insulation. Insulation material must be inspected for voids and contaminants.

d. Cables with repaired insulation defects discovered during factory testing, or with splices or insulation joints, are prohibited.

2.1.4.2 Insulation Thickness

The insulation thickness for each conductor must be based on its rated circuit voltage.

2.1.4.2.1 Power Cables, 2,000 Volts and Below

The insulation thickness for single-conductor and multiple-conductor power cables rated 2,000 volts and below must be as required by NEMA WC 70, as applicable. Some thicknesses of NEMA WC 70 will be permitted only for single-conductor cross-linked thermosetting polyethylene insulated cables without a jacket. NEMA WC 70 ethylene-propylene rubber-insulated conductors must have a jacket.

2.1.4.2.2 Power Cables, Rated 2,001 Volts and Above

Thickness of insulation for power cables rated 2,001 volts and above must be in accordance with the following

a. Non-shielded cables, 2,001 volts to 5,000 volts, must comply with ANSI/NEMA WC 71/ICEA S-96-659, as applicable.

b. Shielded cables rated 5,000 volts to 46,000 volts must comply with NEMA WC 74/ICEA S-93-639, as applicable.

2.1.4.2.3 Single-Conductor and Multiple-Conductor Control Cables

The insulation thickness of control conductor sizes 22 AWG to 10 AWG used for control and related purposes must be as required by NEMA WC 57, as

applicable. Control conductors larger than 10 AWG must be as required by NEMA WC 70.

2.1.4.3 Insulation Shielding

Unless otherwise specified, provide insulation shielding for conductors having rated circuit voltages of 2,001 volts and above. The voltage limits above which insulation shielding is required, and the material requirements, are given in ANSI/NEMA WC 71/ICEA S-96-659 or NEMA WC 74/ICEA S-93-639, as applicable. The material, if thermosetting, must meet the wafer boil test requirements as described in ANSI/NEMA WC 71/ICEA S-96-659 or NEMA WC 74/ICEA S-93-639, as applicable. The method of shielding must be in accordance with the current practice of the industry; however, the application process must include strict precautions to prevent voids or contamination between the insulation and the nonmetallic component. Voids, protrusions, and indentations of the shield must not exceed the maximum allowances specified in ANSI/NEMA WC 71/ICEA S-96-659 or NEMA WC 74/ICEA S-93-639, as applicable. The cable must be capable of operating without damage or excessive temperature when the shield is grounded at both ends of each conductor. All components of the shielding system must remain tightly applied to the components they enclose after handling and installation in accordance with the manufacturer's recommendations. Shielding systems which require heat to remove are prohibited unless specifically approved.

2.1.5 Jackets

All cables must have jackets meeting the requirements of NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, and NEMA WC 74/ICEA S-93-639, as applicable, and as specified herein. Individual conductors of multiple-conductor cables must be required to have jackets only if they are necessary for the conductor to meet other specifications herein. Jackets of single-conductor cables and of individual conductors of multiple-conductor cables, except for shielded cables, must be in direct contact and adhere or be vulcanized to the conductor insulation. Multiple-conductor cables and shielded single-conductor cables must be provided with a common overall jacket, which must be tightly and concentrically formed around the core. Repaired jacket defects found and corrected during manufacturing are permitted if the cable, including jacket, afterward fully meets these specifications and the requirements of the applicable standards.

2.1.5.1 Jacket Material

The jacket must be one of the materials listed below. Variations from the materials required below will be permitted only if approved for each specific use, upon submittal of sufficient data to prove that they exceed all specified requirements for the particular application.

2.1.5.1.1 General Use

Heavy-duty black neoprene	NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639
Heavy-duty chlorosulfonated polyethylene	NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639
Heavy-duty cross-linked (thermoset) chlorinated polyethylene	NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639

2.1.5.1.2 Accessible Use Only, 2,000 Volts or Less

Cables installed where they are entirely accessible, such as cable trays and raceways with removable covers, or where they pass through less than 10 feet of exposed conduit only, must have jackets of one of the materials in item "a. General Use" or one of the following:

General-purpose neoprene	NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639
Black polyethylene (MDPE)	NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639
Thermoplastic chlorinated polyethylene	NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639

2.1.5.2 Jacket Thickness

The minimum thickness of the jackets must be not less than 80 percent of the respective nominal thicknesses specified below.

2.1.5.2.1 Multiple-Conductor Cables

Thickness of the jackets of the individual conductors of multiple-conductor cables must be as required by NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable and must be in addition to the conductor insulation thickness required by the applicable respective NEMA publication for the insulation used. Thickness of the outer jackets and associated coverings of the assembled multiple-conductor cables must be as required by NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable.

2.1.5.2.2 Single-Conductor Cables

Single-conductor cables must have a jacket thickness as specified in NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable.

2.1.6 Multiple-Conductor Cables

Grounding conductor(s) conforming to NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable must be furnished for each multiple-conductor cable. Assembly and cabling must be as specified in paragraph CABLING.

2.2 CABLE IDENTIFICATION

2.2.1 Color-Coding

Insulation of individual conductors of multiple-conductor cables must be color-coded in accordance with ICEA S-58-679, except that colored braids will not be permitted. Only one color-code method must be used for each cable construction type. Control cable color-coding must be as indicated . Other individual conductors must be color-coded as indicated, but such color-coding may be accomplished by applying colored plastic tapes or colored sleeves at terminations.

2.2.2 Shielded Cables Rated 2,001 Volts and Above

Marking must be in accordance with ANSI/NEMA WC 71/ICEA S-96-659 or NEMA WC 74/ICEA S-93-639, as applicable.

2.2.3 Cabling

Individual conductors of multiple-conductor cables must be assembled with flame-and moisture-resistant fillers, binders, and a lay conforming to NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639. Flat twin cables are prohibited. Fillers must be used in the interstices of multiple-conductor round cables with a common covering where necessary to give the completed cable a substantially circular cross section. Fillers must be non-hygroscopic material, compatible with the cable insulation, jacket, and other components of the cable. The rubber-filled or other approved type of binding tape must consist of a material that is compatible with the other components of the cable and must be lapped at least 10 percent of its width.

2.2.4 Dimensional Tolerance

The outside diameters of single-conductor cables and of multiple-conductor cables must not vary more than five percent and 10 percent, respectively, from the manufacturer's published catalog data.

PART 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

Submit cable manufacturing data . The following information must be provided by the cable manufacturer for each size, conductor quantity, and type of cable furnished:

a. Minimum bending radius, in inches - For multiple-conductor cables, this information must be provided for both the individual conductors and the multiple-conductor cable.

b. Pulling tension and sidewall pressure limits, in pounds.

c. Instructions for stripping semiconducting insulation shields, if furnished, with minimum effort without damaging the insulation.

d. Upon request, compatibility of cable materials and construction with specific materials and hardware manufactured by others must be stated. Also, if requested, recommendations must be provided for various cable operations, including installing, splicing, terminating, etc.

3.2 TEST REPORT(S), INSPECTION REPORT(S), AND VERIFICATION REPORT(S)

3.2.1 Cable Data

Do not begin any wire and cable fabrication until materials are submitted and approved by the Contracting Officer. Submit cable data for approval including, but not limited to, dimensioned sketches showing cable construction and sufficient additional data to show that wire and cable meet the requirements of this Section.

3.2.2 Inspection and Tests

Inspection and tests of wire and cable furnished under these specifications must be made by and at the plant of the manufacturer, and the manufacturer must provide certification and certification reports of completed inspections and completed tests. The Government may require or perform further tests before or after installation. Testing in general must comply with NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable. Specific tests required for particular materials, components, and completed cables must be as specified in the sections of the above standards applicable to those materials, components, and cable types. Tests must also be performed in accordance with the additional requirements specified below. Submit two certified copies of test reports.

3.2.2.1 High-Voltage Test Source

Where the applicable standards allow a choice, high-voltage tests for cables to be used exclusively on dc circuits must be made with dc test voltages. Cables to be used exclusively on ac circuits must be tested with ac test voltages. If both ac and dc will be present, on either the same or separate conductors of the cable, ac test voltages must be used.

3.2.2.2 Shielded Cables Rated 2,001 Volts or Greater

The following test(s) must be performed in addition to those specified above:

a. If high-voltage testing is done with an AC test voltage as specified in paragraph "High-Voltage Test Source", an additional test must be made using a DC test voltage rated at 75 percent of the specified full DC test voltage, for five consecutive minutes.

b. If voltage tests after installation are required for 5-65kV shielded power cables then testing must be done in accordance with NEMA WC 74/ICEA S-93-639, Appendix F.

3.2.2.3 Flame Tests

All multiple-conductor and single-conductor cable assemblies must pass either the vertical cable tray flame tests required by ICEA T-30-520 (stated in, but not required by NEMA WC 70), the vertical tray flame propagation test requirements of UL 1685 and IEEE 1202, the wire and cable burning characteristics test of the UL 2556 VW-1 Test, or (for control cables only) the flame test as required by NEMA WC 57. If such tests, however, have previously been made on identical cables, these tests need not be repeated. Instead, certified reports of the original qualifying tests must be submitted. In this case the reports furnished under paragraph "Reports", must include information, identify critical information, and verify that all of each cable's materials, construction, and dimensions are the same as those in the qualifying tests.

3.2.2.4 Independent Tests

The Government may make visual inspections, continuity or resistance checks, insulation resistance readings, power factor tests, or dc high potential tests at field test values. A cable's failure to pass these tests and inspections, or failure to produce readings consistent with acceptable values for the application, will be grounds for rejection of the cable.

-- End of Section --

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SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

10/07

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-- End of Section Table of Contents --

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SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
10/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2017) Steel Construction Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2013; with Change 4, 2018) Structural Engineering

UNDERWRITERS LABORATORIES (UL)

UL 1598 (2008; Reprint Oct 2012) Luminaires

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below.

1.2.2 Electrical Equipment

Electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Control Panels	Motor Control Centers
Pumps with Motors	Transformers
Light Fixtures	

1.2.3 Electrical Systems

The following electrical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification: Power distribution equipment, controls equipment, pump/motor equipment

1.2.4 Contractor Designed Bracing

Submit copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered

Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace. Design the bracing in accordance with UFC 3-301-01 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. UFC 3-301-01 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using UFC 3-301-01 are based on strength design; therefore, AISC 325 shall be used for the design. Develop the bracing for the following electrical equipment and systems: Power distribution equipment, controls equipment, pump/motor equipment.

1.3 EQUIPMENT REQUIREMENTS

Submit detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail, indicating thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction. Submit copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

1.3.1 Rigidly Mounted Equipment

The following specific items of equipment listed below to be furnished under this contract shall be constructed and assembled to withstand the seismic forces specified in UFC 3-301-01. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.

a. Control Panels,

b. Light Fixtures,

c. Transformers,

d. Motor Control Centers, and

e. Free Standing Electric Motors.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting Fixtures

Equipment Requirements

SD-03 Product Data

Lighting Fixtures; G, RO

Equipment Requirements; G, RO

Contractor Designed Bracing; G, RO

PART 2 PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

Lighting fixtures and supports shall conform to UL 1598.

PART 3 EXECUTION (NOT USED)

-- End of Section --

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THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS

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THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS
05/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	((2014; Errata 2016) Electric Meters - Code for Electricity Metering

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	(2018) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM D92	(2012a) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D97	(2017b) Standard Test Method for Pour Point of Petroleum Products
ASTM D117	(2018) Standard Guide for Sampling, Test Methods, and Specifications for Electrical Insulating Liquids
ASTM D877/D877M	(2013) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System
ASTM D3487	(2016; E2017) Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(2016) Separable Insulated Connector

	Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C37.47	(2011) Standard for High Voltage Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches
IEEE C57.12.00	(2015) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.34	(2015) Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 10 MVA and Smaller; High Voltage, 34.5 kV Nominal System Voltage and Below; Low Voltage, 15 kV Nominal System Voltage and Below
IEEE C57.12.80	(2010) Standard Terminology for Power and Distribution Transformers
IEEE C57.12.90	(2015; Corr 2017) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.13	(2016) Requirements for Instrument Transformers
IEEE C57.98	(2011) Guide for Transformer Impulse Tests
IEEE C62.11	(2012) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.7	(2014) Requirements for Watthour Meter Sockets
NEMA 260	(1996; R 2004) Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas

NEMA Z535.4	(2011; R 2017) Product Safety Signs and Labels
NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203	(1992) Fish Acute Toxicity Test

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075	(1998) Fate, Transport and Transformation Test Guidelines - OPPTS 835.3100- "Aerobic Aquatic Biodegradation"
EPA 821-R-02-012	(2002) Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment

UNDERWRITERS LABORATORIES (UL)

UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pad-mounted Transformer Drawings; G, RO

SD-03 Product Data

Pad-mounted Transformers; G, RO

SD-06 Test Reports

Acceptance Checks and Tests; G, RO

SD-07 Certificates

Transformer Efficiencies; G, RO

SD-09 Manufacturer's Field Reports

Transformer Test Schedule; G, RO

Pad-mounted Transformer Design Tests; G, RO

Pad-mounted Transformer Routine and Other Tests; G, RO

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5; G, RO

1.3.1 Reduced Submittal Requirements

Submit the following items:

a. A certification, signed by the manufacturer, stating that the manufacturer will meet the technical requirements of this specification.

b. An outline drawing of the transformer with devices identified (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item a).

c. ANSI nameplate data of the transformer (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item b).

d. Manufacturer's published time-current curves in PDF format and in electronic format suitable for import or updating into the SKM PowerTools for Windows computer program of the transformer high side fuses (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item e).

e. Provide transformer test schedule and routine and other tests required by submittal item "SD-09 Manufacturer's Field Reports".

f. Provide acceptance test reports required by submittal item "SD-06 Test Reports".

g. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

1.4 QUALITY ASSURANCE

1.4.1 Pad-Mounted Transformer Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. IEEE nameplate data.

c. Elementary diagrams and wiring diagrams with terminals identified of watthour meter and current transformers.

d. One-line diagram, including switch(es), current transformers, meters, and fuses.

e. Manufacturer's published time-current curves in PDF format and in electronic format suitable for import or updating into the SKM PowerTools for Windows computer program of the transformer high side fuses.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, except of NFPA 70 when more stringent requirements are specified or indicated, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for two years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 MAINTENANCE

1.5.1 Additions to Operation and Maintenance Data

Submit operation and maintenance data as specified herein. In addition to requirements of Data Package 5, include the following on the actual

transformer(s) provided:

a. An instruction manual with pertinent items and information highlighted;

b. An outline drawing, front, top, and side views;

c. Prices for spare parts and supply list;

d. Routine and field acceptance test reports;

e. Fuse curves for primary fuses;

f. Information on watthour demand meter, CT's, and fuse block;

g. Actual nameplate diagram; and

h. Date of purchase.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

IEEE C57.12.34, IEEE C57.12.28 and as specified herein. Submit manufacturer's information for each component, device, insulating fluid, and accessory provided with the transformer.

2.2.1 Compartments

Provide high- and low-voltage compartments separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage, Dead-Front

High-voltage compartment contains: the incoming line, insulated high-voltage load-break connectors, bushing well inserts, six high-voltage bushing wells configured for loop feed application, load-break switch handle(s), dead-front surge arresters, tap changer handle, connector parking stands with insulated standoff bushings, protective caps, and ground pad.

Minimum high-voltage compartment dimensions: IEEE C57.12.34, Figures 16 and 17.

a. Insulated High-Voltage Load-Break Connectors: IEEE 386, rated 15 kV, 95 kV BIL. Current Rating: 200 amperes rms continuous. Short Time Rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector must have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.

b. Bushing Well Inserts: IEEE 386, 200 amperes, 15 kV Class. Provide a

bushing well insert for each bushing well unless indicated otherwise.

c. Load-Break Switch: Radial-feed two-position oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

d. Bayonet: Provide bayonet oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. The bayonet fuse links sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. Include an oil retention valve inside the bayonet assembly housing, which closes when the fuse holder is removed, and an external drip shield to minimize oil spills. Display a warning label adjacent to the bayonet fuse(s) cautioning against removing or inserting fuses unless the transformer has been de-energized and the tank pressure has been released.

Bayonet Fuse Assembly: 150 kV BIL.

Oil-Immersed Current-Limiting Fuses: IEEE C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified. Connect current-limiting fuses ahead of the radial-feed load-break switch.

e. Surge Arresters: IEEE C62.11, rated 15 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap. Provide three arresters for radial feed circuits.

f. Parking Stands: Provide a parking stand near each bushing. Provide insulated standoff bushings for parking of energized high-voltage connectors on parking stands.

g. Protective Caps: IEEE 386, 200 amperes, 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushings.

2.2.1.2 Low Voltage

Low-voltage compartment contains: low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.

a. Include the following accessories: drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.

b. Metering: NEMA/ANSI C12.10. Provide a socket-mounted electronic programmable outdoor watthour meter, mounted on a freestanding slotted channel mounting bracket, directly adjacent to the utility transformer. Coordinate further metering and service requirements with electrical utility..

(1) Design: Provide meter designed for use on a 3-phase, 4-wire, 480Y/277 volt system with 3 current transformers.

(2) Coordination: Provide meter coordinated with ratios of current transformers and transformer secondary voltage.

(3) Class: 20; Form: 9S; Accuracy: plus or minus 1.0 percent; Finish: Class II

(4) Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.

(5) Kilowatt-hour Register: five digit electronic programmable type

(6) Demand Register:

(a) Provide solid state

(b) Meter reading multiplier: Indicate multiplier on the meter face.

(c) Demand interval length: programmed for 60 minutes with rolling demand up to six subintervals per interval.

(7) Meter Fusing: Provide a fuse block mounted in the secondary compartment containing one fuse per phase to protect the voltage input to the watthour meter. Size fuses as recommended by the meter manufacturer.

(8) Socket: ANSI C12.7. Provide NEMA Type 3R, box-mounted socket having automatic circuit-closing bypass and having jaws compatible with requirements of the meter. Cover unused hub openings with blank hub plates. Paint box Munsell 7GY3.29/1.5 green to match the pad-mounted transformer to which the box-mounted socket is attached. The Munsell color notation is specified in ASTM D1535.

(9) Current Transformers: IEEE C57.13. Provide butyl-molded window type current transformers with 600-volt insulation, 10 kV BIL and mount on the low-voltage bushings. Route current transformer leads in a location as remote as possible from the power transformer secondary cables to permit current measurements to be taken with hook-on-ammeters. Provide three current transformers per power transformer with characteristics listed in the following table.

kVA	Sec. Volt	CT Ratio	RF	Meter Acc. Class
750	480Y/277	800/5	2.0	0.3 thru B-0.5

2.2.2 Transformer

Transformers shall conform to the following requirements:

a. Less-Flammable: liquid-insulated or oil-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.

b. Transformer Rating: 750 kVA.

c. Transformer Voltage Ratings: 12.8k V Delta - 480 V GrdY.

d. Tap Changer: externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Indicate which tap setting is in use, clearly visible when the compartment is opened.

e. Minimum tested percent impedance at 85 degrees C:

(1) 2.50 for units rated 75kVA and below,

(2) 2.87 for units rated 112.5kVA to 300kVA,

(3) 4.03 for 500kVA rated units, and

(4) 5.32 for units rated 750kVA and above.

f. Comply with the following audible sound level limits:

kVA	DECIBELS (MAX
75	51
112.5	55
150	55
225	55
300	55
500	56
750	57
1000	58
1500	60
2000	61
2500	62

g. Include:

(1) Lifting lugs and provisions for jacking under base, with base construction suitable for using rollers or skidding in any direction.

(2) An insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

(3) Provide transformer top with an access handhole.

(4) kVA rating conspicuously displayed using three inch high yellow letters on its enclosure.

2.2.2.1 Specified Transformer Efficiencies

Provide transformer efficiency calculations utilizing the actual no-load and load loss values obtained during the routine tests performed on the actual transformer(s) prepared for this project. Reference no-load losses (NLL) at 20 degrees C. Reference load losses (LL) at 55 degrees C and at 50 percent of the nameplate load. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in the "KVA / Efficiency" table below. The table is based on requirements contained within 10 CFR 431, Subpart K. Submit certification, including supporting calculations, from the manufacturer indicating conformance.

kVA	EFFICIENCY (percent)
15	98.65
30	98.83
45	98.92
75	99.03
112.5	99.11
150	99.16
225	99.23
300	99.27
500	99.35
750	99.40
1000	99.43
1500	99.48
2000	99.51
2500	99.53
above 2500	99.54

2.2.3 Insulating Liquid

Insulating liquid shall conform to the following requirements:

a. Less-Flammable Transformer Liquids: NFPA 70 and FM APP GUIDE for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D92 and a dielectric strength not less than 33 kV tested per ASTM D877/D877M. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate.

Provide a fluid that is a biodegradable, electrical insulating, and cooling liquid classified by UL and approved by FM as "less flammable" with the following properties:

(1) Pour Point: ASTM D97, less than minus 15 degree C

(2) Aquatic Biodegradation: EPA 712-C-98-075, ultimately biodegradable as designated by EPA.

(3) Trout Toxicity: OECD Test 203, zero mortality of EPA 821-R-02-012, pass

b. Mineral Oil: ASTM D3487, Type II, tested in accordance with ASTM D117. Provide identification of transformer as "non-PCB" and "Type II mineral oil" on the nameplate.

2.2.3.1 Liquid-Filled Transformer Nameplates

Provide nameplate information in accordance with IEEE C57.12.00 and as modified or supplemented by this section.

2.2.4 Corrosion Protection

Provide corrosion resistant bases and cabinets of transformers, fabricated of stainless steel conforming to ASTM A240/A240M, Type 304 or 304L. Base includes any part of pad-mounted transformer that is within three inches of concrete pad.

Paint entire transformer assembly 7GY3.29/1.5 green, with paint coating system complying with IEEE C57.12.28 regardless of base, cabinet, and tank material. The color notation is specified in ASTM D1535.

2.3 WARNING SIGNS AND LABELS

Provide warning signs for the enclosures of pad-mounted transformers having a nominal rating exceeding 600 volts in accordance with NEMA Z535.4 and NEMA 260.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28, such as for pad-mounted transformers, provide self-adhesive warning labels (decals, Panduit No. PPSO710D72 or approved equal) on the outside of the high voltage compartment door(s)with nominal dimensions of seven inches by 10 inches with the legend "WARNING HIGH VOLTAGE" printed in two lines of nominal two inch high letters. Include the work "WARNING" in white letters on an orange background and the words "HIGH VOLTAGE" in black letters on a white background.

b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 inches by 10 inches with the legend "WARNING HIGH VOLTAGE KEEP OUT" printed in three lines of nominal three inch high white letters on an orange and black field.

2.4 ARC FLASH WARNING LABEL

Provide arc flash warning label for the enclosure of pad-mounted transformers. Locate this self-adhesive warning label on the outside of the high voltage compartment door warning of potential electrical arc

flash hazards and appropriate PPE required. Provide label format as indicated.

2.5 GROUNDING AND BONDING

UL 467. Provide grounding and bonding as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.6 CAST-IN-PLACE CONCRETE

Provide concrete associated with electrical work for other than encasement of underground ducts rated for 4000 psi minimum 28 calendar-day compressive strength unless specified otherwise. Conform to the requirements of Section 03 30 53 CAST-IN-PLACE CONCRETE.

Provide concrete associated with electrical work as follows:

a. Composed of fine aggregate, coarse aggregate, portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture.

b. Fine aggregate: hard, dense, durable, clean, and uncoated sand.

c. Coarse aggregate: reasonably well graded from 3/16 inch to 1 inch.

d. Fine and coarse aggregates: free from injurious amounts of dirt, vegetable matter, soft fragments or other deleterious substances.

e. Water: fresh, clean, and free from salts, alkali, organic matter, and other impurities.

f. Concrete associated with electrical work for other than encasement of underground ducts: 4000 psi minimum 28-calendar day compressive strength unless specified otherwise.

g. Slump: Less than 4 inches. Retempering of concrete will not be permitted.

h. Exposed, unformed concrete surfaces: smooth, wood float finish.

i. Concrete must be cured for a period of not less than seven calendar days, and concrete made with high early strength portland cement must be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Contracting Officer.

j. Air entrain concrete exposed to weather using an air-entraining admixture conforming to ASTM C260/C260M.

k. Air content: between four and six percent.

2.7 SOURCE QUALITY CONTROL

2.7.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer test schedule for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled

date.

Test Instrument Calibration:

a. General: Provide a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

b. Accuracy: Traceable to the National Institute of Standards and Technology.

c. Instrument Calibration Frequency Schedule: less than or equal to 12 months for both test floor instruments and leased specialty equipment.

d. Dated Calibration Labels: visible on all test equipment.

e. Calibrating Standard: higher accuracy than that of the instrument tested.

f. Records: Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(1) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(2) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.7.2 Design Tests

IEEE C57.12.00, and IEEE C57.12.90. Section 5.1.2 in IEEE C57.12.80 states that "design tests are made only on representative apparatus of basically the same design". Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for the specified transformer, with design tests performed prior to the award of this contract.

a. Tests: certified and signed by a registered professional engineer.

b. Temperature Rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (KNAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.

c. Lightning Impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests includes the primary windings only of that transformer.

(1) IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.

(2) State test voltage levels.

(3) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.

d. Lifting and Moving Devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with IEEE C57.12.34.

e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

f. Short Circuit: "Basically the same design" for the short circuit test means a pad-mounted transformer with the same kVA as the transformer specified.

2.7.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests: performed in accordance with IEEE C57.12.90 by the manufacturer on the actual transformer prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence as follows:

a. Phase relation

b. Ratio

c. No-load losses (NLL) and excitation current

d. Load losses (LL) and impedance voltage

e. Dielectric

(1) Impulse

(2) Applied voltage

(3) Induced voltage

f. Leak

PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of

ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Pad-Mounted Transformer Grounding

Provide a ground ring around the transformer with 4/0 AWG bare copper. Provide four ground rods in the ground ring, one per corner. Install the ground rods at least 10 feet apart from each other. Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 Meters and Current Transformers

ANSI C12.1

3.4 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.6 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least eight inches thick, reinforced with a six inch by six inch - W2.9 by W2.9 mesh placed uniformly four inches from the top of the slab.

b. Place slab on a six inch thick, well-compacted gravel base.

c. Install slab such that top of concrete slab is approximately four inches above the finished grade with gradual slope for drainage.

d. Provide edges above grade with 1/2 inch chamfer.

e. Provide slab of adequate size to project at least eight inches beyond the equipment.

Stub up conduits, with bushings, two inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.6.1 Cast-In-Place Concrete

Provide cast-in-place concrete work in accordance with the requirements of Section 03 30 53 CAST-IN-PLACE CONCRETE.

3.6.2 Sealing

When the installation is complete, seal all entries into the equipment enclosure with an approved sealing method. Provide seals of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7 FIELD QUALITY CONTROL

3.7.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS. Submit reports, including acceptance criteria and limits for each test in accordance with NETA ATS "Test Values".

3.7.1.1 Pad-Mounted Transformers

Pad-mounted transformers shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.

(3) Inspect anchorage, alignment, and grounding.

(4) Verify the presence of PCB content labeling.

(5) Verify the bushings and transformer interiors are clean.

(6) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(7) Verify correct liquid level in tanks and bushings.

(8) Verify that positive pressure is maintained on gas-blanketed transformers.

(9) Perform specific inspections and mechanical tests as recommended by manufacturer.

(10) Verify de-energized tap changer position is left as specified.

b. Electrical Tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.

(2) Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

3.7.1.2 Current Transformers

Current transformers shall conform to the following requirements:

a. Visual and mMchanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify correct connection.

(4) Verify that adequate clearances exist between primary and secondary circuit wiring.

(5) Verify the unit is clean.

(6) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(7) Verify that all required grounding and shorting connections provide good contact.

(8) Verify correct operation of transformer withdrawal mechanism and grounding operation.

(9) Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

b. Electrical Tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform insulation-resistance test.

(3) Perform a polarity test.

(4) Perform a ratio-verification test.

3.7.1.3 Watthour Meter

Watthour meters shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical Tests

(1) Calibrate watthour meters according to manufacturer's published data.

(2) Verify that correct multiplier has been placed on face of meter, where applicable.

(3) Verify that current transformer secondary circuits are intact.

3.7.1.4 Grounding System

Groundint systems shall conform to the following requirements:

a. Visual and Mechanical Inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.7.1.5 Surge Arresters, Medium- and High-Voltage

Surge arresters, medium- and high-voltage elements shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect anchorage, alignment, grounding, and clearances.

(4) Verify the arresters are clean.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

b. Electrical Tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform an insulation-resistance test on each arrester, phase terminal-to-ground.

(3) Test grounding connection.

3.7.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer five working days in advance of the dates and times of checking and testing.

-- End of Section --

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MOTOR CONTROL CENTERS AND PANELBOARDS

10/07

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MOTOR CONTROL CENTERS AND PANELBOARDS
10/07

PART 1 GENERAL

1.1 SUMMARY

These specifications include the design, fabrication, assembly, wiring, testing, and delivery of the items of equipment and accessories and spare parts listed in the Schedule and shown on the drawings.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	((2014; Errata 2016) Electric Meters - Code for Electricity Metering

ASME INTERNATIONAL (ASME)

ASME B1.1	(2003; R 2018) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	(2013) Pipe Threads, General Purpose (Inch)

ASTM INTERNATIONAL (ASTM)

ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B187/B187M	(2016) Standard Specification for Copper, Bus Bar, Rod and Shapes and General Purpose Rod, Bar and Shapes

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE 399	(1997) Brown Book IEEE Recommended Practice for Power Systems Analysis
IEEE 519	(2014) Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 61800-3	(2017) Adjustable Speed Electrical Power Drive Systems - Part 3: EMC Requirements and Specific Test Methods

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA ICS 18	(2007) Motor Control Centers
NEMA PB 1	(2011) Panelboards
NEMA ST 1	(1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)
NEMA ST 20	(1992; R 19972014) Standard for Dry-Type Transformers for General Applications

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Mar 2019) UL Standard for Safety Panelboards

UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 845	(2005; Reprint Oct 2018) UL Standard for Safety Motor Control Centers
UL 1063	(2017) UL Standard for Safety Machine-Tool Wires and Cables

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G, RO

Shop Drawings; G, RO

Motor Control Centers; G, RO

Panelboards; G, RO

Dimensioned Outline Drawings; G, RO

Schematic Diagrams; G, RO

Power and Control Connection Diagrams; G, RO

SD-03 Product Data

Equipment; G, RO

Factory Tests

Harmonic Analysis

SD-05 Design Data

Request For Settings; G, RO

SD-06 Test Reports

Factory Tests

Acceptance Checks And Tests; G, RO

SD-07 Certificates

Motor Control Centers

1.4 DELIVERY, STORAGE, AND HANDLING

Submit six copies of such descriptive cuts and information as are required to demonstrate fully that all parts of the equipment will conform to the requirements and intent of the specifications. Data shall include descriptive data showing typical construction of the types of equipment proposed, including the manufacturer's name, type of molded case circuit breakers or motor circuit protectors, performance capacities and other information pertaining to the equipment. Ship the equipment as completely assembled and wired as feasible so as to require a minimum of installation work. Each shipping section shall be properly match marked to facilitate reassembly, and shall be provided with removable lifting channels with eye bolts for attachment of crane slings to facilitate lifting and handling. Any relay or other device which cannot withstand the hazards of shipment when mounted in place on the equipment shall be carefully packed and shipped separately. These devices shall be marked with the number of the panel which they are to be mounted on and fully identified. All finished painted surfaces and metal work shall be wrapped suitably or otherwise protected from damage during shipment. All parts shall be prepared for shipment so that slings for handling may be attached readily while the parts are in a railway car or transport truck. All spare parts and accessories shall be carefully packaged and clearly marked.

1.5 MAINTENANCE

1.5.1 Accessories and Tools

Furnish a complete set of accessories and special tools unique to equipment provided and required for erecting, handling, dismantling, testing and maintaining the apparatus.

1.5.2 Extra Materials

Furnish spare parts as specified below. All spare parts shall be of the same material and workmanship, shall meet the same requirements, and shall be interchangeable with the corresponding original parts furnished.

SPARE PARTS	
AMOUNT	DESCRIPTION
2 of each type and size	Fuses
1	Circuit breaker auxiliary switch
2 for each size ac contactor	Operating coils
1 for each size dc contactor	Operating coil
2 Complete sets for each size ac contactor	3-pole stationary and moving contact assemblies
1 Complete set for each size dc contactor	2-pole stationary and moving contact assemblies

SPARE PARTS	
AMOUNT	DESCRIPTION
3 of each type and rating	Contactor overload relays, each relay with a complete set of contact blocks
1 Spare set for each heater rating provided	Heater elements
2 for each type	Indicating lamp assemblies
1 of each type and rating	Control transformer
1 of each type and rating	Control relay
1 of each type	Contactor auxiliary contact
4 One quart containers	Finish paint for indoor equipment
2 One quart containers	Paint used for the exterior surfaces of outdoor equipment
4	Keys for motor control center door loc

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are standard products of a manufacturer regularly engaged in their manufacture and that essentially duplicate items that have been in satisfactory use for at least two years prior to bid opening and that conform to the requirements of these specifications. Materials shall be of high quality, free from defects and imperfections, of recent manufacture, and of the classification and grades designated. All materials, supplies, and articles not manufactured by the Contractor shall be the products of other recognized reputable manufacturers.

2.1.1 Rules

Provide equipment conforming to the requirements of NFPA 70 unless more stringent requirements are indicated herein or shown. NEMA rated and UL listed equipment has been specified when available. Equipment shall meet NEMA and UL construction and rating requirements as specified. No equivalent will be acceptable. Immediately notify the Contracting Officer of any requirements of the specifications or Contractor proposed materials or assemblies that do not comply with UL or NEMA. International Electrotechnical Commission (IEC) rated equipment will not be considered an acceptable alternative to specified NEMA ratings.

2.1.2 Coordination

The general arrangement of the motor control centers, switchboards and panelboards is shown on the contract drawings. Any modifications of the equipment arrangement or device requirements as indicated will be subject to the approval of the Contracting Officer. If any conflicts occur

necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. Completely assemble all equipment at the factory. The motor control centers and switchboards may be disassembled into sections, if necessary, for convenience of handling, shipping, and installation.

2.1.3 Drawing Submittals

Submit dimensioned outline drawings, schematic diagrams, and power and control connection diagramsin accordnace with requirements of this section.

2.2 NAMEPLATES

Provide nameplates made of laminated sheet plastic or of anodized aluminum approximately 1/8 inch thick, engraved to provide white letters on a black background. The nameplates shall be fastened to the panels in proper positions with anodized round-head screws. Lettering shall be minimum 1/2 inch high. Nameplate designations shall be in accordance with lists on the drawings, and as a minimum shall be provided for the following equipment:

a. Motor Control Centers

b. Individual items of equipment mounted in the Motor Control Centers

c. Panelboards

d. Individually-mounted circuit breakers in Panelboard

Provide equipment of the withdrawal type with nameplates mounted on the removable equipment in locations visible when the equipment is in place.

2.3 CONNECTIONS

All bolts, studs, machine screws, nuts, and tapped holes shall be in accordance with ASME B1.1. The sizes and threads of all conduit and fittings, tubing and fittings, and connecting equipment shall be in accordance with ASME B1.20.1. All ferrous fasteners shall have rust-resistant finish and all bolts and screws shall be equipped with approved locking devices. Manufacturer's standard threads and construction may be used on small items which, in the opinion of the Contracting Officer, are integrally replaceable, except that threads for external connections to these items shall meet the above requirements.

2.4 MOLDED CASE CIRCUIT BREAKERS

Molded case circuit breakers shall conform to the applicable requirements of UL 489 and UL 489. The circuit breakers shall be manually-operated, shall be quick-make, quick-break, common trip type, and shall be of automatic-trip type unless otherwise specified or indicated on the drawings. All poles of each breaker shall be operated simultaneously by means of a common handle. The operating handles shall clearly indicate whether the breakers are in "On", "Off", or "Tripped" position and shall have provisions for padlocking in the "Off" position. Personnel safety line terminal shields shall be provided for each breaker. The circuit breakers shall be products of only one manufacturer, and shall be interchangeable when of the same frame size.

2.4.1 Trip Units

Except as otherwise noted, the circuit breakers, of frame sizes and the trip unit ratings as shown on the drawings, shall be provided with combination thermal and instantaneous magnetic or solid state trip units. The Government reserves the right to change the indicated trip ratings, within frame limits, of the trip devices at the time the shop drawings are submitted for approval. The breaker trip units shall be interchangeable and the instantaneous magnetic trip units shall be adjustable on frame sizes larger than 150 amperes. Nonadjustable instantaneous magnetic trip units shall be set at approximately 10 times the continuous current ratings of the circuit breakers.

2.4.2 480-Volt AC Circuits

Circuit breakers for 480-volt or 277/480-volt ac circuits shall be rated 600 volts ac, and shall have an UL listed minimum interrupting capacity of 65,000 symmetrical amperes at 600 volts ac.

2.4.3 120/240-Volt AC Circuits

Circuit breakers for 120-volt ac circuits shall be rated not less than 120/240 volts or 240 volts ac, and shall have a UL listed minimum interrupting capacity of 10,000 symmetrical amperes.

2.5 WIRING

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44 or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Power wiring for 480-volt circuits and below shall be of the same type as control wiring and the minimum size shall be No. 12 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.6 TERMINAL BLOCKS

Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. Submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.6.1 Types of Terminal Blocks

2.6.1.1 Short-Circuiting Type

Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

2.6.1.2 Load Type

Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.6.2 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Drawings shall show the general arrangement and overall dimensions of the motor control centers, switchboards, and panelboards. These drawings shall show space requirements, details of any floor supports to be embedded in concrete and provisions for conduits for external cables. Prints of drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

2.7 SPACE HEATERS

Space heaters shall be provided where indicated on the drawings and shall be controlled using an adjustable 10 degrees Celsius (C) to 30 degrees C thermostat, magnetic contactor, and a molded-case circuit breaker and a 480 volt to 120 volt single-phase transformer. The space heaters shall be 250-watt, 120 volt strip elements operated at 120 volts and shall be supplied from the motor control center bus . The contactors shall be open type, electrically-held, rated 30 amperes, two-pole, with 120-volt ac

coils.

2.8 MOTOR CONTROL CENTERS

Each motor control center shall be designed for operation on 480-volts ac, three-phase, 60-Hz system, and the equipment shall conform to all the applicable requirements of NEMA ICS 1, NEMA ICS 2, NEMA ICS 4and NEMA ICS 6. Vertical sections and individual units shall be listed and labeled under UL 845 where ever possible. In lieu of the UL listing, certification from any nationally recognized, adequately equipped, testing agency that the individual units and vertical sections have been tested and conform to the UL requirements of that agency will be acceptable when approved by the Contracting Officer.

a. Certification of factory test reports. Certification shall be signed by official authorized to certify on behalf of the manufacturer, attesting that the motor control center meets the specified requirements. The statement shall be dated after the award of this contract, shall state the Contractor's name and address, shall name the project and location, and shall list the specific requirements which are being certified.

b. The motor control center shall be NEMA Class II, Type B , motor control centers in accordance with NEMA ICS 2. The NEMA Class II motor control center drawings shall include a connection diagram with wire designations and schematic diagrams to illustrate operation of associated motor unit controls.

c. Submit an individual wiring diagram for each motor control center. Wiring diagrams shall be in a form showing physical arrangement of the control center with interconnecting wiring shown by lines or by terminal designations (wireless). Provide a single-line diagram, equipment list and nameplate schedule for each switchboard and panelboard.

2.8.1 Enclosures

Each motor control center shall consist of the required number of vertical sections of 90 inches nominal height, bolted together, with steel channel sills and suitable for mounting against a wall. Vertical section shall be 20 inches deep and buses, control wiring, control transformers, small power transformers, terminal blocks, line terminals, cable supports, and clamps shall be accessible from the front. Enclosure shall be NEMA Type 3R. The control centers shall be fabricated from smooth select steel sheets shaped and reinforced to form rigid free-standing structures. Metal thickness for enclosures shall be not less than specified in NEMA ICS 6 without exception. Vertical edges of sections exposed to view shall be so fabricated and bolted that the joints will not pass a 1/16 inch gage. Each structure shall be designed for addition of future sections required. Individual compartments shall be isolated from adjacent compartments.

2.8.1.1 Unit Compartments

Each operating unit shall contain equipment as shown on the drawings, mounted in an individual cell. The unit assembly, except main circuit breakers, panelboards and auxiliary control devices, shall be drawout type removed from the front, without rear access or disturbing other units in the control center assembly. All drawout type unit assemblies shall have

positive guide rail system to ensure alignment of connection to vertical bus. Units shall be mechanically interlocked with the door to prevent removal while in the energized position. Each removable unit shall have provision for padlocking in a position in which it is disconnected from the vertical bus although not removed from the stationary structure. All ventilating openings shall be provided with corrosion-resistant insect-proof screens on the inside. Bus closing plugs shall be provided for all unused openings in vertical bus barriers.

2.8.1.2 Motor Control Center Doors and Covers

Each unit compartment, including blank compartments for future use, shall be provided with either a flange-formed or a rolled-edge door. Each door shall be mounted on fully-concealed or continuous full-length piano-type hinges and shall be provided with positive fasteners. Door sag shall be prevented by proper alignment of hinges made of sufficiently strong material. The door fastenings shall be so interlocked to prevent opening when the equipment is energized. The external operating handle shall clearly indicate whether the equipment is in an "ON", "OFF" or "TRIPPED" position.

2.8.1.3 Horizontal Wireways

Structure shall have a minimum six inches high wireway at the top and a 12 inches minimum wireway at the bottom. Both horizontal wireways shall run the length of the structure Cover plates shall be provided on the side of the assembly to permit extension of the horizontal bus and wireway when vertical sections are added.

2.8.1.4 Vertical Wireways

Vertical wireways shall be provided in all vertical sections accepting multiple plug-in components. Vertical wireways shall connect with horizontal wireways at the top and bottom and be a minimum four inches wide. Barriers shall be provided in sections containing both ac and dc vertical buses. Doors shall be provided on each vertical wireway. The exposed surface of any door shall not deviate more than 1/16 inch from a true plane.

2.8.1.5 Sills

Channel iron foundations, complete with bolts and drilled holes for grouting and anchoring to the floor, shall be furnished for the complete length (front and rear) of each motor control center assembly. The channels shall be designed for flat mounting and maximum channel depth shall be 1-1/2 inches. Additional channel or substantial metal trim shall be provided flush with the end panels to completely enclose the bases across the ends of the equipment assemblies.

2.8.1.6 NEMA 3R Enclosures

The motor control center shall be non-walk in NEMA Type 3R rainproof enclosure as shown on the drawings. The outside enclosure shall consist of smooth select steel sheets on a structural steel frame. Full-length single or double doors shall be provided with top and bottom bolts and a center latch operated by means of a keyed handle. Steel sheets and doors shall be not less than No. 10 gage thick and doors shall have bent angle or channel edges with all corner seams welded and ground smooth. The motor control center within the enclosure shall be assembled with adequate

gaskets and structure to assure a measure of vandal resistance. Ventilating openings and an effective insulating air space of approximately two inches shall be provided below the roof of the structure which shall slope from front to back for adequate drainage. The outside edges of the control center base shall permit easy sealing at the concrete surface with mastic compound. A 200-watt outdoor lighting fixture with globe and guard shall be furnished to light the front of the assembly. All lighting connections shall be watertight. A weatherproof switch installation shall be furnished on the front or side of the enclosure so that the light can be switched prior to opening the assembly doors. The exterior manual switch shall be "ac" rated, 15 amperes, 120/277 volts. Two duplex receptacle units shall be provided within the outer weatherproof enclosure. The lighting fixture and receptacles shall be wired to the 120-volt ac panelboard located in the control center, and external wiring shall be run in rigid galvanized steel conduit.

2.8.1.7 Shutters

Drawout units shall have shutters which close when the unit is withdrawn to isolate the vertical bus.

2.8.1.8 Thermostatically Controlled Strip Heaters

Thermostatically controlled strip heaters as specified in paragraph SPACE HEATERS shall be provided.

2.8.2 Buses

All buses shall be of copper and all bolted splices and connections between buses and for extensions or taps for equipment shall be tin or silver-plated . Copper bars and shapes for bus conductors shall conform to the applicable requirements of ASTM B187/B187M . All splices for field assembly shall be bolted with at least two bolts and shall employ the use of "Belleville" washers in the connection. The bus ratings shall be based on a 65 degree Celsius maximum temperature rise in accordance with UL 845 requirements. Bus shall have a short-circuit current rating of not less than 100,000 RMS symmetrical amperes. All bus work shall be supported on wet process porcelain insulators, glass polyester, or suitable molded material.

2.8.2.1 Horizontal Bus

Each control center assembly shall be provided with a three-phase main horizontal bus, with a continuous current rating not less than 1,000 amperes, located across the top of each vertical section. The ends of horizontal buses shall be drilled for future extensions. The main horizontal bus shall be fully insulated.

2.8.2.2 Vertical Bus

Each vertical section shall be provided with a three-phase vertical bus with a continuous current rating of 600 amperes connected to the horizontal bus by brazing, welding, or bolting. Where the incoming feeder breakers are located at the bottom of a control center, the vertical bus in that section shall be rated the same as the main horizontal bus. Vertical buses shall extend from the horizontal bus to the bottom of the lowest available unit mounting space. The vertical bus shall be isolated from wireways and equipment in compartments.

2.8.2.3 Ground Bus

A copper ground bus shall be provided full width at the bottom of the motor control center line-up. A full clamp-type solderless copper or copper alloy lug for No. 2/0 AWG stranded copper cable shall be provided at each end of the bus for connection to the station grounding system.

2.8.2.4 Neutral Bus

A fully rated neutral bus shall be furnished continuous through the control center. Lugs of appropriate capacity will be furnished.

2.8.3 Combination Starters

Combination motor controller units shall contain motor circuit protectors, auxiliary and pilot devices and a magnetic contactor with thermal overload relays. The ratings of motor circuit protectors, air circuit breakers, contactors, motor controllers and other devices shall be as shown on the drawings. All combination motor controller units shall have short circuit ratings equal to 65,000 or greater. Where control push-buttons, indicating lamps, "Hand-Off-Automatic" switches, and similar control devices are associated with a unit, they shall be mounted on the unit compartment door. Door-mounted components shall not interfere with access within the compartments. Motor circuit protectors shall be only part of the combination starters as required by NFPA 70 and shall conform to all requirements of paragraph MOLDED CASE CIRCUIT BREAKERS, except that trip units shall have provision for locking the selected trip setting.

2.8.3.1 Magnetic Contactors

Magnetic contactors shall be of the NEMA sizes indicated on the drawings. The rating, performance and service characteristics shall conform to the requirements of NEMA ICS 2 for contactors with continuous current ratings for the duty indicated. Contactors for motor control shall be rated for full-voltage starting (Class A controllers). Contactors shall be suitable for at least 200,000 complete operations under rated load without more than routine maintenance. The interruption arc and flame shall be minimized by suitable arc chutes or other means so that no damage will be done to other portions of the device. The arc chutes, if provided, shall be easily removable without removing or dismantling other parts. The contacts shall be easily removable. All current-carrying contact surfaces shall be silver-surfaced or of other approved material to prevent the formation of high resistance oxides. The contactor shall operate without chatter or perceptible hum while energized. Coils shall be suitable for continuous operation 120-volt ac circuits. Alternating-current contactors shall be three-pole, except where otherwise noted, and shall be insulated for 600 volts ac and of the electrically- operated, magnetically-held type. Direct-current contactors shall be two-pole, suitable for controlling circuits operating at 125 volts dc, insulated for 250 volts dc, electrically-operated, magnetically-held type and adequate for full-voltage motor starting service.

2.8.3.2 Auxiliary Contacts

Each controller shall be provided with a minimum of three auxiliary contacts which can be easily changed from normally open to normally closed. Where indicated on the drawings, a fourth auxiliary contact and red and green indicating lights shall be provided.

2.8.3.3 Overload Relays

Except as otherwise indicated, each controller shall be provided three NEMA Class 20 thermal overload relays with external manual reset. Prior to shipment of the control centers, the Contracting Officer will furnish the ratings of the heater elements to be installed in the relays by the Contractor.

2.8.3.4 Individual Control Transformers

Where 120 volt ac control of contactors is indicated or required, individual control transformer shall be provided on the load side of the unit disconnect. The control transformers shall be rated 480-120 volts and shall conform to the requirements for control transformers in NEMA ST 1. Control transformers shall have adequate volt-ampere capacity for the control functions indicated. Transformers shall be installed with primary fuses. Except as otherwise indicated on the drawings, each control transformer shall be provided with a fuse in one secondary lead and shall have the other secondary lead grounded.

2.8.3.5 Voltage Fault Protection

Where shown, starters shall be provided with protection against voltage faults, phase unbalance, phase loss, phase reversal, undervoltage and overvoltage. Upon sensing one of these faults, the protector shall de-energize the starter. The protector shall use a combination of voltage and phase-angle sensing to detect phase loss even when regenerated voltages are present. The protector shall be connected to the load side of the motor circuit disconnect. The protector shall have an adjustable line voltage trip level, adjustable trip delay, automatic reset and Double Pull Double Throw (DPDT) output contacts. Protector operation shall have repeatability of plus one percent of set point, maximum, and a dead band of two percent maximum. Protector shall have green indicator to show normal status and red indicator to show tripped status. Indicators will be visible through the compartment door, when LED's are used protector shall be covered with a clear unbreakable cover, when lamps are used they shall have nameplates and be grouped with other indicating lights.

2.8.3.6 Control Circuit Disconnects

Control circuit power shall disconnect when the unit compartment is opened.

2.8.4 Molded Case Circuit Breakers in Unit Compartments

Molded case circuit breakers for installation in unit compartments shall meet the requirements of paragraph MOLDED CASE CIRCUIT BREAKERS above.

2.8.5 Adjustable Frequency Drives

Where shown on the drawings, adjustable frequency drives 1 through 2000 Horsepower (HP), Constant Torque (CT), shall have the following features:

a. The AFD shall be rated for 480 VAC. The AFD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on 50 degrees C ambient and 10 kHz switching frequency below 40-HP (CT) and 3.6 kHz switching frequency 40-HP and above to reduce motor noise and avoid increased motor losses.

b. The AFD shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source AFD are not acceptable. Insulated Gate Bipolar Transistors (IGBT's) shall be used in the inverter section. Bipolar Junction Transistors, GTO's or SCR's are not acceptable. The AFD shall run at the above listed switching frequencies.

c. The AFD shall have efficiency at full load and speed that exceeds 95 percent for AFD below 15-HP and 97 percent for drives 15-HP and above. The efficiency shall exceed 90 percnet at 50 percent speed and load.

d. The AFD shall maintain the line side displacement power factor at no less than 0.96, regardless of speed and load.

e. The AFD shall have a one minute overload current rating of 150 percent and a two second overload current rating of 250 percent for constant torque drives.

f. The AFD shall be capable of operating of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the AFD.

g. The AFD shall have an integral EMI/RFI filter as standard.

h. The AFD shall limit harmonic distortion reflected onto the utility system to a voltage and current level as defined by IEEE 519 for general systems applications, by utilizing the standard three percent nominal impedance integral AC three-phase line reactor integrally mounted in the AFD enclosure.

i. Any harmonic calculations shall be done based on the kVA capacity, X/R ratio and the impedance of the utility transformer feeding the installation, as noted on the drawings, and the total system load. The calculations shall be made with the point of common coupling being the point where the utility feeds multiple customers.

j. Total harmonic distortion shall be calculated under worst-case conditions in accordance with the procedure outlined in IEEE standard 519-1992. Copies of these calculations are to be made available upon request. The contractor shall provide any needed information to the AFD supplier three weeks prior to requiring harmonic calculations.

k. The system containing the AFD shall comply with the five percent level of total harmonic distortion of line voltage and the line current limits as defined in IEEE 519. If the system cannot meet the harmonic levels with the with the AFD provided with the standard input line reactor or optional input isolation transformer, the AFD manufacturer shall supply an eighteen pulse, multiple bridge rectifier AC to DC conversion section with phase shifting transformer for all drives 50-HP and above. This eighteen-pulse rectifier converter shall result in a multiple pulse current waveform that will more nearly approximate a true sine-wave to reduce voltage harmonic content on the utility line. The phase shifting transformer shall be of a single winding type to optimize its KVA rating and harmonic cancellation capability.

   Harmonic filters are not acceptable for drives 50-HP and above.

l. The AFD shall be able to start into a spinning motor (flying start). The AFD shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.

m. Standard operating conditions shall be:

(1) Incoming Power: Three-phase, 480 Vac (+10 percent to -15 percent) and 50/60 Hz (+/-5 Hz) power to a fixed potential DC bus level.

(2) Frequency Stability: Frequency stability of +/-0.05 percent for 24 hours with voltage regulation of +/-1 percent of maximum rated output voltage.

(3) Speed Regulation: Speed regulation of +/- 0.5 percent of base speed.

(4) Load Inertia: Load inertia dependant carryover (ride-through) during utility loss.

(5) Line Rotation Sensitivity: Insensitive to input line rotation.

(6) Humidity: 0 percent to 95 percent (non-condensing and non-corrosive).

(7) Altitude: 0 feet to 3,300 feet (1000 meters) above sea level.

(8) Ambient Temperature: Minus 10 degrees C to plus 50 degrees C (CT).

(9) Storage Temperature: Minus 40 degrees C to plus 60 degrees C.

n. Control Functions

(1) Frequently accessed AFD programmable parameters shall be adjustable from a digital operator keypad located on the front of the AFD. The AFD shall have a three line alphanumeric programmable display with status indicators. Keypads must use plain English words for parameters, status, and diagnostic messages. Keypads that are difficult to read or understand are not acceptable, and particularly those that use alphanumeric code and tables. Keypads shall be adjustable for contrast with large characters easily visible in normal ambient light.

(2) The keypad shall include a Local/Remote pushbutton selection. Both start/ stop source and speed reference shall be independently programmable for Keypad, Remote I/O, or Field Bus.

(3) The keypad shall have copy / paste capability.

(4) Upon initial power up of the AFD, the keypad shall display a start up guide that will sequence all the necessary parameter adjustments for general start up.

(5) Standard advanced programming and trouble-shooting functions shall be available by using a personal computer's RS-232 port and Windows™ based software. In addition the software shall permit control and monitoring via the AFD RS232 port. The manufacturer

shall supply a diskette with the required software. An easily understood instruction manual and software help screens shall also be provided. The computer software shall be used for modifying the drive setup and reviewing diagnostic and trend information as outlined in this section through section "r. Protective Functions". Provide one copy of the advanced programming software.

(6) The operator shall be able to scroll through the keypad menu to choose between the following:

(a) Monitor
(b) Operate
(c) Parameter setup
(d) Actual parameter values
(e) Active faults
(f) Fault history
(g) LCD contrast adjustment
(h) Information to indicate the standard software and optional features software loaded.

(7) The following setups and adjustments, at a minimum, are to be available:

(a) Start command from keypad, remote or communications port
(b) Speed command from keypad, remote or communications port
(c) Motor direction selection
(d) Maximum and minimum speed limits
(e) Acceleration and deceleration times, two settable ranges
(f) Critical (skip) frequency avoidance
(g) Torque limit
(h) Multiple attempt restart function
(i) Multiple preset speeds adjustment
(j) Catch a spinning motor start or normal start selection
(k) Programmable analog output
(l) DC brake current magnitude and time
(m) PID process controller

o. The AFD shall have the following system interfaces:

(1) Inputs - A minimum of six programmable digital inputs, two analog inputs and serial communications interface shall be provided with the following available as a minimum:

(a) Remote manual/auto
(b) Remote start/stop
(c) Remote forward/reverse
(d) Remote preset speeds
(e) Remote external trip
(f) Remote fault reset
(g) Process control speed reference interface, 4-20mA DC
(h) Potentiometer and 1-10VDC speed reference interface
(i) RS-232 programming and operation interface port
(j) Serial communications port

(2) Outputs - A minimum of two discrete programmable digital outputs, one programmable open collector output, and one programmable analog output shall be provided, with the following available at minimum.

Programmable relay outputs with one set of Form C contacts for each, selectable with the following available at minimum:

(a) Fault
(b) Run
(c) Ready
(d) Reversed
(e) Jogging
(f) At speed
(g) Torque Limit Supervision
(h) Motor rotation direction opposite of commanded
(i) Over-temperature

(3) Programmable open collector output with available integral power supply and selectable with the following available at minimum:

(a) Fault
(b) Run
(c) Ready
(d) Reversed
(e) Jogging
(f) At speed
(g) Torque Limit Supervision
(h) Motor rotation direction opposite of commanded
(i) Over-temperature

(4) Programmable analog output signal, selectable with the following available at minimum:

(a) Motor current
(b) Output frequency
(c) Frequency reference
(d) Motor speed
(e) Motor torque
(f) Motor power
(g) Motor voltage
(h) DC-bus voltage
(i) AI1 (Analog Input 1)
(j) AI2 (Analog Input 2)
(k) PT100 temperature
(l) FB digital input 4 (Field Bus Input)

p. Monitoring and Displays - The AFD display shall be a LCD type capable of displaying three lines of text and the following 13 status indicators:

(1) Run
(2) Forward
(3) Reverse
(4) Stop
(5) Ready
(6) Alarm
(7) Fault
(8) Input/Output (I/O) terminal
(9) Keypad
(10) Bus/Communication
(11) Local (LED)
(12) Remote (LED)
(13) Fault (LED)

q. The AFD keypad shall be capable of displaying the following monitoring functions at a minimum:

(1) Output frequency
(2) Frequency reference
(3) Motor speed
(4) Motor current
(5) Motor torque
(6) Motor power
(7) Motor voltage
(8) DC-bus voltage
(9) Unit temperature
(10) Calculated motor temperature
(11) Voltage level of analog input
(12) Current level of analog input
(13) Digital inputs status
(14) Digital and relay outputs status
(15) Analog Input

r. Protective Functions

(1) The AFD shall include the following protective features at minimum:

(a) Over-current
(b) Over-voltage
(c) Inverter fault
(d) Under-voltage
(e) Input phase loss
(f) Output phase loss
(g) Under-temperature
(h) Over-temperature
(i) Motor stalled
(j) Motor over-temperature
(k) Motor under-load
(l) Logic voltage failure
(m) Microprocessor failure

(2) The AFD shall provide ground fault protection during power-up, starting, and running. AFD with no ground fault protection during running are not acceptable.

s. Diagnostic Features - Fault History

(1) Record and log faults.

(2) Indicate the most recent first, and store up to 30 faults.

t. Optional features to be included in the AFD:

(1) HMCP or thermal magnetic breaker to provide a disconnect means. Operating handle shall protrude through the door. The disconnect shall not be mounted on the door. The handle position shall indicate ON, OFF, and TRIPPED condition. The handle shall have provisions for padlocking in the OFF position with at least three padlocks. Interlocks shall prevent unauthorized opening or closing of the AFD door with the disconnect handle in the ON position. Door handle interlock can be defeated by qualified maintenance personnel.

(2) AC input line current limiting fuses shall provide a means of disconnecting the AFD from the line under fault conditions.

(3) Three contactor bypass shall include a drive input disconnect, an AFD input isolation contactor, bypass contactor and an AFD output contactor that is electrically and mechanically interlocked with the bypass contactor. This circuit shall include control logic, status lights and motor over-current relays. The complete bypass system. Hand-Off-Auto with Inverter-Bypass selector switch(s), and Inverter/Bypass pilot lights shall be packaged with the AFD. The unit may be set up for Manualbypass operation upon an AFD trip.

(4) AC output contactor to provide a means for positive disconnection of the drive output from the motor terminals.

(5) Fused space heaters with thermostat for oversize enclosures to minimize condensation potential upon drive shutdown.

(6) Laminated plastic or steel nameplate engraved with user's identifying name or number for oversize enclosures.

(7) Control to allow AFD to interface with remote dry contacts.

(8) Motor over-current relay to provide sensing of a given level of load current.

(9) Input isolation transformers, separately mounted, with NEMA 1 enclosure.

(10) Motor filter for use on motor cable runs exceeding 100 feet for motors with a peak voltage insulation rating less than 1600 Vac.

(11) The dv/dt filter shall be located at the AFD and shall reduce the dv/dt clamp any voltage overshoots of the AFD output. It will return the energy in the voltage overshoots to the AFD DC bus. A power dissipative resistance device is not acceptable.

(12) Dynamic braking control circuitry shall be provided to decelerate the motor faster than the internal losses can absorb. Dynamic braking shall cause an optional resistor bank, when specified, to be switched onto the DC link as required to absorb the regenerative energy. This shall allow the fastest controlled deceleration and/or stop without an over-voltage condition. The resistor bank, when specified, shall be located external to the drive enclosure to prevent overheating of the drive.

(13) Resistor bank for dynamic braking load rated for 100 percent braking torque for a 20 percent duty cycle based on a sixty-second cycle time.

(14) Copy/Paste keypad

(a) The operator interface shall consist of a LCD keypad located on the front of the AFD. Features shall include:

Nine pushbuttons for selection, display, and modification of the AFD characteristics as follows:

(i) Scroll left
(ii) Scroll right
(iii) Scroll up/increase
(iv) Scroll down/decrease
(v) Enter
(vi) Reset
(vii) Start
(viii) Stop
(ix) Local/Remote

(b) The keypad LCD panel shall provide a choice of 4-line 16 character/line, backlit alphanumeric LCD display.

(c) The operator shall be able to scroll through the keypad menu to choose between the following screens:

(i) Parameters
(ii) Keypad control
(iii) Active faults
(iv) Fault history
(v) System menu
(vi) Expander boards
(vii) Monitor
(viii) Operate menu

(15) Serial communication shall be coordinated between the AFD and the pump controller by the systems integrator.

(16) Provide an input EMI filter to minimize conducted electrical noise to meet the requirements of IEC 61800-3.

u. Spare Parts - The main logic board, keypad and power supply board shall be supplied as spares, one for each different part number supplied.

v. The AFD manufacturer shall maintain, as part of a national network, engineering service facilities within 100 miles of project to provide start-up service, emergency service calls, repair work, service contracts, maintenance and training of customer personnel.

2.8.6 Panelboards for Motor Control Centers

Panelboards shall meet the requirements of paragraph PANELBOARDS.

2.8.7 Distribution Transformers

Dry type transformers for power and lighting loads shall be furnished with voltage and kVA ratings as indicated on the drawings. The transformers shall conform to the requirements for general-purpose transformers in NEMA ST 20. Each transformer shall be protected on the primary side with a molded case circuit breaker as indicated on the drawings.

2.8.8 Ground Detector Indicator

Ground-detector indicator (GDI) shall be rated 120-volts; have three lamps, one per phase, three 480-120 volt transformers connected delta-wye, adjustable loading resistor for balancing capacitive charging current, and push-to test-switch. GDI shall provide visual indication of a single ground-fault on any phase (A, B, or C) of a three-phase, three-wire

ungrounded power system. When no phase is grounded, all lamps shall glow at partial brightness, giving long lamp life, the push-to test switch shall not affect the brightness of any lamp. When a single ground-fault occurs on any phase, the lamp that corresponds to the faulted phase shall be dark and the other two lamps shall glow at full brightness. The push-to-test switch shall cause all lamps to return to partial brightness, showing the GDI is functioning properly.

2.8.9 Wiring for Motor Control Centers

All wiring shall meet the requirements of paragraph WIRING above. Provide heavy-duty clamp type terminals for terminating all power cables entering the control centers.

2.8.9.1 Contractor's Wiring

The Contractor's wiring shall be formed into groups, suitably bound together, properly supported and run straight horizontally or vertically. There shall be no splices in the wiring. The manufacturer's standard pressure-type wire terminations for connections to internal devices will be acceptable. Terminal blocks shall be added for wiring to devices having leads instead of terminals. Ring tongue indented terminals shall be used on all wires terminated on control terminal blocks for external or interpanel connections and at shipping splits. All stud terminals shall have contact nuts and either locking nuts or lockwashers.

2.8.9.2 External Connections

Power and control cables will enter the control centers at the bottom.

2.8.9.3 Terminal Blocks

Terminal blocks shall meet the requirements of paragraph TERMINAL BLOCKS above. In no case shall the terminals provided for circuit breakers or contactors accommodate less than the number or size of conductors shown on the drawings. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.8.10 Accessories and Control Devices

Control accessories shall be provided, and shall be suitable for mounting on the front of, or inside, the control centers as indicated on the drawings. Control accessories shall meet the applicable requirements of NEMA ICS 2. Relays and other equipment shall be so mounted that mechanical vibration will not cause false operation.

2.8.10.1 Control Stations

Push-button stations and selector switches shall conform to NEMA ICS 2, shall be of the heavy-duty, oil-tight type, rated 600 volts ac, and have a contact rating designation of A600. Switches shall be provided with escutcheon plates clearly marked to show operating positions.

2.8.10.2 LED Indicating Lights

Red and green LED's shall be furnished where shown on the drawings, indicating contact "open" and "closed" position. The LED's shall be accessible and replaceable from the front of the control center through a

finished opening in the compartment door. The LED assemblies shall be of the heavy duty oiltight, watertight, and dusttight type.

2.8.10.3 Control Relays

Control relays shall be of the electrically operated, magnetically held, self-reset, open type, suitable for mounting inside the starter compartments, and shall be 120-volt ac. Contacts shall be as indicated on the drawings and shall have a contact rating designation of A600 or N600, as required, in accordance with NEMA ICS 2.

2.8.10.4 Elapsed-Time Meters

Hour-indicating time meters shall have six-digit registers with counter numbers at least 1/4 inch high. White numbers on black backgrounds shall provide hour indication with the last digit in contrasting colors to indicate tenths of an hour. The enclosure shall be 3-1/2 inches square and dust resistant. Operating voltage shall be 120 volts ac. They shall be of the nonreset type.

2.8.11 Feeder Tap Units

Feeder tap units shall be provided as indicated on the drawings.

2.9 PANELBOARDS

Panelboards shall consist of assemblies of molded-case circuit breakers with buses and terminal lugs for the control and protection of branch circuits to motors, heating devices and other equipment operating at 480 volts ac or less. Panelboards shall be UL 67 labeled. "Loadcenter" type panels are not acceptable. Panelboards shall be designed for installation in surface-mounted or flush-mounted cabinets accessible from the front only, as shown on the drawings. Panelboards shall be fully rated for a short-circuit current of 14,000 symmetrical amperes RMS ac.

2.9.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gage if flush-mounted or mounted outdoors, and not less than No. 12 gage if surface-mounted indoors, with full seam-welded box ends. Cabinets mounted outdoors or flush-mounted shall be hot-dipped galvanized after fabrication. Cabinets shall be painted in accordance with paragraph PAINTING. Outdoor cabinets shall be of NEMA 3R raintight and conduit hubs welded to the cabinet Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch. Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface. Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets. Enclosure shall have nameplates in accordance with paragraph NAMEPLATES. Directory holders,

containing a neatly typed or printed directory under a transparent cover, shall be provided on the inside of panelboard doors.

2.9.2 Buses

All panelboards shall be of the dead-front type with buses and circuit breakers mounted on a plate or base for installation as a unit in a cabinet. All buses shall be of copper. Copper bars and shapes for bus conductors shall conform to the applicable requirements of ASTM B187/B187M. The sizes of buses and the details of panelboard construction shall meet or exceed the requirements of NEMA PB 1. Suitable provisions shall be made for mounting the bus within panelboards and adjusting their positions in the cabinets. Terminal lugs required to accommodate the conductor sizes shown on the drawing, shall be provided for all branch circuits larger than No. 10 AWG. A grounding lug suitable for 1/0 AWG wire shall be provided for each panelboard.

2.9.3 Components

Each branch circuit, and the main buses where so specified or shown on the drawings, shall be equipped with molded-case circuit breakers having overcurrent trip ratings as shown on the drawings. The circuit breakers shall be of a type designed for bolted connection to buses in a panelboard assembly, and shall meet the requirements of paragraph MOLDED CASE CIRCUIT BREAKERS. Circuit breakers of the same frame size and rating shall be interchangeable.

2.10 FACTORY TESTS

Each item of equipment supplied under this contract shall be given the manufacturer's routine factory tests and tests as specified below, to insure successful operation of all parts of the assemblies. All tests required herein shall be witnessed by the Contracting Officer unless waived in writing, and no equipment shall be shipped until it has been approved for shipment by the Contracting Officer.

a. Submit six copies of manufacturer's routine factory test procedures and production line tests for all motor control centers and switchboards, within a minimum of 14 calendar days prior to the proposed date of tests. Notify the Contracting Officer a minimum of 14 calendar days prior to the proposed date of the tests so that arrangements can be made for the Contracting Officer to be present at the tests.

b. The factory test equipment and the test methods used shall conform to the applicable NEMA Standards, and shall be subject to the approval of the Contracting Officer. Submit six complete reproducible copies of the factory inspection results and six complete reproducible copies of the factory test results in booklet form, including all plotted data curves, all test conditions, a listing of test equipment complete with calibration certifications, and all measurements taken.

c. Report shall be signed and dated by the Contractor's and Contracting Officer's Representatives. Reports of all witnessed tests shall be signed by witnessing representatives of the Contractor and Contracting Officer. The cost of performing all tests shall be borne by the Contractor and shall be included in the prices bid in the schedule for equipment.

2.10.1 Motor Control Centers Tests

2.10.1.1 Dielectric Tests

Each motor control center shall be completely assembled and given dielectric tests in accordance with NEMA ICS 1.

2.10.1.2 Operational Tests

The correctness of operation of each air circuit breaker or motor circuit protector and magnetic contactor and of all control devices, accessories and indicating lamps, shall be checked. These checks shall be made at rated voltage with power supplies to the main buses. All magnetic contactors shall also be checked for proper operation with power at 90 percent of rated voltage.

2.10.1.3 Short Circuit Tests

If the unit is not UL labeled for the specified short circuit, the Contractor may submit design tests demonstrating that satisfactory short-circuit tests, as specified in NEMA ICS 2, have been made on a motor control center of similar type of construction and having the same available short circuit current at the motor terminals, including any motor contributions, as the motor control centers specified to be furnished under these specifications.

2.10.2 Panelboards Tests

Each panelboard shall be assembled with cabinet and front to the extent necessary to check the fit and provisions for installing all parts in the field. Each panelboard shall be given a dielectric test in accordance with NEMA PB 1. All circuit breakers shall be operated to check mechanical adjustments. All doors and locks shall be checked for door clearances and fits and the performance of lock and latches.

2.11 PAINTING

Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray, and equipment located outdoors shall be ANSI Light Grey . All touch-up work shall be done with manufacturer's coatings as supplied under paragraph SPARE PARTS.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to NFPA 70 and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounds and grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Equipment Grounding

Provide bare copper cable not smaller than No. 4/0 AWG not less than 24 inches below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 MCC

MCCs shall be installed in accordance with the requirements of NEMA ICS 18.

3.3.2 Meters and Instrument Transformers

ANSI C12.1

3.3.3 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3.4 Galvanizing Repair

Repair damage to galvanized coatings using ASTM A780/A780M, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

3.3.5 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FIELD QUALITY CONTROL

Submit request for settings of breakers to the Contracting Officer after approval of MCC and at least 30 calendar days in advance of their requirement.

3.4.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.4.1.1 MCC

MCC shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical, electrical, and mechanical condition.

(3) Verify appropriate anchorage, required area clearances, and correct alignment.

(4) Clean MCC and verify shipping bracing, loose parts, and documentation shipped inside cubicles have been removed.

(5) Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

(6) Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings as well as to the circuit breaker’s address for microprocessor-communication packages.

(7) Verify that current transformer ratios correspond to approved shop drawings.

(8) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(9) Confirm correct operation and sequencing of electrical and mechanical interlock systems.

(10) Confirm correct application of manufacturer's recommended lubricants.

(11) Inspect insulators for evidence of physical damage or contaminated surfaces.

(12) Verify correct barrier and shutter installation and operation.

(13) Exercise all active components.

(14) Inspect all mechanical indicating devices for correct operation.

(15) Verify that filters are in place and vents are clear.

(16) Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

(17) Inspect control power transformers.

b. Electrical Tests

(1) Perform insulation-resistance tests on each bus section.

(2) Perform dielectric withstand voltage tests.

(3) Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.

(4) Perform control wiring performance test.

(5) Perform primary current injection tests on the entire current circuit in each section of assembly.

(7) Verify operation of MCC heaters.

(8) Verify proper ABC rotation.

3.4.1.2 Circuit Breakers - Low Voltage - Power

Circuit breakers - low voltage - power elements shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Compare nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect anchorage, alignment, and grounding.

(4) Verify that all maintenance devices are available for servicing and operating the breaker.

(5) Inspect arc chutes.

(6) Inspect moving and stationary contacts for condition, wear, and alignment.

(7) Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of the breaker are correct.

(8) Perform all mechanical operator and contact alignment tests on both the breaker and its operating mechanism.

(9) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(10) Verify cell fit and element alignment.

(11) Verify racking mechanism.

(12) Confirm correct application of manufacturer's recommended lubricants.

b. Electrical Tests

(1) Perform contact-resistance tests on each breaker.

(2) Perform insulation-resistance tests.

(3) Adjust Breaker(s) for final settings in accordance with Government provided settings.

(4) Determine long-time minimum pickup current by primary current injection.

(5) Determine long-time delay by primary current injection.

(10) Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and antipump function.

(11) Verify operation of charging mechanism.

3.4.1.3 Current Transformers

Current transformers shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify correct connection.

(4) Verify that adequate clearances exist between primary and secondary circuit.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform insulation-resistance tests.

(3) Perform polarity tests.

(4) Perform ratio-verification tests.

3.4.1.4 Metering and Instrumentation

Metering and instrumentation shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical Tests

(1) Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

(2) Calibrate watthour meters according to manufacturer's published data.

(3) Verify all instrument multipliers.

(4) Electrically confirm that current transformer and voltage transformer secondary circuits are intact.

3.4.1.5 Grounding System

Grounding systems shall conform to the following requirements:

a. Visual and Mechanical Inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

(1) IEEE 81. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and

grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.4.1.6 Adjustable Frequency Drives

Provide the services of a qualified manufacturer's employed Field Service Engineer to assist the Contractor in installation and start-up of the equipment specified under this section. Field Service personnel shall be factory trained with periodic updates and have experience with the same model of AFD on the job site. Sales representatives will not be acceptable to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, installation as specified in manufacturer's installation instructions, wiring, application dependant adjustments, and verification of proper AFD operation.

The Contractor under the technical direction of the manufacturer's service representative shall perform the following minimum work.

a. Inspection and final adjustments,

b. Operational and functional checks of AFD and spare parts, and

c. The contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the AFD in accordance with those instructions.

The Contractor shall provide three) copies of the manufacturer's field start-up report before final payment is made.

3.4.2 Harmonic Analysis

Submit harmonic analysis results. Harmonic analysis studies shall be per NETA ATS and IEEE 399.

3.4.3 Follow-Up Verification

Upon completion of acceptance checks, settings, and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Trip circuit breakers by operation of each protective device. Test each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, provide the Contracting Officer five working days advance notice of the dates and times for checks, settings, and tests.

3.5 WARRANTY OF ADJUSTABLE FREQUENCY DRIVE

Warranty to commence 24 months from the date of start-up, not to exceed 36 months from the date of shipment, and include all parts, labor, and travel time.

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COORDINATED POWER SYSTEM PROTECTION
10/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C37.13	(2015) Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE C37.16	(2009) Standard for Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC 3200 V and below) Power Circuit Breakers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C37.50	(20122018) American National Standard for Switchgear--Low-Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures
NEMA FU 1	(2012) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 3	(2005; R 2010) Medium-Voltage Controllers Rated 2001 to 7200 V AC
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17)

National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 198M	(2018) UL Standard for Mine-Duty Fuses
UL 486E	(2015; Reprint Nov 2017Apr 2019) UL Standard for Safety Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 508	(2018) UL Standard for Safety Industrial Control Equipment
UL 845	(2005; Reprint Oct 2018) UL Standard for Safety Motor Control Centers
UL 1203	(2013; Reprint Apr 2018) UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

1.2 SYSTEM DESCRIPTION

The power system covered by this specification consists of project service entrance, motor control center, and generator equipment. Designer of record (DOR) shall be responsible for modeling of pump station power distribution system. Once final equipment has been approved and installed, DOR shall update model to determine coordination settings on all devices. Setting shall be provide to contractor to implement.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment

Protective Relays

Installation

SD-06 Test Reports

Field Testing

SD-07 Certificates

Devices and Equipment

1.4 QUALITY ASSURANCE

The System Installer for the calibration, testing, adjustment, and placing into service of the protective devices shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of two years of current product experience in protective devices.

1.5 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected when received and prior to acceptance from conveyance. Protect stored items from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Provide protective devices and equipment which are the standard product of a manufacturer regularly engaged in the manufacture of the product and that essentially duplicate items that have been in satisfactory utility type use for at least two years prior to bid opening. Submit data consisting of manufacturer's time-current characteristic curves for individual protective devices, recommended settings of adjustable protective devices, and recommended ratings of non-adjustable protective devices. Submit manufacturer certificates for devices and equipment.

2.2 NAMEPLATES

Provide nameplates to identify all protective devices and equipment. Nameplate information shall be in accordance with UL 489.

2.3 CORROSION PROTECTION

Metallic materials shall be protected against corrosion. Ferrous metal hardware shall be zinc or chrome-plated.

2.4 MOTOR CONTROLS AND MOTOR CONTROL CENTERS

Motor controls and motor control centers shall be in accordance with NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508and UL 845.

2.4.1 Motor Starters

Provide combination starters with circuit breakers.

2.4.2 Thermal-Overload Protection

Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

2.4.3 Low-Voltage Motor Overload Relays

2.4.3.1 General

Thermal overload relays and solid state overload monitoring (within variable frequency drives) shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided either integral with the motor or controller, and shall be rated in accordance with the requirements of NFPA 70. Standard units shall be used for motor starting times up to seven seconds. Quick trip units shall be used on hermetically sealed, submersible pumps, and similar motors.

2.4.3.2 Construction

Manual reset type thermal relays shall be bimetallic construction. Automatic reset type relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

2.4.3.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Where the controller is remotely-located or difficult to reach, an automatic reset, non-compensated overload relay shall be provided. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than 14 degrees Fahrenheit (F), an ambient temperature-compensated overload relay shall be provided.

2.4.4 Automatic Control Devices

2.4.4.1 Direct Control

Automatic control devices (such as thermostats, float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose and have an adequate horsepower rating.

2.4.4.2 Pilot-Relay Control

Where the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

2.4.4.3 Manual/Automatic Selection

Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.

Connections to the selector switch shall only allow the normal automatic regulatory control devices to be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the

Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

2.4.5 Motor Control Centers

Control centers shall be outdoor type and shall contain variable frequency drives, combination starter and other equipment as indicated. Control centers shall be NEMA ICS 2, Class I, Type B. Each control center shall be mounted on floor sills or mounting channels. Each circuit shall have a suitable metal or laminated plastic nameplate with white cut letters. Motor control centers shall be provided with a full-length ground bus bar.

2.5 LOW-VOLTAGE FUSES

2.5.1 General

Low-voltage fuses shall conform to NEMA FU 1. Time delay and nontime delay options shall be as specified. Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics requires for effective power system coordination.

2.5.2 Cartridge Fuses; Noncurrent-Limiting Type

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. Class H Fuses shall conform to UL 198M. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds. Cartridge fuses shall be used for circuits rated in excess of 30 amperes, 125 volts, except where current-limiting fuses are indicated.

2.5.3 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class G, J, K, and RK5 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject Class H fuses.

a. Class G, J, and L fuses shall conform to UL 198M.

b. Class K fuses shall conform to UL 198M.

2.5.3.1 Continuous Current Ratings (600 amperes and smaller)

Service entrance and feeder circuit fuses (and smaller) shall be Class RK5 and J, current-limiting, time-delay with 200,000 amperes interrupting capacity.

2.5.3.2 Motor and Transformer Circuit Fuses

Motor, motor controller, transformer, and inductive circuit fuses shall be

Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

2.6 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

2.6.1 General

Motor short-circuit protectors shall conform to UL 508 and shall be provided as shown. Protectors shall be used only as part of a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection, and shall be rated in accordance with the requirements of NFPA 70.

2.6.2 Construction

Motor short-circuit protector bodies shall be constructed of high temperature, dimensionally stable, long life, nonhygroscopic materials. Protectors shall fit special MSCP mounting clips and shall not be interchangeable with any commercially available fuses. Protectors shall have 100 percent one-way interchangeability within the A-Y letter designations. All ratings shall be clearly visible.

2.6.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Letter designations shall be A through Y for motor controller Sizes 0, 1, 2, 3, 4, and 5, with 100,000 amperes interrupting capacity rating. Letter designations shall correspond to controller sizes as follows:

CONTROLLER SIZE	MSCP DESIGNATION
NEMA 0	A-N
NEMA 1	A-P
NEMA 2	A-S
NEMA 3	A-U
NEMA 4	A-W
NEMA 5	A-Y

2.7 MOLDED-CASE CIRCUIT BREAKERS

2.7.1 General

Molded-case circuit breakers shall conform to UL 489 and UL 489. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers. Circuit breakers and circuit breaker enclosures located in hazardous (classified) areas shall conform to UL 1203.

2.7.2 Construction

Molded-case circuit breakers shall be assembled as an integral unit in a

supporting and enclosing housing of glass reinforced insulating material providing high dielectric strength. Circuit breakers shall be suitable for mounting and operating in any position. Lugs shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.7.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with UL 489. Ratings shall be coordinated with system X/R ratio.

2.7.4 Cascade System Ratings

Circuit breakers used in series combinations shall be in accordance with UL 489. Equipment, such as switchboards and panelboards, which house series-connected circuit breakers shall be clearly marked accordingly. Series combinations shall be listed in the UL Recognized Component Directory under "Circuit Breakers-Series Connected".

2.7.5 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes at and above 50 amperes.

2.7.6 Solid-State Trip Elements

Solid-state circuit breakers shall be provided as shown. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other contaminants. Solid-state sensing shall measure true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be toroidal construction, encased in a plastic housing filled with epoxy to protect against damage and moisture and shall be integrally mounted on the breaker. Where

indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as shown on the drawings and as described below:

a. Long-time current pick-up, adjustable from 50 percent to 100 percent of continuous current rating.

b. Fixed long-time delay.

c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.

d. Adjustable short-time delay.

e. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.

f. Ground-fault pick-up, adjustable from 20 percent to 60 percent of sensor rating, but in no case greater than 1200 amperes. Sensing of ground-fault current at the main bonding jumper or ground strap shall not be permitted.

g. Fixed ground-fault delay.

h. Overload Ground-fault trip indicators shall be provided.

2.7.7 Current-Limiting Circuit Breakers

Current-limiting circuit breakers shall be provided as shown. Current-limiting circuit breakers shall limit the let-through I square times t to a value less than the I square times t of one-half cycle of the symmetrical short-circuit current waveform. On fault currents below the threshold of limitation, breakers shall provide conventional overload and short-circuit protection. Integrally-fused circuit breakers shall not be used.

2.7.8 SWD Circuit Breakers

Circuit breakers rated 15 amperes or 20 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be marked "SWD".

2.7.9 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, one-pole or two-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type".

2.7.10 Motor Circuit Protectors (MCP)

Motor circuit protectors shall conform to UL 489 and UL 489 and shall be provided as shown. MCPs shall consist of an adjustable instantaneous trip circuit breaker in conjunction with a combination motor controller which provides coordinated motor circuit overload and short-circuit protection. Motor Circuit Protectors shall be rated in accordance with NFPA 70.

2.8 LOW-VOLTAGE POWER CIRCUIT BREAKERS

2.8.1 Construction

Low-voltage power circuit breakers shall conform to IEEE C37.13 and IEEE C37.16 and shall be three-pole, single-throw, stored energy, electrically operated, with drawout mounting. Solid-state trip elements which require no external power connections shall be provided. Circuit breakers shall have an open/close contact position indicator, charged/discharged stored energy indicator, primary disconnect devices, and a mechanical interlock to prevent making or breaking contact of the primary disconnects when the circuit breaker is closed. Control voltage shall be 24 V dc The circuit breaker enclosure shall be suitable for its intended location.

2.8.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Circuit breakers shall be rated for 100 percent continuous duty and shall have trip current ratings and frame sizes as shown. Nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings shall be in accordance with IEEE C37.16. Tripping features shall be as follows:

a. Long-time current pick-up, adjustable from 50 percent to 100 percent of sensor current rating.

b. Adjustable long-time delay.

c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.

d. Adjustable short-time delay.

e. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.

f. Ground-fault pick-up, adjustable from 20 percent to 60 percent of sensor rating, but in no case greater than 1200 amperes. Sensing of ground-fault current at the main bonding jumper or ground strap shall not be permitted.

g. Fixed ground-fault delay.

h. Overload and Ground-fault trip indicators shall be provided.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 INSTALLATION

Submit procedures including diagrams, instructions, and precautions required to properly install, adjust, calibrate, and test the devices and

equipment. Install protective devices in accordance with the manufacturer's published instructions and in accordance with the requirements of NFPA 70 and IEEE C2.

3.3 FIELD TESTING

Prior to field tests, submit the proposed test plan consisting of complete field test procedure, tests to be performed, test equipment required, and tolerance limits, and complete testing and verification of the ground fault protection equipment, where used. Submit performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

3.3.1 General

Perform field testing in the presence of the Contracting Officer. Notify the Contracting Officer 14 calendar days prior to conducting tests. Furnish all materials, labor, and equipment necessary to conduct field tests. Perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. Maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results.

3.3.2 Safety

Provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. Replace any devices or equipment which are damaged due to improper test procedures or handling.

3.3.3 Molded-Case Circuit Breakers

Circuit breakers shall be visually inspected, operated manually, and connections checked for tightness. Current ratings shall be verified and adjustable settings incorporated in accordance with the coordination study.

3.3.4 Power Circuit Breakers

3.3.4.1 General

Visually inspect the circuit breaker and operate the circuit breaker manually; adjust and clean primary contacts in accordance with manufacturer's published instructions; check tolerances and clearances; check for proper lubrication; and ensure that all connections are tight. For electrically operated circuit breakers, verify operating voltages on closing and tripping coils. Verify fuse ratings in control circuits; electrically operate the breaker, where applicable; and implement settings in accordance with the coordination study.

3.3.4.2 Power Circuit Breaker Tests

The following power circuit breakers shall be tested in accordance with NEMA C37.50.

a. Main and Generator,

b. Flood and Sump Pump Feeders, and

c. Control Panel Circuit Breaker.

3.3.5 Protective Relays

Protective relays shall be visually and mechanically inspected, adjusted, tested, and calibrated in accordance with the manufacturer's published instructions. Submit data including calibration and testing procedures and instructions pertaining to the frequency of calibration, inspection, adjustment, cleaning, and lubrication. Tests shall include pick-up, timing, contact action, restraint, and other aspects necessary to ensure proper calibration and operation. Relay settings shall be implemented in accordance with the coordination study. Relay contacts shall be manually or electrically operated to verify that the proper breakers and alarms initiate.

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EARTHWORK

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1140	(2017) Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2487	(2017) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and

	Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D698	(2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, CL-ML. Satisfactory materials for grading comprise stones less than eight inches, except for fill material for pavements and railroads which comprise stones less than three inches in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136/C136M and ASTM D1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.2.5 Topsoil

Material suitable for topsoils obtained from excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.2.6 Unstable Material

Unstable materials are too wet to properly support the utility pipe or structure.

1.2.7 Select Granular Material

1.2.7.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, SP, by ASTM D2487 where indicated.

1.2.8 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks three inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

1.2.9 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material are a uniformly graded washed sand with a maximum particle size of five inches and less than five percent passing the No. 200 size sieve, and with not more than three percent by weight finer than 0.02 mm grain size.

1.3 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring; G, DG

SD-03 Product Data

Utilization of Excavated Materials; G, DG

SD-06 Test Reports

Testing

SD-07 Certificates

Testing

PART 2 PRODUCTS

2.1 MATERIAL FOR RIPRAP

Refer to Section 31 37 16.00 03 RIPRAP FOR EROSION CONTROL.

2.1.1 Bedding Material

Refer to Section 31 37 16.00 03 RIPRAP FOR EROSION CONTROL.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where shown, topsoil shall be stripped. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than one inch in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the Drawings. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum four feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of

structure footings and foundations as shown. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete is to be placed.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Refer to Section 31 23 19 PROTECTION AND DEWATERING for dewatering requirements.

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of three inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove

such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.3 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.3 SHORING

3.3.1 General Requirements

Submit a Shoring and Sheeting plan for approval 30 calendar days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.3.2 Geotechnical Engineer

Hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contracting Officer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.4 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Backfill and compact over excavations to 95 percent ASTM D698 maximum density

3.5 GROUND SURFACE PREPARATION

3.5.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in

excavated areas. Scarify the surface to a depth of six inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than one vertical to four horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of six inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.5.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted.

3.6 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.7 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, in successive horizontal layers of loose materia not more than eight inches in depth. Compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Backfill material must be within the range of minus two to plus two percent of optimum moisture content at the time of compaction.

Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.7.1 Trench Backfill

Backfill trenches to the grade shown and as described in Section 33 40 00 STORM DRAINAGE UTILITIES.

3.7.1.1 Bedding and Initial Backfill

Provide bedding of the type and thickness shown. Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ASTM D698 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

3.7.1.1.1 Class I

Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

3.7.1.1.2 Class II

Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.7.1.1.3 Sand

Clean, coarse-grained sand classified as SW or SP by ASTM D2487 for bedding and backfill as indicated.

3.7.1.1.4 Gravel and Crushed Stone

Clean, coarsely graded natural gravel, crushed stone or a combination thereof having a classification of GW or GP in accordance with ASTM D2487 for bedding and backfill as indicated. Do not exceed maximum particle size of 3 inches.

3.7.1.2 Final Backfill

Fill the remainder of the trench with satisfactory material. Place backfill material and compact as follows:

3.7.1.2.1 Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.7.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for three calendar days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.8 SUBGRADE PREPARATION

3.8.1 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Bring up low areas resulting from removal of unsatisfactory material to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.8.2 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.9.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.9.2 Grading Around Structures

Construct areas within five feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.10 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a two inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of six inches and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry.

Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.11 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with ASTM D6938. ASTM D6938 results in a wet unit weight of soil in determining the moisture content of the soil when using this method.

b. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.

c. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.11.1 Fill and Backfill Material Gradation

One test per 500 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136/C136M or ASTM D1140.

3.11.2 In-Place Densities

In-Place density test shall be completed as listed below:

a. One test per 200 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 100 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

3.11.3 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.11.4 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including

borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.11.5 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.11.6 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to two feet above the top of the pipe, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 36 inches, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.12 DISPOSITION OF SURPLUS MATERIAL

Place surplus material soil material not required or suitable for filling or backfilling as shown on the plans. Remove brush, refuse, stumps, roots, and timber from Government property to a location in accordance with Section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLINOIS.

-- End of Section --

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DIVISION 31 - EARTHWORK

SECTION 31 23 19

PROTECTION AND DEWATERING

08/19

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SECTION 31 23 19

PROTECTION AND DEWATERING
08/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Dewatering Plan; G,DT,DH

Dewatering Structures; G, DT

PART 2 PRODUCTS

2.1 DEWATERING PLAN

Submit a comprehensive plan detailing the work items to be completed, the proposed time for accomplishing the same, the method proposed to install the dewatering structures, the method proposed to dewater the areas in which work is to be performed in the dry, the method proposed to dispose the discharge from dewatered areas in accordance with Section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLINOIS, and the method proposed to seal leakage around or through the dewatering structures, through cracks/joints in the concrete which may leak and where existing structures have concrete spalling and exposed reinforcing in the areas of the cofferdam seals. The Dewatering Plan must be approved by a licensed Structural Engineer. Submit the dewatering plan a minimum of 45 calendar days prior to the closue period.

2.2 DEWATERING STRUCTURES

Design, fabrication, location, and installation of dewatering structures in accordance with Corps of Engineers technical manuals, safety manuals, and applicable design codes such as ACI, ASCE, AISC, IBC, and AWS D1.1/D1.1M. Submit the proposed plan and detailed design drawings,

calculations, and other pertinent data related to the design and construction of the dewatering structures, including but not limited to possible walkways and handrails, as applicable, for approval a minimum of 45 calendar days prior to start of construction of such items. Proposed dewatering structure designs shall be performed by a licensed professional structural engineer in the State of Illinois with experience in designing dewatering structures and so indicated on the submitted design with the structural engineer's signed stamp. The cofferdam design shall consider the following technical requirements, at a minimum:

a. Cofferdam to be designed for water to the top of the structure in a dewatered state, as to provide the maximum hydraulic force on the structure. As such, cofferdam height extensions will not be allowed unless specifically included in the design.

b. Impact loads from falling debris and external forces such as floating debris and ice.

c. Consideration for all uplift forces on the cofferdam.

d. Considerations for securing the cofferdam to the existing structure, noting the condition of the existing concrete.

e. Considerations for sealing of cofferdam on sheetpile structures and surfaces which are cracked, spalled, which have exposed reinforcing or have other forms of deterioration.

Dewatering structures to be designed to fit the areas in which work is to be performed in the dry.

PART 3 EXECUTION

3.1 REMOVAL OF MATERIAL FROM DEWATERED AREAS

Remove all debris and materials in the dewatering structure location to ensure the Contractor-designed cofferdam may be placed and dewatered. If any hazardous materials, debris, or waste are encountered, work shall immediately cease and the Contracting Officer shall be notified. See Section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLINOIS, for removal of found hazardous materials, debris, or waste.

3.2 DEWATERING PLAN

A representative of the Contractor will be present at all times during dewatering and rewatering of the areas in which work is to be performed in the dry. During the time the work areas are dewatered and when a Contractor representative is not on the job site during Contractor working hours, the Contractor will ensure that a Contractor representative can be contacted via telephone at all times by Government personnel. If requested by the Contracting Officer, the Contractor representative will be able to be present on the project site within 1/2 hour after the request is made.

Include a list of equipment to be used in the Plan. Include perimeter and diversion ditches and dikes to be maintained to prevent surface water from entering any excavation. Control surface water that falls or flowing into the excavation by adequate pumps and sumps. Seepage of any water from excavated slopes should be controlled to prevent sloughing, and ponding of

water in the excavation and should be prevented during construction operations. If the flow of water into the excavation becomes excessive and cannot be controlled by the dewatering system that the Contractor has installed, excavation should be halted until satisfactory remedial measures have been taken. Comply with Section 01 57 20.01 03 ENVIRONMENTAL PROTECTION FOR ILLINOIS for the Dewatering Work and obtain all applicable permits prior to conducting any dewatering work.

Address provisions to control leakage around the cofferdam and through joints in the existing concrete structure.

3.3 REMOVAL OF DEWATERING EQUIPMENT

Upon completion of all work within the areas to be protected, the Contractor must remove all protective structure material, equipment, and appurtenances installed for protection and dewatering.

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RIPRAP FOR EROSION CONTROL

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SECTION 31 37 16.00 03

RIPRAP FOR EROSION CONTROL
12/14

PART 1 GENERAL

The work covered by this section includes the furnishing of all plant, labor, equipment, and materials; and performing all operations necessary for the installation of riprap and bedding material, in accordance with these specifications and drawings.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT)

IDOT	(2007) Standard Specifications for Road and Bridge Construction; and current Supplemental Specifications and Recurring Special Provisions

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following must be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Sources and Evaluation Testing; G, DG

SD-06 Test Reports

Bedding for Riprap Material; G, DG

Riprap Gradation; G, DG

Bedding Material Gradation; G, DG

1.3 SOURCES AND EVALUATION TESTING

Unless approved otherwise, materials must be procured from a supplier that holds current state certification as an approved, active commercial aggregate supplier. If the Contractor proposes to furnish materials from another source, the Contracting Officer's Representative (COR) will make such investigations and evaluations as necessary to determine whether or not materials meeting the contract requirements could be produced from the proposed source. Sources from which Contractor proposes to obtain the materials must be selected and submitted for approval at least 60 calendar days in advance of the proposed date when the material must be delivered to the project work site.

Include with the source the following information:

a. Geographical location (as opposed to P.O. Box or corporate headquarters),

b. Laboratory test results indicating the source meets the material requirements,

c. Proof of certification by Illinois Department of Transportation (IDOT), and

d. List of projects where similar quantitite and materials have been used in the past three years.

If additional laboratory testing is required, it shall be performed at USACE validated laboratories for the respective test procedures.

PART 2 PRODUCTS

2.1 STONE MATERIALS

Materials must meet all quality requirements outlined in this Section of the specification and specified gradations. Materials which have been delivered to the project site and are rejected, whether in stockpile or in place in the structure, must be removed from the project site at the Contractor's expense and must be returned to the source at the Contractor's expense.

2.2 RIPRAP

Riprap must be durable quarried or field stone of a quality suitable to ensure permanence in the structure and in the climate in which it is to be used. Material must meet the quality requirements outlined in this section. The stone must be well graded within the required limits and must be free from cracks, seams, and other defects that would unduly increase deterioration from natural causes. The inclusion of objectionable quantities of dirt, sand, clay, or rock fines will not be permitted. Neither the breadth nor the thickness of any piece of stone must be less than one third of its length. Occasional pieces of stone slightly larger than the maximum weight will be permitted, provided the gradation and voids are not unduly affected and that surface tolerances are met.

2.2.1 Riprap Gradation

Riprap must meet the gradation requirements of either RR-4 or RR-5, depending on the location of placement per the plans and IDOT Standard Specification.

2.3 BEDDING FOR RIPRAP MATERIAL

Bedding for riprap material must consist of cobbles, gravel and sand, or crushed stone, meeting the characteristics of "Class A" aggregate or better per IDOT and must be well graded. The material must be composed of tough, durable particles; must be free of thin, flat, and elongated pieces; and must contain no organic matter or soft friable particles in quantities considered by the Contracting Officer to be objectionable.

2.3.1 Bedding Material Gradation

Bedding for riprap material must meet the gradation requirements of CA-2 and IDOT Standard Specification.

PART 3 EXECUTION

3.1 FOUNDATION PREPARATION

Each foundation area must be excavated or filled to lines and grades shown, or otherwise established, within a tolerance of plus or minus two inches for areas at or above the river water surface and plus or minus three inches for areas below the river water surfaces. Fill such areas, at no additional expense to the Government, with: material similar to adjacent undisturbed in-place material and well compacted; or with bedding material. Immediately prior to placing bedding the prepared subgrade will be inspected by the COR and no material must be placed thereon until that area has been approved.

3.2 PLACEMENT

3.2.1 Bedding for Riprap

3.2.1.1 Bedding for Riprap Materials

Bedding for riprap materials must be spread uniformly on grade to the lines and grades shown on the drawings. The placing of material by methods of which could segregate particle sizes will not be permitted. All damage to the surface of the subgrade must be repaired before proceeding with the work. Except where bedding is used to repair damage to the subgrade, compaction will not be required but bedding must be finished to a uniform surface, free from mounds and windrows.

3.2.1.2 Bedding for Riprap Materials Placed Under Water

Bedding for riprap materials placed under water must be discharged from a bucket or other suitable container, resting on the subgrade, as close to its final position as practicable so as to avoid segregation. Bedding material must not be cast across, or dumped through, the water. Placed bedding material must be spread to a uniform thickness by dragging a bucket or other suitable device over the surface of placed material.

3.2.2 Riprap

3.2.2.1 Riprap Sections

Riprap sections must be dumped or dropped from a height not greater than 1.5 feet onto the bedding material. Riprap sections must be constructed to the lines and grades shown or established within a tolerance of six inches above and zero inches below the required grade, except either extreme must not be continuous over an area greater than 200 square feet. In circumstances where the existing bank does not allow for the lines and grades provided, coorinate with the COR for field placement. Riprap must be placed to the full surface course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing riprap in layers will not be permitted. The finished mass must be free from pockets of small stones, clusters, or larger stones and excessive

voids. Placing riprap by dumping into chutes or by similar methods likely to cause segregation will not be permitted. Distribution of various sizes of stones must be obtained during final placing, or by methods which will produce the required results. Rearranging of individual riprap stones by mechanical equipment or by hand will be required to obtain a reasonably well graded distribution of stone sizes. The Contractor must maintain the stone protection until accepted, and displaced material must be replaced by the Contractor at no additional cost to the Government.

3.2.2.2 Underwater Placement

Stone for riprap to be placed under water must meet gradation requirements in the bucket or container used for placing, and must be placed in a systematic manner directly on the subgrade, bedding for riprap, riprap, or rockfill so as to assure a continuous and uniform layer of well graded rock of that required thickness. Rock to be placed under water must not be cast across the surface of the water.

3.3 QUALITY CONTROL

The Contractor must establish and maintain quality control for work under this section to assure compliance with contract requirements and maintain quality control for all construction operations including, but not limited, to the following:

a. Quality,

b. Testing for gradation and shape,

c. Foundation preparation,

d. Elevations of underlying materials,

e. Layer thickness,

f. Uniformity of in place materials,and

g. Finish elevations of in-place materials.

A copy of the records of inspections and tests, as well as the records of corrective action taken, must be furnished to the Government as directed by the COR.

-- End of Section --

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SECTION 32 31 13

CHAIN LINK FENCES AND GATES
11/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A702	(2013) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A90/A90M	(2013; R 2018) Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM F1043	(2018) Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	(2018) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F567	(2014a) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2014) Standard Specification for Fence Fittings
ASTM F883	(2013) Padlocks

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191	(Rev K) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories)
FS RR-F-191/1	(Rev F) Fencing, Wire and Post, Metal

	(Chain-Link Fence Fabric)
FS RR-F-191/2	(Rev E) Fencing, Wire and Post, Metal (Chain-Link Fence Gates)
FS RR-F-191/3	(Rev E; Am 1) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FS RR-F-191/4	(Rev F) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Assembly; G, DT

Location of Gate, Corner, End, and Pull Posts; G, DT

Gate Assembly; G, DT

Gate Hardware and Accessories; G, DT

Erection/Installation Drawings; G, DT

SD-03 Product Data

Fence Assembly; G, DT

Gate Assembly; G,DT

Gate Hardware and Accessories; G, DT

Zinc Coating; G, DT

Stretcher Bars; G, CN

SD-04 Samples

Posts

Braces

Line Posts

Sleeves

Top Rail

Bottom Rail

Tension Wire

Stretcher Bars

Gate Posts

Gate Hardware and Accessories

Padlocks; G, CN

Wire Ties

SD-07 Certificates

Certificates of Compliance

SD-08 Manufacturer's Instructions

Fence Assembly

Gate Assembly

Hardware Assembly

Accessories

SD-11 Closeout Submittals

Recycled Material Content

1.3 QUALITY CONTROL

1.3.1 Certificates of Compliance

Submit certificates of compliance in accordance with the applicable reference standards and descriptions of this section for the following:

a. Zinc coating

d. Fabric

e. Stretcher bars

f. Gate hardware and accessories

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide fencing materials conforming to the requirements of ASTM A116, ASTM A702, ASTM F626.

Submit reports of listing chain-link fencing and accessories regarding

weight in ounces for zinc coating.

Submit manufacturer's catalog data for complete fence assembly, gate assembly, hardware assembly and accessories.

Fence must be designed to withstand either a concentrated load of 250 lbf at any location and any direction or a load of 50 plf along the top rail, whichever is more severe.

Fence should be designed to match the existing fences of the adjacent closure structures in terms of height and bar spacing. Fence/Gate design and shop drawings must be submitted for aprovial before fabrication.

2.2 COMPONENTS

2.2.1 Fabric

FS RR-F-191 and detailed specifications as referenced and other requirements as specified.

FS RR-F-191/1; Type I, zinc-coated steel, 9 gage . Mesh size, two inches. Provide selvage knuckled at one selvage and twisted and barbed at the other. Height of fabric, as indicated.

Provide fabric consisting of No. 9-gage wires woven into a two inch diamond mesh, with dimensions of fabric and wire conforming to ASTM A116, with 1.20 ounces per square foot zinc galvanizing.

Provide one-piece fabric widths for fence heights up to 12 feet.

2.2.1.1 Top and Bottom Selvages

Provide knuckled selvages at top and bottom for fabric with two inch mesh and up to 60 inches high, and if over 60 inches high, provide twisted and barbed top selvage and knuckled bottom selvage.

Knuckle top and bottom selvages for 1-3/4 inch and 1 inch mesh fabric.

2.2.2 Posts and Braces

FS RR-F-191/3 line posts; Class 1, steel pipe, Grade A or Bor . End, corner, and pull posts; Class 1, steel pipe, Grade A or B, , 6, steel square sections . Braces ; Class 1, steel pipe, Grade A or B or 3, formed steel sections, in minimum sizes listed in FS RR-F-191/3 for each class and grade .

2.2.3 Line Posts

Minimum acceptable line posts are as follows:

Up to 6 feet High:

Grade A: 1.900 inch O.D. pipe weighing 2.72 pounds per linear foot.

Grade B: 2.375 inch O.D. pipe weighing 3.12 pounds per linear foot.

Over 6 feet High:

2.5 inch O.D. pipe weighing 3.65 pounds per linear foot.

2.2.4 End, Corner, and Pull Posts

Provide minimally acceptable end, corner, and pull posts as follows:

Up to 6 feet High:

Grade A: 2.375 inch O.D. pipe weighing 3.65 pounds per linear foot.

Grade B: 2.375 inch O.D. pipe weighing 3.12 pounds per linear foot.

Over 6 feet High:

Grade A: 2.875 inch O.D. pipe weighing 5.79 pounds per linear foot.

Grade B: 2.875 inch O.D. pipe weighing 4.64 pounds per linear foot.

2.2.5 Top Rail

Provide top rails with Grade A weighing 2.27 pounds per linear foot or Grade B weighing 1.82 pounds per linear foot. Provide expansion couplings 6 inches long at each joint in top rails.

2.2.6 Bottom Rail

Provide bottom rail conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade unless members are to be oversized.

2.2.7 Post-Brace Assembly

Provide bracing consisting of 1.660 inches O.D. pipe, Grade A weighing 2.27 pounds per linear foot, and Grade B weighing 1.82 pounds per linear foot and 3/8 inch adjustable truss rods and turnbuckles.

2.2.8 Stretcher Bars

Provide bars that have one-piece lengths equal to the full height of the fabric with a minimum cross section of 3/16 by 3/4 inch, in accordance with ASTM F626.

2.2.9 Stretcher Bar Bands

Provide bar bands for securing stretcher bars to posts that are steel, wrought iron, or malleable iron spaced not over 15 inches on center. Bands may also be used in conjunction with special fittings for securing rails to posts. Provide bands with projecting edges chamfered or eased.

2.2.10 Post Tops

Provide tops that are steel, wrought iron, or malleable iron designed as a weathertight closure cap. Provide one cap for each post, unless equal protection is provided by a combination post-cap and wire supporting arm. Provide caps with an opening to permit through passage of the top rail.

2.2.11 Gate Posts

Provide a gate post for supporting each gate leaf as follows:

Up to 6-feet Wide:

Provide 2.875 inch O.D. pipe Grade A weighing 5.79 pounds per linear foot or Grade B weighing 4.64 pounds per linear foot.

Over 6 feet Wide and Up to 13 feet Wide:

Provide 2.875 inch O.D. pipe Grade A weighing 5.79 pounds per linear foot or Grade B weighing 4.64 pounds per linear foot.

Over 13-feet Wide and Up to 18-feet Wide:

Provide 6.625 inch O.D. pipe weighing 18.97 pounds per linear foot.

Over 18-feet Wide:

Provide 8.625 inch O.D. pipe weighing 24.70 pounds per linear foot.

2.2.12 Gates

FS RR-F-191/2; Type I, single swing . Shape and size of gate frame, as indicated. Framing and bracing members, round of steel alloy. Steel member finish, zinc-coated . Provide gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade, except that steel pipe frames are a minimum of 1.90 inches o.d., 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces are 1.869 inches o.d. minimum, 0.940 lb/ft of length. Gate fabric, is as specified for fencing fabric. Coating for steel latches, stops, hinges, keepers, and accessories, is galvanized Provide fork or plunger bar type gate latches. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding is not permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

For gate leaves up to 6 feet high or 6 feet wide, provide perimeter gate frames of 1.66 inch O.D. pipe Grade A weighing 2.27 pounds per linear foot or Grade B weighing 1.82 pounds per linear foot.

For gate leaves over 6 feet high or 6 feet wide, provide perimeter gate frames of 1.90 inch O.D. pipe Grade A weighing 2.72 pounds per linear foot or Grade B weighing 2.28 pounds per linear foot.

Provide gate frame assembly that is welded or assembled with special malleable or pressed-steel fittings and rivets to provide rigid connections. Install fabric with stretcher bars at vertical edges; stretcher bars may also be used at top and bottom edges. Attach stretcher bars and fabric to gate frames on all sides at intervals not exceeding 15 inches. Attach hardware with rivets or by other means which provides equal security against breakage or removal.

Provide diagonal cross-bracing, consisting of 3/8 inch diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist. Provide nonwelded gate frames with diagonal bracing.

Gate stops shall be placed is an appropriate postion to keep gate from hitting light pole.

2.2.13 Gate Hardware and Accessories

Provide gate hardware and accessories that conforms to ASTM A116 and ASTM F626, and be as specified:

Provide malleable iron hinges to suit gate size, non-lift-off type, offset to permit 180-degree opening.

Provide latch that permits operation from either side of the gate, with a padlock eye provided as an integral part of the latch.

Provide stops and holders of malleable iron for vehicular gates. Provide stops that automatically engage the gate and hold it in the open position until manually released.

2.2.14 Miscellaneous Hardware

Provide miscellaneous hot-dip galvanized hardware as required.

2.2.15 Wire Ties

Provide 9-gage galvanized steel wire for tying fabric to line posts,spaced 12 inches on center. For tying fabric to rails and braces, space wire ties 24 inches on center. For tying fabric to tension wire, space 0.105-inch hog rings 24 inches on center.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

FS RR-F-191/4. Provide wire ties constructed of the same material as the fencing fabric.

2.2.16 Padlocks

Provide padlocks conforming to ASTM F883, with chain.

2.3 MATERIALS

2.3.1 Zinc Coating

Provide hot-dip galvanized (after fabrication) ferrous-metal components and accessories, except as otherwise specified.

Provide zinc coating of weight not less than 1.94 ounces per square foot, as determined from the average result of two specimens, when tested in accordance with ASTM A90/A90M.

Provide zinc coating conforming to the requirements of the following:

a. Pipe: FS RR-F-191/3 Class 1 Grade A in accordance with ASTM F1083 or Grade B in accordance with ASTM F1043.

b. Hardware and Accessories: ASTM A153/A153M, Table 1

c. Surface: ASTM F1043

d. External: Type B-B surface zinc with organic coating, 0.97 ounce per square foot minimum thickness of acrylated polymer.

e. Internal: Surface zinc coating of 0.97 ounce per square foot minimum.

Provide galvanizing repair material that is cold-applied zinc-rich coating conforming to ASTM A780/A780M.

2.3.2 Tension Wire

Provide galvanized, coiled spring wire, No. 7-gage. Provide zinc coating that weighs not less than 1.2 ounces per square foot.

PART 3 EXECUTION

Submit manufacturer's erection/installation drawings and instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

Provide complete installation conforming to ASTM F567.

3.1 PREPARATION

Ensure final grading and established elevations are complete prior to commencing fence installation.

3.2 INSTALLATION

3.2.1 Fence Installation

Install fence on prepared surfaces to line and grade indicated. Secure fastening and hinge hardware in place to fence framework by peening or welding. Allow for proper operation of components. Coat peened or welded areas with a repair coating matching original coating. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.1.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Submit drawings showing location of gate, corner, end, and pull posts.

3.2.2 Top Rails

Provide top rails that run continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by the fencing manufacturer.

3.2.3 Brace Assembly

Provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Install brace assemblies so posts are plumb when the diagonal rod is under proper tension.

Provide two complete brace assemblies at corner and pull posts where

required for stiffness and as indicated.

3.2.4 Tension Wire Installation

Install tension wire by weaving them through the fabric and tying them to each post with not less than 7-gage galvanized wire or by securing the wire to the fabric with 10-gage ties or clips spaced 24 inches on center.

3.2.5 Fabric Installation

Provide fabric in single lengths between stretch bars with bottom barbs placed approximately 1-1/2 inches above the ground line. Pull fabric taut and tied to posts, rails, and tension wire with wire ties and bands.

Install fabric on the security side of fence, unless otherwise directed.

Ensure fabric remains under tension after the pulling force is released.

3.2.6 Stretcher Bar Installation

Thread stretcher bars through or clamped to fabric four inches on center and secured to posts with metal bands spaced 15 inches on center.

3.2.7 Gate Installation

Install gates plumb, level, and secure, with full opening without interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricated where necessary.

3.2.8 Tie Wires

Provide tie wires that are U-shaped to the pipe diameters to which attached. Twist ends of tie wires not less than two full turns and bent so as not to present a hazard.

3.2.9 Fasteners

Install nuts for tension bands and hardware on the side of the fence opposite the fabric side. Peen ends of bolts to prevent removal of nuts.

3.2.10 Zinc-Coating Repair

Clean and repair galvanized surfaces damaged by welding or abrasion, and cut ends of fabric, or other cut sections with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

3.2.11 Accessories Installation

3.2.11.1 Post Caps

Install post caps as recommended by the manufacturer.

3.2.11.2 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

3.2.12 Grounding

Ground fencing as indicated on drawings.

3.3 CLOSEOUT ACTIVITIES

Remove waste fencing materials and other debris from the work site.

Submit manufacturer's data indicating percentage of recycled material content in protective fence materials, including chain link fence, fabric, and gates to verify affirmative procurement compliance.

-- End of Section --

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SEEDING
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT)

IDOT	(2007) Standard Specifications for Road and Bridge Construction; and current Supplemental Specifications and Recurring Special Provisions

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Seed Mixes; G, CN

Delivery Schedule

SD-06 Test Reports

Seed

Fertilizer

SD-08 Manufacturer's Instructions

Erosion Control Material

SD-10 Operation and Maintenance Data

Maintenance Instructions

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Seed material shall be inspected upon arrival at the jobsite. The Contractor will insure that all seed materials are delivered in manufacturer's original, unopened containers with labels and tags intact and legible. The Contracting Officer shall certify that all seed materials received proper handling during delivery (including moisture content and temperature control), especially any grasses that need special attention between gathering and planting. Materials violating any of the above mentioned conditions shall be removed from the jobsite at no additional cost to the Government. Delivery of fertilizer to the site shall be in the original, unopened containers bearing manufacturer's chemical analysis. Instead of containers, fertilizer may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.

Submit the delivery schedule at least 10 working days before delivery.

1.3.2 Storage

Materials shall be stored in areas provided by the Contractor. Seed and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall not be stored with other landscape materials.

1.3.3 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4 RESTRICTIONS

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.5 TIME LIMITATIONS

Apply seed within twenty four hours after seed bed preparation. Apply seed during the planting season described in paragraph "Seeding Times".

PART 2 PRODUCTS

2.1 SEED

2.1.1 IDOT Seed Classification

State-certified seed of the latest season's crop, shall be provided in original sealed packages bearing the producer's guaranteed analysis for mixture percentage, purity, germination, weed seed content, and inert material. Labels shall be in conformance with AMS Seed Act, Federal Seed Act Regulations and applicable state seed laws.

2.1.2 Seed Mixtures

The contractor shall use a 2A class and Salt Tolerant Roadside seeding mixture type as defined in Articles 250.07 Seeding Mixture of the IDOT

Standard Specifications.

Submit seed mixes indicating the name and address of seed supplier and estimated seed per pound (or seed per ounce) of each species.

Submnit vendor's invoice for each shipment of seed material showing botanical and common names, quantities by species, geographic origin, and harvest date of seed.

Submit seed test reports for the mixture percentage, pure live seed, weed seed content, and germination. Submittal shall also include physical characteristics, and recommendations.

2.1.3 Weed Seed

Weed seed shall not exceed one percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed will be rejected. Create field mixes on site in the presence of the Contracting Officer's Representative.

2.2 SOIL AMENDMENTS

Soil amendments shall consist of standard 12-12-12 fertilizer and soil conditioners meeting the following requirements: Commercial grade, free flowing, uniform in composition, and conforming to Article 913.03 of IDOT, Standard Specifications. Fertilizers shall be applied at the rate of 800 lbs per acre.

Submit fertilizer product data and chemical analysis composition percent for review and approval. Include physical characteristics, and recommendations.

2.3 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials.

2.3.1 Straw Material

Straw mulch materials shall consist of wheat, oat, or rye straw, hay, grass cut from native grasses, or other plants approved by the Contracting Officer. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The mulch shall be seed free or fumigated to prevent introduction of weeds. The use of mulch that contains noxious weeds will not be accepted. Dry mulching material which breaks and does not bend is unacceptable. Mulch shall have a consistency for placing with commercial mulch blowing equipment.

2.4 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.5 HERBICIDE

Herbicide shall be broad spectrum that leaves no lasting harmful residues and allows planting within 10 to 14 working days after application. Herbicide shall be applied per manufacturer's recommendations.

2.6 SPECIAL SEEDING AND MULCHING EQUIPMENT

Only pneumatic tired tractors shall be permitted on levee sections having topsoil. Special equipment such as mulch spreaders may be used if approved by the Contracting Officer. The request for approval shall be made well in advance of the planned planting date and shall include full information on equipment and materials.

PART 3 EXECUTION

3.1 SEEDING TIMES

Seed shall ideally be sown from April 15 to June 30 for spring planting and from September 1 to October 15 for fall planting. In the event that seeding must occur from July 1 to August 31, the soil shall receive an equivalent of one inch of water per week, either through rainfall, watering, or both.

3.2 SITE PREPARATION

3.2.1 Preparation of Seeding Areas

3.2.1.1 Grading

The Contractor shall verify that the finished grades were executed as indicated on drawings, and that the placing of topsoil and the smooth grading have been completed. Deviations in the ground surface in relation to the grades indicated on the drawings shall be corrected prior to seeding.

3.2.1.2 Unsatisfactory Environmental Conditions

Site preparation work shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory condition prevails, the work shall be stopped when directed by the Contracting Officer.

3.2.2 Tilling

3.2.2.1 Minimum Depth

Soil shall be tilled to a minimum depth of four inches by plowing, disking, harrowing, rototilling or other approved method. On slopes two horizontal to one vertical and steeper, the soil shall be tilled to a maximum depth of two inches by scarifying with heavy rakes, or other approved method. Rototillers shall be used where soil conditions and length of slope permit. On slopes one horizontal to one vertical and steeper, no tillage is required.

3.2.2.2 Applying Fertilizer

For areas seeded with the seed mixture shown in Table 1, fertilizer, as specified herein, may be applied during tilling in accordance with the manufacturers recommendations.

3.2.3 Finished Grading

3.2.3.1 Preparation

Turf areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Turf areas compacted by construction operations shall be completely pulverized by tillage. Finished grade shall be one inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas.

Three copies written maintenance instructions for long-term and year-round care of turfed areas.

3.2.3.2 Debris, Three Inch

Graded areas within the work limits shall have debris and stones larger than three inches in any dimension removed from the surface.

3.2.3.3 Protection

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3.3 SEEDING

Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rains, traffic, or other cause, shall be reworked to restore the ground condition previously specified. Seed will not be broadcast when the wind velocity is great enough as to prevent uniform seed distribution. The Contractor shall follow Articles 250.06 Seeding Methods of IDOT Standard Specifications for applying seeds.

3.3.1 General

Seed shall be applied to the areas designated on the plans immediately following the completion of site preparation. Climatic conditions should be favorable for growth. Seed may be drilled using a Truax seed drill or other approved equipment, broadcast and raked into the soil, or hydroseeded. Other seeding methods are subject to approval. When drills are used, markers or other means shall be provided to insure that the successive seeded strips shall overlap or be separated by a space no greater than equipment row spacings. When delays in operations extend the work beyond the most favorable planting season, or when conditions are unsuitable due to drought, high winds, excessive moisture, or other factors so that satisfactory results are not likely to be obtained, work shall be halted as directed and resumed only when conditions are favorable or when approved alternate or corrective measures and procedures have been effected. If inspection during seeding operations or after germination indicates that strips wider than the space between the rows planted have been left unplanted, additional seed shall be sown as directed.

3.3.2 Broadcast Seeding

In areas inaccessible to drill seeding, seed shall be broadcast by hand. Seed shall be distributed uniformly over designated areas. Half of seed shall be sown with sower moving in one direction, and the remainder with sower moving at right angles to first sowing. Seed shall be covered to an average depth of 1/4 inch by brush harrow, spike-tooth harrow, chain

harrow, cultipacker, hand rake with wood tines, or other approved device. Seed shall not be broadcast when wind speed exceeds five miles per hour.

3.3.3 Drill Seeding

Drill seeding shall be accomplished with approved equipment with drills set not more than one inch to two inches apart. Drill seeding shall occur across slopes parallel with the contours and not up and down slopes. Seed shall be uniformly drilled to a maximum 1/4-inch depth. When slopes exceed one vertical on five horizontal, baffle plates spaced not more than six inches apart shall be installed in the seed box.

3.3.4 Seeding Rate

Seed shall be uniformly mixed and applied at the rate stated in the seed mix table.

3.3.5 Applying and Anchoring Mulch

Immediately after the seeding has been completed, mulch shall be spread uniformly in a continuous blanket at a rate of 1 1/2 tons per acre. Mulch shall be spread by hand, manure spreader, modified grain combine with straw-spreader attachment, or a blower-type mulch spreader. Mulching shall be started at the windward side of relatively flat areas, or at the upper part of a steep slope, and continued uniformly until the area is covered. Mulch shall not be bunched. Immediately following the spreading, the mulch shall be anchored to the soil by a V-type wheel land packer, a scalloped-disk land packer designed to force mulch into the soil surface, or other suitable equipment. The number of passes needed, not to exceed three, will be determined by the Contracting Officer. All areas seeded on any given day must be mulched on that same day.

3.3.6 Watering

Immediately upon completion of seeding and mulching, all seeded areas shall be given one watering. Sufficient water to penetrate the seed bed to a minimum of three inches shall be applied. Water shall be delivered through a system which will insure even distribution. Watering shall be done in manner which will provide uniform coverage, prevent erosion, and prevent damage to the finished surface by the watering equipment. Maintenance watering shall commence within seven calendar days after completing the seeded area. Water shall be applied at a rate to insure moist soil conditions to a depth of two inches. Runoff and puddling shall be prevented. The Contractor shall water seeded areas so that adequate growth and development are maintained.

3.3.7 Topsoil and Seeding

No finished construction area shall be left untopsoiled and unseeded during the winter months. All construction areas finished before June 15th shall be topsoiled and spring-seeded; all construction finished before October 1st shall be topsoiled and seeded in fall seeding.

3.3.8 Temporary Winter Cover

When the completion schedule of the work under the contract requires a delay in the seeding operations due to the limitation dates above, the areas not yet seeded or which do not have grass shall be planted with temporary winter cover. Temporary seed species shall be *Secale cereale*

(rye) at 91 percent pure live seed, applied at a seeding rate of two bushels per acre. Temporary winter cover planting shall include the application of 1/2 the amounts of fertilizer specified with the remaining 1/2 to be included with the permanent seeding operations. The areas to be seeded to a temporary winter cover shall be thoroughly mowed prior to permanent seeding in the same manner as specified for the existing ground cover. Areas which have been provided temporary winter cover shall be thoroughly mowed and turfed with permanent species. All areas seeded with temporary winter cover shall be staked in the field and marked on the plans. A copy of the plans shall then be submitted to the Contracting Officer.

3.4 EROSION CONTROL MATERIAL

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer. Submit manufacturer's literature discussing physical characteristics, applications, guarantees, and installation.

3.5 RESTORATION AND CLEANUP

Excess and waste material shall be removed and properly disposed of off the site. Adjacent paved areas shall be cleaned. Existing turf areas which have been damaged during the contract operations, and which are outside of the limits designated to be seeded, shall be restored using the seed mix as shown in Table 1 following the requirements in this section, at no additional cost to the Government.

3.6 PROTECTION OF TURFED AREAS

Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required or as directed by the Contracting Officer.

3.7 TURF ESTABLISHMENT PERIOD

3.7.1 Length of Period

On completion of the last day of the turfing operation, the Turf Establishment Period will begin. Establishment period shall extend for 12 months after completion of the seeding on the entire project, unless desired growth is established, and shortening the period of the Contractor's responsibility for acceptably established areas is authorized by the Contracting Officer.

3.7.2 Stand of Turf

A stand of turf from the turf grass seeding operation is defined as a uniform stand of grass that is at least two inches tall with a minimum of 100 grass plants per square foot and reasonably free of weeds and visual imperfections as assessed by the Contracting Officer.

3.7.3 Maintenance During Establishment Period

3.7.3.1 Mulched Areas

Mulched areas shall be maintained until all work or designated portions thereof have been completed and accepted. Any damage shall be repaired, and mulch material that has been removed by wind or other causes shall be

replaced and secured. Maintenance shall include protecting embankments and ditches from erosion and maintaining erosion control material.

3.7.3.2 Seeded Areas

The Contractor shall be responsible for the proper care of seeded areas during the period of establishment or until the project is accepted, whichever requires the longer period of maintenance.

3.7.3.3 Turf Grass Mowing Maintenance

All seeded areas shall be mowed prior to inspection for acceptance in order to improve visibility and to facilitate the evaluation of the seeding work. Clippings shall be removed when the amount of cut turf is heavy enough to damage turfed areas. Other mowing shall be done as needed to maintain lawn areas at a height of two inches until Final Acceptance. The first mowing shall not be performed until there is enough growth to cut. Not more than 1/3 of the grass blade shall be removed during initial or subsequent cuttings. Mowing equipment shall be power drawn rotary type in good operating condition, well adjusted and with sharp blades.

3.7.3.4 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of wo inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.7.3.5 Post-Seeding Fertilization

Fertilizer shall be applied to seeded areas if deemed necessary by the Contracting Officer prior to final acceptance. The Contracting Officer shall base the need for post-seeding fertilizer on poor turf stand establishment during turf establishment period and subsequent soil tests. The application shall be timed prior to the advent of winter dormancy and shall avoid excessively high nitrogen levels.

3.7.3.6 Erosion Control

The Contractor shall control erosion during the maintenance period by using ditch checks, sod swales, silt fences or other methods until a proper stand of turf is established.

3.7.3.7 Repair

Any portions of the surface that becomes rilled, gullied, damaged, or destroyed, shall be repaired to re-establish the area without additional cost to the government.

3.8 QUALITY CONTROL

The Contractor shall establish and maintain a quality control system for the work under this section, in accordance with Section 01 45 00.10 20 QUALITY CONTROL FOR MINOR CONSTRUCTION, including but not limited to the following:

a. Materials:

(1) Fertilizer

(2) Seed

(3) Mulch;

b. Seeding, Sodding, and Mulching;

c. Maintenance and Turf Establishment;

d. Repair of Damaged Areas; and

e. Soil Erosion Control.

A copy of the records of inspections and tests, as well as the records of corrective action taken, shall be furnished the Government as directed by the Contracting Officer.

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SECTION 33 40 00

STORM DRAINAGE UTILITIES
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1103	(2014) Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C425	(2004; R 2013) Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C443	(2012; R 2017) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C828	(2011) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C969	(2017) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D3212	(2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Pipe for Culverts and Storm Drains

SD-07 Certificates

Leakage Test

Hydrostatic Test on Watertight Joints

Determination of Density

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Culvert

Manufactured in accordance with and conforming to Illinois Department of Transportation (IDOT) Specification Section 540 for Precast Concrete Culverts.

2.1.2 Concrete Pipe

Manufactured in accordance with and conforming to IDOT Specification Section 550 for Reinforced Concrete Sewer Storm Drain, and Culvert Pipe.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements of IDOT Standard Specifications 540 for precast concrete culverts and 550 for Reinforced conrete pipe. Pipe placement shall be per IDOT standrard specifications.

3.2 JOINTING

3.2.1 Concrete Culvert and Clay Pipe

All jointing for precast concrete culverts shall be per IDOT Standard Specificaion 540. Jointing for Reinforced Concrete Pipe shall be per IDOT Standard Specification 550.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Testing is the responsibility of the Contractor. Perform all testing and retesting at no additional cost to the Government.

3.3.1.1 HYDROSTATIC TEST ON WATERTIGHT JOINTS

Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed.

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to ASTM C990 or ASTM C443. Test requirements for joints in clay pipe shall conform to ASTM C425. Test requirements for joints in PVC, PE, and PP plastic pipe shall conform to ASTM D3212.

3.3.1.2 Leakage Test

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate, prior to completing backfill. Low pressure air testing for concrete pipes shall conform to ASTM C969. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C828 or ASTM C969, after consultation with the pipe manufacturer. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C1103. Prior

to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is two feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least two feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than four hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a two-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour.

3.3.1.3 Determination of Density

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D6938 results in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.3.2 Inspection

3.3.2.1 Post-Installation Inspection

Visually inspect each segment of concrete culvert and pipe for alignment, settlement, joint separations, soil migration through the joint, cracks, buckling, bulging and deflection. An engineer must evaluate all defects to determine if any remediation or repair is required.

3.3.2.1.1 Concrete

Cracks with a width greater than 0.01 inches. An engineer must evaluate all pipes with cracks with a width greater than 0.01 inches but less than 0.10 inches to determine if any remediation or repair is required.

3.3.3 Repair Of Defects

Defects or visible leakage from joints or pipe shall be corrected. Defective pipe or joints disclosed in the hydrostatic test shall be replaced and the test repeated until the results are satisfactory to the Contracting Officer.

3.4 PROTECTION

Protect storm drainage piping and adjacent areas from superimposed and external loads during construction.

3.5 WARRANTY PERIOD

Pipe segments found to have defects during the warranty period must be replaced with new pipe and retested.

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(2015) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(2014) Load Ratings and Fatigue Life for Roller Bearings

ASME INTERNATIONAL (ASME)

ASME B16.1	(2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.5	(2017) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2016) Forged Fittings, Socket-Welding and Threaded
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.2.2	(2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts
ASME B31.1	(2016; Errata 2016) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings

ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A106/A106M	(2018) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A479/A479M	(2018) Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM F593	(2017) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	(2009; E 2015) Standard Specification for Stainless Steel Nuts

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C153/A21.53	(2011) Ductile-Iron Compact Fittings for Water Service
AWWA C600	(2017) Installation of Ductile-Iron Mains

and Their Appurtenances

HYDRAULIC INSTITUTE (HI)

HI 9.1-9.5	(2000) Pumps - General Guidelines for Types, Applications, Definitions, Sound Measurements and Documentation
HI 9.6.4	(2009) Rotodynamic Pumps for Vibration Analysis and Allowable Values

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1	(2003; R 2008) Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(2013) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-45	(2003; R 2008) Bypass and Drain Connections
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
MSS SP-83	(2014) Class 3000 Steel Pipe Unions Socket Welding and Threaded

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2018) Motors and Generators
NEMA WC 70	(2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658
NEMA WC 72	(1999; R 2015) Standard for Continuity of Coating Testing for Electrical Conductors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

U.S. DEPARTMENT OF THE NAVY (DON)

MIL-DTL-24441	(2009; Revision D) Detail Specification: Paint, Epoxy-Polyamide, General Specification

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G, DT

SD-03 Product Data

Support of the Equipment

Piping and Fittings

Valves

Sump Pumps

Expansion Joints

Waste Water Disposal

Flexible Check Valves (Duckbill); G, DT

Flap Gates; G, DT

Pump Field Tests; G, DT

Air Vent; G, DT

Coating; G, DT

Cole Tar Epoxy Painting System; G, DT

SD-06 Test Reports

Hydrostatic and Leakage Tests; G, DT

Valve Testing

Field Test Report; G, DT

Impeller Balancing

SD-08 Manufacturer's Instructions

Installation Instruction Manual

SD-10 Operation and Maintenance Data

Operating And Maintenance Instructions

1.3 QUALITY ASSURANCE

1.3.1 Detail Drawings

Submit detail drawings 60 calendar days after notice to proceed for valve manholes and the piping and equipment in the valve manholes, such as steam traps, valves, sump pumps, pressure gauges, thermometers and insulation, including a complete list of equipment and materials, manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, installation instructions, and complete wiring and schematic diagrams. Show on the drawings pipe anchors and guides, and layout and anchorage of equipment and appurtenances in valve manholes, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect all materials and equipment delivered and placed in storage from the weather, excessive humidity, and excessive temperature variation; dirt, dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two years prior to bid opening.

Equipment items must be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations must be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

2.2 NAMEPLATES

Supply each major item of equipment such as sump pump, motor, steam trap, and pressure reducing valve with the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to

the item of equipment.

2.3 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products are not allowed.

2.4 ELECTRICAL WORK

Provide motors, manual or automatic motor control equipment, and protective or signal devices required for the operation specified under this section in accordance with NFPA 70.

2.5 PIPING AND FITTINGS

2.5.1 General Requirements

Provide piping, fittings and piping accessories inside the valve manholes suitable for the working pressure and temperature requirements of the system conforming to ASME B31.1. To the greatest extent possible, match the piping and fittings inside the valve manholes to the piping and fittings located on the outside of the valve manhole. Provide steel piping in valve manholes with joints welded except that joints 3/4 inch and smaller may be threaded. When threaded joints are used on High Temperature Water Systems, seal weld (continuous fillet weld) the interface area where the pipe threads meet the threaded fittings to preclude any water leakage. Do not attach supports, anchors, or stays to any piping system in places where either the installation of or the movement of the pipe and its contents will cause damage to the construction.

2.5.2 Steel Pipe

Provide black steel, seamless or electric-resistance welded, conforming to the requirements of ASTM A53/A53M, Grade B or ASTM A106/A106M, Grade B. Provide schedule 40 type for pipe up to and including 10 inches in diameter. Provide 0.375 inch nominal wall thickness for pipe 12 inches in diameter and greater.

2.5.3 Fittings

Provide fittings, valves, flanges and unions with the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.5.3.1 Welded Fittings

Provide welded fittings to match connecting pipes with butt welded fittings, conforming to ASME B16.9, and socket welded fittings, conforming to ASME B16.11.

2.5.3.2 Unions

Provide unions that conform to MSS SP-83 as required to match adjacent piping.

2.5.4 Ductile Iron Pressure Pipe and Fittings

Ductile-iron pipe shall conform to AWWA C111/A21.11, Thickness Class 53. Flanged pipe shall conform to AWWA C115/A21.15. Fittings shall conform to

AWWA C110/A21.10or AWWA C153/A21.53. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the joints specified hereinafter. Pipe and fittings shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness.

2.5.5 Ductile Iron Pressure Joints and Jointing Materials

Ductile iron pressure joints and jointing materials shall meet the following requirements:

a. Generall: Joints for pipe and fittings shall be restrained and shall be push-on joints or mechanical joints except as otherwise specified in this paragraph. Joints shall be mechanical-joints where indicated. Joints shall be flanged joints where indicated. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint.

b. Push-on Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111/A21.11. Joints shall be restrained.

c. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111/A21.11. Joints shall be restrained.

d. Flanged Joints: Bolts, nuts, and gaskets for flanged connections shall be as recommended in the Appendix to AWWA C115/A21.15. Flange for setscrewed flanges shall be of ductile iron,ASTM A536, Grade 65-45-12, and shall conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated, and zinc-coated steel. Gasket for setscrewed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

e. Joints Made with Sleeve-type Mechanical Couplings: Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat, two follower rings, two resilient tapered rubber gaskets, and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. Middle ring shall be of cast-iron or steel, and the follower rings shall be of malleable iron or ductile iron. Cast iron shall conform to ASTM A48/A48Mand shall be not less than Class 25. Malleable iron shall conform to ASTM A47/A47M. Ductile iron shall conform to ASTM A536. Steel shall have a strength not less than that of the pipe. Gaskets shall be designed for long life and resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be track-head type; bolts and

nuts shall be either of the following: bolts conforming to the tensile requirements of ASTM A307, Grade A, with nuts conforming to the tensile requirements of ASTM A563, Grade A; or round-head square-neck type bolts conforming to ASME B18.5.2.1M and ASME B18.5.2.2M with hex nuts conforming to ASME B18.2.2. Bolts shall be 5/8 inch in diameter. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Sleeve-type mechanical couplings shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Joints shall be restrained.

2.6 PIPE SUPPORTS AND PENETRATIONS

2.6.1 General

Auxiliary steel shall be provided by the Contractor where the support of piping systems and equipment is required. Light gauge and structural steel shapes shall conform to the requirements of ASTM A36/A36M. The Contractor shall have the option to use pre-engineered support systems of electrogalvanized steel products. However, a mixture of support system manufacturers products is not permitted.

2.6.2 Pipe Supports

Pipe supports shall be galvanized and conform to the requirements of MSS SP-58, MSS SP-69, and MSS SP-58. Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither shall have a deteriorating action on the other. Chains, straps, or single point supports are not allowed.

2.6.3 Wall Penetrations

2.6.3.1 Below Grade Wall Penetrations

Below-grade wall penetrations shall be provided with hydrostatic seals designed to seal opening between pipe or conduit and a through-structure opening. The seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.

2.6.3.2 Pipe Sleeves

Provide zinc-coated steel pipe, conforming to ASTM A53/A53M, Schedule 40 or standard weight. Install so there is no electrical continuity between the pipe sleeve and the pipe casing.

2.7 VALVES

Provide valves that conform to the material, fabrication, and operating requirements of ASME B31.1, unless otherwise specified. Provide valves suitable for the service temperatures and pressures utilized. Valves 3/4 inch and smaller may be bronze where seal welding is not required. Provide valves 6 inches and larger with a 1 inch minimum gate or globe bypass valve sized in conformance with MSS SP-45.

2.7.1 Air Release Valves

Provide air release valves designed to permit release of air from an empty pipe during filling and capable of discharging accumulated air in the line

while the line is in operation and under pressure. Attach valves by means of threaded pipe connections. Vent valves to the atmosphere. The single body and Dual Sewage Combination Air Valves shall be specifically adapted for use with sewage. Valves shall be equipped with double acting throttling devise.

2.7.2 Single Body Sewage Combination Air Valve

The Sewage Combination Air Valve shall be a single body valve with double orifice. When the pipeline is filled and pressurized the large orifice shall stay closed. The valve's large orifice shall shut off when the free floating, center-guided plug is raised into the orifice by the lifting force of the concave bottom float. The valve's small diameter air release orifice shall remain operative and open during normal system operation to allow small pockets of air accumulation to escape automatically and independently of the large orifice.

The single body combination sewage valve shall be a compound lever type capable of withstanding operating pressures of 150 psi, with a 2 inch NPT inlet and 1 inch NPT outlet. The air release valve shall release air and prevent the formation of a vacuum.

The air release valve shall be with iron body and cover of the valve and a stainless steel float that automatically releases air when the lines are being filled with water and allow air to re-enter when draining to prevent vacuum or column separation from occurring. It shall allow air to escape, while the pipe line is in operation, using a compound lever system. Valve seat shall be resilient material and must be fastened to the valve cover, without distortion, for driptight shut-off. The valve internal parts made entirely of stainless steel or bronze.

The single body combination sewage air valve shall be specified with optional Backflushing Attachments. Backflushing attachments shall include Blow-off valves, with quick disconnect couplings, and minimum five foot hose for flushing. The backflushing attachment shall permit backflushing without dismantling the valve. The single body combination sewage valve shall be installed with shut off isolation valve at the inlet.

2.7.3 Dual Sewage Combination Air Valves

Dual Combination Sewage Air Valves shall consist of an independent large orifice Air/Vacuum Valve with an independent small orifice Air Release Valve side connected. Dual Sewage Combination Air Valves shall provide venting of large volumes of air through the large orifice valve and small pockets of air through the small orifice valve. The air valve shall vent large volumes of air when the sewage line is filled and allow air to re-enter when draining to prevent vacuum or column separation from occurring. While pressurized, the accumulated pockets of air shall be vented through the small orifice automatically.

The large orifice Air/Vacuum Valve shall open to permit large volumes of air to enter the pipeline to prevent a vacuum when draining or in the event of a break in the pipeline. The large orifice valve shall incorporate one upper float and one lower concave float, thereby maintaining an air gap between the concave bottom float and upper shut-off float.

The small orifice Air Release Valve shall be separated from the large orifice by a piping and a gate valve. The small orifice valve shall have

an internal compound lever mechanism including a long float stem with a stainless steel float thereby maintaining an air gap between the float and the mechanism. The air gap shall prevent waste solids from clogging the lever mechanism of the small orifice valve.

Dual Combination Sewage Air Valve shall be specified with optional Backflushing Attachments. Provide valve specifically adapted for use with sewage and complete with hose and blow-off valves to permit backflushing without dismantling the valve.

2.8 FLEXIBLE CHECK VALVES (DUCKBILL)

Check Valves shall be all rubber with an integral flanged end connection. The port area shall contour down to a duckbill which shall allow passage of flow in one direction while preventing reverse flow. The flange and flexible duckbill sleeve shall be one-piece rubber construction with nylon reinforcement. The bill portion shall be thinner and more flexible than the valve body. The duckbill shall be offset so that the bottom line of the valve is flat, keeping the invert of the pipe parallel with the invert of the valve. The top of the valve shall rise to form the duckbill shape. When line pressure inside the valve exceeds the backpressure outside the valve, the line pressure forces the bill of the valve open, allowing flow to pass. When backpressure exceeds the line pressure, the bill of the valve is forced closed preventing backflow.

2.8.1 Flange Drilling

The flange drilling shall conform to ASME B16.1/ASME B16.5 standards. The valves shall be furnished with stainless steel back-up rings for installation.

2.9 FLAP GATES

Flap gates and accessories shall be of the size, type, material and construction shown on the drawings and specified herein. All component parts shall be of the type and material indicated below. The gate shall be designed to allow free outflow and prevent back flow for up to maximum seating heads as indicated.

Shop drawings shall be submitted for sluice gates, flap gates, and flexible check valves showing details for mounting, materials description, calculations (sluice gates opening and closing torque, stem buckling strength and pedestal (lift)), gate operating pedestal (lift), concrete reinforcement, anchorage, dimensions, performance and operation, weights, elastomer characteristics, headloss and flow data, pressure rating and construction and manufacturer's installation procedures. The shop drawings shall show the clearance dimensions between stem couplings and stem guides and the end of the stem and the top of the stem cover, in both the open and closed positions of the sluice gates. Manufacturer's catalog data, including specifications and full descriptive data, shall be submitted for all materials and equipment furnished. Contractor shall be responsible for verifying that the specific manufacturers' sluice gates to be provided at the listed location will fit and function in the area available.

2.9.1 Gravity Flow Flap Gate Components

2.9.1.1 Seat

The seat shall be flat back one piece with a raised section around the perimeter of the waterway opening to provide for mounting the seating face. The raised section shall provide a seating plane to assist in positive closure of the cover. The seat shall be shaped to provide two bosses extended above the top of the waterway opening for mounting the top pivot lugs. Pivot lug bosses shall be drilled and tapped for mounting studs. Seat shall be flat back as shown in the Flap Gate details. The flat back gate shall be designed for attaching to the wall thimble.

2.9.1.2 Cover

The cover shall be one piece cast iron with necessary reinforcing ribs, with a lifting eye for manual operation, and with bosses to provide a pivot point connection with the links. Bosses shall be designed to place the hinge bolts in double shear when gate is assembled.

2.9.1.3 Seating Faces

The cast iron seating faces on the seat and the cover shall be machined to a plane with a minimum 63 micro inch finish.

2.9.1.4 Pivot Lugs

Each pivot lug shall be one-piece cast iron. Lugs shall have double bosses to place the top hinge bolts in double shear when they are assembled through the links. The lugs shall be adjustable in the horizontal plane without removal of the cover from the gate links. The adjustment shall allow the top pivots to be moved toward the gate seat for reduced sensitivity of the cover, or moved away from the gate seat to provide opening with a minimum differential head. Two studs shall be used to connect each pivot to the gate seat.

2.9.1.5 Links

The links connecting the cover and pivot lugs shall be one piece heavy-duty cast iron. Each link shall be provided with commercial grade bronze bushings at each pivot point. The bottom of the links shall be provided with an adjusting screw to properly align seating faces on the cover with respect to the seat. The links shall be designed to limit the double hinge action, preventing the cover from rotating sufficiently to become wedged in the open position.

2.9.1.6 Fasteners

All anchor bolts, assembly bolts, screws and nuts shall be of stainless steel of ample section to safety withstand the forces created by operation of the gate. Quantity and size of the fasteners shall be as recommended by the manufacturer. Anchor bolts shall be furnished with two nuts each to facilitate installation and alignment of the flat back gates when attached to concrete.

2.9.1.7 Materials

Materials shall conform to the requirements of the following Standards: Cast Iron ASTM A126, Class B Stainless Steel (Fasteners) ASTM F593,

ASTM F594

2.10 SUMP PUMPS

2.10.1 Sump Pumps

Provide a manufacturer's standard commercial product that is electrically driven and submersible, capable of operating while completely submerged, and capable of running without damage when not submerged. The sump pump shall be equipped with a 5 HP submersible electric motor connected for operation on 460 volts, three phase, 60 hertz, wire service, with an adequate length of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards. The pumps and motors must be capable of continuously pumping liquids at a temperature of 200 degrees Fahrenheit (F). Provide sump pumps with permanently lubricated bearings, stainless steel shafts, and cast iron impellers. Each sump pump must be capable of passing a 3/8 inch sphere.

2.10.2 Operating Conditions

The pump must be capable of operating in the dry (for the purpose of maintenance and operating checks) for short periods of time as stated in the manufacturer's operating instruction.

The pump manufacturer establishes and states in the operating manual the procedures for starting and stopping the pumps, including setting of valves or any sequential operations.

2.10.3 Performance Requirements

When operated in the dry, the maximum level of vibration of the assembled pumping unit cannot be greater than the value of the lower limit of the good range of the "General Machinery Vibration Severity Chart". Take measurements at pump operating speed during the Factory Test and the field start-up test.

The pump must be capable of operating without instability over the required range of head.

The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2.10.4 Capacities

Discharge cannot be less than 641 gpm against total dynamic head (TDH) of 17.2 feet with water surface in the intake sump at elevation 623 feet. Shut off head shall be 34.8 feet (minimum).

2.10.5 Efficiency

The pump must have an efficiency of not less than 62 percent at 17.2 feet.

2.10.6 Materials

Major pump components shall be of grey cast iron, ASTM A48/A48M, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

2.10.7 Design and Manufacture

The submersible pump may be either of cast or fabricated construction. The level of manufacture skill must be consistent with the standards referenced in the specifications. All work performed in the manufacturing of the pumps must be in a skillful and workmanlike manner in accordance with the best modern shop practice and manufacturing of finished products similar in nature to those specified herein. The Government reserves the right to observe and witness the manufacturing of the pumps and to inspect the pumps for compliance with contract requirements during factory assembly.

2.10.7.1 Pump Speed

Rotative speed of the pump cannot be greater than 1745 rpm.

2.10.7.2 Runaway Speed

Design the pump to sustain full runaway speed without damage at maximum head difference across the pump. Based on the system design as indicated, the manufacturer must compute the maximum reverse runaway speed, and design the pump and motor to sustain that reverse rotation without damage.

2.10.7.3 Pump and Motor Bearing Arrangement

The pump and motor bearings must be the standard design of the manufacturer for the pump supplied under this specification. The type and number must be of proven design as used in previous operating units supplied by the manufacturer. Provide bearings of the grease lubricated and sealed type; having a minimum B-10 bearing life of 50,000 hours. The motor bearings shall be permanently grease lubricated. Each bearing must be of the correct design to resist the radial and thrust loads applied. Provide enough bearings to ensure the pump rotating elements are supported so that the possibility of excessive vibration is eliminated. Conform ball and roller bearings life and load ratings to ABMA 9 and ABMA 11. Single row lower bearings are not acceptable.

2.10.7.4 Mechanical Seals

Provide a mechanical rotating shaft seal system between the impeller and motor to ensure the motor housing is sealed properly. The mechanical

seals must be in tandem, consisting of two totally independent seal assemblies, lapped and face type seals running in lubricant reservoirs for cooling and lubrication. The mechanical seals must contain both stationary and rotating tungsten carbide face rings unless otherwise specified. In order to avoid seal failure from sticking, clogging, and misalignment from elements contained in the mixed media, only the seal faces of the outer seal assembly and its retaining clips can be exposed to the mixed media. Contain all other components in the lubricant housing. All seal faces must be solid material capable of being relapped. Each seal interface shall be held in contact by its own spring system. The seals must require neither maintenance nor adjustment nor depend on direction of rotation for sealing, but be easy to check and replace. Shaft seals without positively driven rotating members are not considered acceptable or equal.

2.10.7.5 Lubricant Housing

Provide an oil housing with oil, as recommended by the pump manufacturer, to lubricate the shaft sealing system and to dissipate the heat generated by the motor and bearings.

2.10.7.6 Impeller

The impeller design and manufacture must be the manufacturer's standard. The impeller shall be dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on a replaceable insert ring.The impeller surface must be smooth, without holes and fabrication offsets. The attachments to shaft must be with keys or other fasteners that are made of stainless steel, and of sturdy construction designed to not loosen, but be easily removed for maintenance. The impeller construction may be cast or fabricated. At the time of assembly the impeller clearances must be those shown on assembly drawings and may be checked in the field or at the factory at the Contracting Officer's option. Balance the impeller at the design operating speed. The standard balance quality grade is G6.3 in accordance with ISO 1940-1. Balance in accordance with the procedure in HI 9.6.4, except that a two-plane balance is required. Submit the results of impeller balancing.

2.10.7.7 Shaft

The shaft must be one piece integral with the motor of high-strength cold-rolled carbon steel or stainless steel, ASTM A1064/A1064M with a factor of safety of five measured against the ultimate strength. Two piece shaft with couplings shall not be acceptable. If a shaft material of lower quality than stainless steel - ASTM A479/A479M S43100-T is used, a shaft sleeve of stainless steel - ASTM A479/A479M S43100-T is used to protect the shaft material. Design the shaft for all torque conditions during normal operation and for runaway speed during reverse flow.

2.10.7.8 Bowl Assembly

The bowl assembly may be of cast or fabricated manufacture. The hydraulic design must be the manufacturer's standard design as used in previous operating installations. The general manufacture quality relating to flange design, drilling, bolts, alignments, must be in accordance with industry standard practice.

2.10.7.9 Motor

The motor must be submersible and conform to the requirements of NEMA MG 1. Size the motor to avoid overload when operating at any point along the characteristic curve of the pump. Provide three-phase, 60-Hz, 460 V, squirrel cage induction type motors, NEMA Design B Type. Insulate the stator windings and stator leads with a moisture-resistant Class H insulation with temperature resistance of 356 degrees F. The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95 percent. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The temperature rise above ambient for continuous full load rated conditions and for the class of insulation used cannot exceed the values in NEMA MG 1. The motor must be rated for continuous duty when submerged and also be capable of operation in the dry for short periods of time for testing and maintenance purposes. The motor shall be capable of no less than 30 evenly spaced starts per hour.

2.10.7.9.1 Torque

Starting torque must be sufficient to start the pump, but in no case less than 60 percent of full-load torque. Break-down torque cannot be less than 150 percent of full-load torque.

2.10.7.9.2 Support

Provide thrust bearing support of sufficient strength and rigidity to support the weight of the entire rotating element of the motor, pump impeller and shaft, and the hydraulic thrust.

2.10.7.10 Cable

Specifically design power and instrumentation cable for use with a submersible pump application and conform to the requirements of NEMA WC 70 and NEMA WC 72. Use submersible cable suitable for continuous immersion in water at the maximum depth encountered. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. Cable must have an ampacity of not less than 125 percent of the motor full load current. The cable length must be determined by the pump manufacturer for the installation shown.

Power and instrumentation cables must enter the motor through a sealing system that prevents water entry into the unit and provides strain relief. The cable entry may be comprised of rubber bushings, flanked by stainless steel washers, having a close tolerance fit against the cable outside diameter and the entry inside diameter for sealing by compression of the bushing, or the entry may be sealed by other gland compression methods.

2.10.8 Pump Control and Monitoring

Provide a self-contained pump control and monitoring system. The controls, controllers, water level switches, and electrical connections suitable for service at 100 percent humidity, at 200 degrees F temperature, and occasional water submersion. The sump pumps automatic control switches must have demonstrated 200,000 cycles at 200 degrees F and 100 percent relative humidity while totally submersed in water at 200

degrees F. Provide independent local indication of the alarm and separate contacts for the remote indication of each alarm and local reset. Sensors must alarm and shut down the pump at an abnormal operating condition. Provide separate red alarm indicator lamps and green pump running lamps and label in the enclosure. Provide the following sensors:

2.10.8.1 Temperature Sensor

Temperature sensors in the stator windings to protect the motor against overheating.

Temperature sensors to monitor the main and support bearings.

2.10.8.2 Float Switch Sensor

Float-switch sensor positioned between the bearings and the stator-end coils to detect if liquid penetrates the stator housing.

2.10.8.3 Detectors

A junction box leakage detector and a water-in-oil detector.

2.10.8.4 Painting

All castings must be blasted before coating. All wet surfaces are to be coated with two-pack oxyrane ester paint. The total layer thickness should be at least 120 microns. Zink dust primer shall not be used.

2.10.9 Air Vent

Provide an air vent, located as indicated, and a combination air and vacuum valve type. The valve must be a minimum 125 lb class and sized for the design flow rate. Provide an isolation valve at the valve's inlet. Materials of construction must be cast iron for the valve body; stainless steel for the internal linkage, float, and float stem; and Buna-N for the needle and seat. The valve must provide a dual function to release air during pump start-up and to permit air to re-enter to break the vacuum during pump shutdown.

2.11 EXPANSION JOINTS

Submit manufacturer's descriptive data and technical literature, performance charts, catalog cuts and installation instructions.

2.11.1 Bellows-Type

Type 304 stainless steel corrugated bellows, reinforced with rings, internal sleeves, and external protective covers, designed to withstand 10,000 cycles over a 20 year period and a minimum working pressure of ASME Class 150. Provide limit stops to limit total movement in both directions. Cold set the joints to compensate for temperature at time of installation. Provide single or double bellows expansion joint as indicated. Provide first pipe alignment guide no more than four pipe diameters from the expansion joint; provide second pipe alignment guide no more than 14 pipe diameters from the first guide. Provide flanged or buttwelding end connections as indicated.

2.12 COLE TAR EPOXY PAINTING SYSTEM

2.12.1 Materials

Conform to the coating specifications and standards referenced in paragraph "COLE TAR EPOXY PAINTING SYSTEM" this setion. Submit product data sheets for specified coatings and solvents. Provide preprinted cleaning and maintenance instructions for all coating systems. Submit Manufacturer's Instructions on Mixing: Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

2.12.2 Preparation of Metal Surfaces

Clean surfaces to be painted before applying paint or surface treatments. Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Remove deposits of grease or oil in accordance with SSPC SP 1, prior to mechanical cleaning. Solvent cleaning shall be accomplished with mineral spirits or other low toxicity solvents having a flash point above 100 degrees F. Use clean cloths and clean fluids to avoid leaving a thin film of greasy residue on the surfaces being cleaned. Parts shall be blasted, according to SSPC SP 10/NACE No. 2, to remove surface contaminants, rust and foreign particles. Foreign particles shall be removed thoroughly so that any residues appear only as a slight discoloration of the surface. Use as a visual reference, photographs in SSPC VIS 1 for the appearance of cleaned surfaces. Protect items not to be prepared or coated from damage by the surface preparation methods. Machinery shall be protected against entry of blast abrasive and dust into working parts. Cleaning and painting shall be so programmed that dust or other contaminants from the cleaning process do not fall on wet, newly painted surfaces, and surfaces not intended to be painted shall be suitably protected from the effects of cleaning and painting operations. Welding of, or in the vicinity of, previously painted surfaces shall be conducted in a manner to prevent weld spatter from striking the paint and to otherwise reduce coating damage to a minimum; paint damaged by welding operations shall be restored to original condition. Surfaces to be painted that will be inaccessible after construction, erection, or installation operations are completed shall be painted before they become inaccessible.

2.12.3 Coating Application

2.12.3.1 General

The finished coating shall be free from holidays, pinholes, bubbles, runs, drops, ridges, waves, laps, excessive or unsightly brush marks, and variations in color, texture, and gloss. Application of initial or subsequent coatings shall not commence until the Contracting Officer has verified that atmospheric conditions and the surfaces to be coated are satisfactory. Each paint coat shall be applied in a manner that will produce an even, continuous film of uniform thickness. Edges, corners, crevices, seams, joints, welds, rivets, corrosion pits, and other surface irregularities shall receive special attention to ensure that they receive an adequate thickness of paint. Spray equipment shall be equipped with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, and screens or filters. Air caps, nozzles, and needles shall be as recommended by the spray equipment manufacturer for the material being applied. Airless-type spray equipment may be used

only on broad, flat, or otherwise simply configured surfaces, except that it may be employed for general painting if the spray gun is equipped with dual or adjustable tips of proper types and orifice sizes. Airless-type equipment shall not be used for the application of vinyl paints. Comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein

2.12.3.2 Mixing and Thinning

Paints shall be thoroughly mixed, strained where necessary, and kept at a uniform composition and consistency during application. Dry-powder pigments specified to be added at the time of use shall, with the aid of powered stirrers, be incorporated into the vehicle or base paint in a manner that will produce a smooth, homogeneous mixture free of lumps and dry particles. Where necessary to suit conditions of the surface temperature, weather, and method of application, the paint may be thinned immediately prior to use. Thinning shall generally be limited to the addition of not more than one pint per gallon of the proper thinner; this general limitation shall not apply when more specific thinning instructions are provided. Paint that has been stored at low temperature, shall be brought up to at least 70 degrees F before being mixed and thinned, and its temperature in the spray tank or other working container shall not fall below 60 degrees F during the application. Paint that has deteriorated in any manner to a degree that it cannot be restored to essentially its original condition by customary field-mixing methods shall not be used and shall be removed from the project site. Paint and thinner that is more than one year old shall be resampled and resubmitted for testing to determine its suitability for application. Moisture cure urethane paint shall be resampled and resubmitted for testing to determine its suitability for application whenever the paint is more than six months old as indicated by the date of manufacture on the container. The use of thinner does not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning cannot cause the paint to exceed limits on volatile organic compounds. Do not mix paints of different manufacturers.

2.12.3.3 Coal Tar-Epoxy (Black) Paint (Formula C-200a)

2.12.3.3.1 Mixing

Component B shall be added to previously stirred Component A and thoroughly mixed together with a heavy-duty mechanical stirrer just prior to use. The use of not more than 1 pint of xylene thinner per one gallon of paint will be permitted to improve application properties and extend pot life. The pot life of the mixed paint, extended by permissible thinning, may vary from 2 hours in very warm weather to five or more hours in cool weather. Pot life in warm weather may be extended by precooling the components prior to mixing; cooling the mixed material; and/or by slow, continuous stirring during the application period. The mixed material shall be applied before unreasonable increases in viscosity take place.

2.12.4 System No. 6-A-Z

Epoxy zinc-rich primer 19B shall be applied in accordance with the manufacturer's directions in two single, half-lapped spray coats to an average dry film thickness of a minimum of 3.0 mils. The thickness at any

point shall not be less than 2.5 mils or greater 8.0 mils for the primer. After a minimum drying period of six hours and no more than 96 hours, at least two coats of coal tar epoxy paint shall be applied to provide a minimum thickness at any point of 16 mils for the completed system. If the epoxy zinc-rich paint has been applied in the shop or otherwise has been permitted to cure for longer than 96 hours, it shall be abraded and recoated with an additional thin tack coat of the zinc-rich paint, which in turn shall be overcoated within 96 hours with the first coat of coal tar-epoxy paint. The specified film thicknesses shall be attained in any event, and any additional coats needed to attain specified thickness shall be applied at no additional cost to the Government.

2.12.5 PAINTING SCHEDULES

SYSTEM NO. 6-A-Z			
Items or surfaces to be coated:		FSI, 6" and 30" Steel discharge pipe, Discharge Column Pipe and takeoff	
SURFACE PREPARATION	1st & 2nd COAT	3rd COAT	4th COAT
White metal blast cleaning	MIL-DTL-24441/19B	Coal tar epoxy C-200a (black)	Coal tar epoxy C-200a (black)

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 SITE WORK

3.2.1 Excavation, Trenching, and Backfilling

Excavate, trench, and backfill the valve manholes as indicated and in accordance with Section 31 00 00 EARTHWORK.

3.2.2 Electric Work

Provide any wiring required for the operation of the equipment specified, but not indicated on the electrical drawings or under this section, in accordance with all Division 26 - ELECTRICAL sections of these specifications.

3.2.3 Painting

Clean the heat affected zone of field welded galvanized surfaces and other galvanized surfaces damaged during installation in compliance with SSPC SP 10/NACE No. 2. Clean steel and iron appurtenances, piping, and supports in compliance with SSPC SP 10/NACE No. 2, and paint in accordance with paragraph "COLE TAR EPOXY PAINTING SYSTEM" for this section.

3.3 WASTE WATER DISPOSAL

The water used for testing, cleaning, flushing and/or disinfection shall be disposed of in accordance with all applicable regulations. Disposal is solely the responsibility of the Contractor. The method proposed for disposal of waste water shall be provided to, and approved by, the Contracting Officer prior to performing any testing, cleaning, flushing and disinfection activities.

3.4 PUMP INSTALLATION

Perform correct installation and assembly of the pumping unit in accordance with the drawings and with the manufacturer's installation instruction manual. Submit, no later than 30 calendar days prior to time of pump delivery, three copies of a typed and bound manual describing procedures to be followed by the installation engineer in assembling, installing, and dry- and/or wet-testing the pump. Coordinate and consolidate the description of the pump with similar descriptions for other specified pump parts. The description must be of such a nature that it may be comprehended by an engineer or mechanic without extensive experience in erecting or installing pumps of this type. The description must be a step-by-step explanation of operations required, and include, where applicable, such things as alignment procedures, bolt torque values, recommended instrument setups, recommended gauges and instruments, and similar details. Furnish all bolts, shims, tools, and other devices necessary for installing the pumping units. The manufacturer's representative(s) familiar with the equipment being installed must supervise the handling, installation, start-up, and testing of the equipment as required in the paragraph INSTALLATION AND START-UP ENGINEER.

3.4.1 Cleanup Prior to Start

After the pumping unit is installed and prior to start-up, completely clean the sump area of any accumulated construction debris. This final cleaning of the sump area will be witnessed by a representative of the Government. Correct any damage to the pumping units or related equipment during initial start-up due to foreign objects left in the sump areas.

3.4.2 Pump Field Tests

Submit a field test plan prior to field testing. Field testing must be conducted by an experienced field test engineer and will be witnessed by the Contracting Officer. Before initially energizing the pump/motors, ensure that all pumping plant control, monitoring, and protective circuits have been successfully tested. This thorough electrical checkout procedure must follow a detailed step-by-step approved test plan. Check the motor and other pumping unit elements undergoing tests at this time. Field test the plan prior to field testing.

3.4.3 Dry Test

Test each pumping unit in the dry in accordance with the pump manufacturer's instructions to determine whether it has been properly installed. Conduct such test when, and as, directed by Contracting Officer. Operate the pump at full rated speed. If tests reveal a design or installation deficiency or a manufacturing error in pumping unit components, promptly correct the problem.

3.4.4 Wet Test

Test each unit under load for a period of at least two hours or as directed by the Contracting Officer. Conduct the tests to be witnessed by the Government. During the tests, observe, measure, and record the operation of the pumping units noise (in accordance with HI 9.1-9.5), motor-bearing temperatures, voltage, and current for each pump. Measured parameters must be within the pump manufacturer's published limits. Make vibration measurements at the top of the discharge tube and flange of the discharge elbow for each pump. Vibration limits must not exceed those recommended by HI 9.6.4.

3.4.5 Field Test Report

Prepare and submit the field test report and a manual of Operating and Maintenance Instructions for the completed system. Submit the Instructions containing complete information on operation, lubrication, adjustment, routine and special maintenance disassembly, repair, reassembly, and trouble diagnostics of pump and auxiliary equipment. Provide the operation and maintenance manual and both parts lists on optical disc, formatted to print on ANSI size A 8-1/2 inch by 11-inch paper.Drawings incorporated in manual or parts lists, may be reduced to page size provided they are clear and legible, or may be folded into the manual to page size. Photographs or catalog cuts of components may be included for identification.

3.4.6 Painting

Paint the pump/motor in accordance with the pump manufacturer's standard coating system. Paint the discharge pipe and discharge elbow and appurtenances in accordance with paragraph "COLE TAR EPOXY PAINTING SYSTEM" spec section 33 61 13.19.

3.5 PIPING

3.5.1 General

Use steel piping and insulate in valve manholes. Protect insulation with an aluminum jacket. Cut pipe to measurements established at the site and work into place without springing or forcing. Clear all openings and equipment, and avoid cutting or other weakening of structural members to facilitate piping installation. Remove burrs from ends of pipe by reaming. Install to permit free expansion and contraction without damage to joints or hangers and in accordance with ASME B31.1. Do not attach supports, anchors, or stays where either expansion or the weight of the pipe could cause damage to permanent construction. The method of attaching supports must not interfere with the operation of the cathodic protection system.

3.5.2 Flanged and Threaded Joints

3.5.2.1 Flanged Joints

Flanged joints are permitted for dielectric isolation only. Construct flanged joints to be faced true, provided with gaskets, and made perfectly square and tight. Use flanged joints only for electrical isolation and in other special cases where connected equipment is available with only flanged joints, or when specifically indicated. Provide electrically isolated flange joints at all connections to or from the heat distribution

system and between dissimilar metals.

3.5.2.2 Threaded Joints

Apply graphite or inert filler and oil, graphite compound, or polytetrafluoroethylene tape to the male threads only. Provide unions at all screwed valves, strainers and connections to equipment 3/4 inch and smaller. Use dielectric unions at connections of dissimilar metals in 3/4 inch and smaller piping. When used on High Temperature Water Systems, seal weld threaded joints.

3.5.3 Pipe Supports

Securely support horizontal and vertical runs of pipe.

3.6 VALVE INSTALLATION

Flanged valve bolt holes shall be installed so as to straddle the vertical centerline of pipe. Flanged faces shall be cleaned prior to inserting the gasket and bolts, and then the nuts shall be tightened progressively and uniformly. Threaded ends shall have the threads cleaned by wire brushing or swabbing prior to installation.

3.6.1 Valve Orientation

The operating stem of a manual valve shall be installed in a vertical position when the valve is installed in horizontal runs of pipe having centerline elevations 4.5 feet or less above finished floor, unless otherwise shown on contract drawings. The operating stem of a manual valve shall be installed in a horizontal position in horizontal runs of pipe having centerline elevations between 4.5 feet and 6.75 feet above finish floor, unless otherwise shown on contract drawings.

3.7 FLEXIBLE CHECK VALVE (DUCKBILL) INSTALLATION

Flexible check valves shall be installed in accordance with the approved shop drawings and the manufacturer's recommendations. Manufacturer's authorized representative shall be available for customer service during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valves.

3.8 FLAP GATE INSTALLATION

Flap gates shall be installed in accordance with the approved shop drawings and the manufacturer's recommendations.

3.9 FLEXIBLE JOINTS AT CONCRETE STRUCTURES

Flexible joints shall be provided at the face of all structures, whether or not shown on the contract drawings. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints shall be considered flexible joints; welded pipe joints shall not. Joints may be flush with the structure face or may be located up to one pipe diameter away from face.

3.10 PENETRATIONS

For below grade, or in submerged and damp environments, steel pipe sleeves shall be lined and coated. Embedded metallic piping shall be isolated

from concrete reinforcement using coated pipe penetrations. Wall pipes shall be securely supported by form work to prevent contact with reinforcing steel and tie-wires. Joints shall be sealed with a wall penetration seal. For existing concrete walls, rotary drilled holes may be provided in lieu of sleeves.

3.11 CONNECTING DISSIMILAR PIPE

Flexible transition couplings, dielectric fittings and isolation joints shall be installed in accordance with the manufacturer's instructions.

3.12 FIELD QUALITY CONTROL

3.12.1 General

The Contractor shall establish and maintain quality control for work under this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including but not limited to the following:

a. Materials and workmanship,

b. Installation,

c. Trial operation of each gate, and

d. Adjustment.

A copy of the records of inspections and tests, as well as the records of corrective action taken, shall be furnished to the Government as directed by the Contracting Officer.

3.12.2 Hydrostatic and Leakage Tests

Where any section of a pipeline is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until at least five calendar days after the installation of the concrete thrust blocking, unless otherwise approved by the Contracting Officer. Use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Test ductile-iron pressure lines in accordance with the requirements of AWWA C600 for hydrostatic testing. Leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; allow no leakage at joints made by other methods.

3.12.3 Valve Testing

Valves may either be tested while testing pipelines, or as a separate step. It shall be demonstrated that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications. The Contractor shall count and record the number of turns required to open and close each valve, and account for any discrepancies with manufacturer's data.

3.13 FINAL CLEANING

3.13.1 Interim Cleaning

The Contractor shall prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping sections during fabrication. The piping shall be examined to assure removal of these and other foreign objects prior to assembly and installation.

3.13.2 Flushing

Following assembly and testing, and prior to final acceptance, piping systems shall be flushed with water to remove accumulated construction debris and other foreign matter. The piping shall be flushed until all foreign matter is removed from the pipeline. The Contractor shall provide all hoses, temporary pipes, ditches, and other items as required to properly dispose of flushing water without damage to adjacent properties. The minimum flushing velocity shall be 2.5 fps. For large diameter pipe where it is impractical to flush the pipe at the minimum flushing velocity, the pipeline shall be cleaned in-place from the inside by brushing and sweeping, then flushing the pipeline at a lower velocity. Cone strainers shall be installed in the flushing connections of attached equipment and left in place until cleaning is completed. Accumulated debris shall be removed through drains, or by removing spools or valves.

3.14 MAINTENANCE AND OPERATING MANUALS

The Contractor shall furnish maintenance data and operating instructions, including parts list, for the sluice gate equipment covering, servicing, and dismantling of the respective items and for the power operating device. The manuals shall be furnished to the Contracting Officer not later than the date the equipment is shipped from the manufacturer's plant.

Each set shall be permanently bound and shall have on the cover the following:

a. The words "Operating and Maintenance Instructions",

b. Name and location of the project,

c. Contractor's name,

d. Invitation number, and

e. Contract number.

Flysheets shall be placed before instructions covering the subject. The sheet shall be approximately 8-1/2 inches by 11 inches, with large sheets of drawings folded in.

Each set shall include, but not be limited to, the following:

a. Operation and maintenance instructions for each piece of equipment, including lubrication instructions;

b. Manufacturer's bulletins, cuts, and descriptive data; and

c. Parts list and recommended spare parts.

The Contractor shall provide ten copies of installation, operation, maintenance, lubrication and repair manuals for all equipment installed.

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318M	(2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary
ACI SP-66	(2004) ACI Detailing Manual

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS8	(2013) Specification for Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B3	(2013) Standard Specification for Soft or Annealed Copper Wire
ASTM B8	(2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B496	(2016) Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM C32	(2013; R 2017) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C478	(2018) Standard Specification for Circular Precast Reinforced Concrete Manhole

	Sections
ASTM C857	(2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 48	(2009) Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE 400.2	(2013) Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)
IEEE 404	(2012) Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-94-649	(2013) Standard for Concentric Neutral Cables Rated 5 Through 46 KV

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C119.1	(2016) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA TC 2	(2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 9	(2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
NEMA WC 74/ICEA S-93-639	(2012) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)

ANSI/SCTE 77	(2013) Specification for Underground Enclosure Integrity

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60005	(Basic; Notice 2) Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole

UNDERWRITERS LABORATORIES (UL)

UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 94	(2013; Reprint Sep 2017) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2018) UL Standard for Safety Wire Connectors

UL 510	(2017) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514B	(2012; Reprint Nov 2014) Conduit, Tubing and Cable Fittings
UL 651	(2011; Reprint Nov 2018) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 854	(2004; Reprint Nov 2014) Standard for Service-Entrance Cables
UL 1072	(2006; Reprint Jun 2013) Medium-Voltage Power Cables
UL 1242	(2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast Underground Structures; G, RO

SD-03 Product Data

Medium Voltage Cable; G, RO

Medium Voltage Cable Joints; G, RO

Medium Voltage Cable Terminations; G, RO

Precast Concrete Structures; G, RO

Sealing Material

SD-06 Test Reports

Medium Voltage Cable Qualification and Production Tests; G, RO

Field Acceptance Checks and Tests; G, RO

Arc-proofing Test for cable fireproofing tape; G, RO

SD-07 Certificates

Cable Splicer/Terminator; G, RO

Cable Installer Qualifications; G, RO

1.4 QUALITY ASSURANCE

1.4.1 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:

a. Material description (i.e., f'c and Fy),

b. Manufacturer's printed assembly and installation instructions,

c. Design calculations,

d. Reinforcing shop drawings in accordance with ACI SP-66, and

e. Plans and elevations showing opening and pulling-in iron locations and details.

1.4.2 Certificate of Competency for Cable Splicer/Terminator

The cable splicer/terminator must have a certification from the National Cable Splicing Certification Board (NCSCB) in the field of splicing and terminating shielded medium voltage (5 kV to 35 kV) power cable using pre-manufactured kits (pre-molded, heat-shrink, cold shrink). Submit "Proof of Certification" for approval, for the individuals that will be performing cable splicer and termination work, 30 calendar days before splices or terminations are to be made.

1.4.3 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers. Cable installer must demonstrate experience with a minimum of three medium voltage cable installations. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for an alternate qualified cable installer.

1.4.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of

similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of IEEE C2 and NFPA 70 unless more stringent requirements are specified or indicated.

1.4.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory twoommercial or industrial use for two years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.5.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.5.2 Material and Equipment Manufacturing Date

Products manufactured more than three years prior to date of delivery to site are not acceptable, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6

2.1.1.1 Rigid Metallic Conduit, PVC Coated

Provide NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.2 Intermediate Metal Conduit

UL 1242

2.1.2.1 Intermediate Metal Conduit, PVC Coated

Provide NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.3 Plastic Conduit for Direct Burial and Riser Applications

Provide UL 651 and NEMA TC 2, as indicated.

2.1.4 Plastic Duct for Concrete Encasement

Provide Type EPC-40 per UL 651 and NEMA TC 2.

2.1.5 Innerduct

Provide corrugated polyethylene (PE) or PVC innerducts, or fabric-mesh innerducts, with pullwire. Size as indicated.

2.1.6 Duct Sealant

UL 94, Class HBF. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be capable of curing in temperature ranges of 0 degrees Celsius (C) to 35 degrees C. Cured sealant must withstand temperature ranges of minus 30 degrees C to 90 degrees C without loss of function.

2.1.7 Fittings

2.1.7.1 Metal Fittings

UL 514B

2.1.7.2 PVC Conduit Fittings

UL 514B, UL 651

2.1.7.3 PVC Duct Fittings

NEMA TC 9

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller must be solid. Conductors No. 8 AWG and larger must be stranded. All conductors must be copper.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type RHW conforming to UL 44. Copper conductors must be annealed copper complying with ASTM B3 and ASTM B8.

2.2.3 Jackets

Multiconductor cables must have an overall PVC outer jacket.

2.2.4 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors must be color coded. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations must be properly identified. Color must be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals must be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems must be as follows:

a. 208/120 volt, Three-Phase:

   (1) Phase A - Black

   (2) Phase B - Red

   (3) Phase C - Blue

b. 480/277 volt, Three-Phase:

   (1) Phase A - Brown

   (2) Phase B - Orange

   (3) Phase C - Yellow

c. 120/240 volt, Single Phase: Black and Red

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Must provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors. Provide For use with copper conductors: UL 486A-486B.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 MEDIUM VOLTAGE CABLE

Cable (conductor) sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 12 months prior to date of delivery to the site are not acceptable. Provide single conductor type cables unless otherwise indicated.

2.5.1 Cable Configuration

Provide Type MV cable, conforming to NEMA WC 74/ICEA S-93-639 and UL 1072. Provide cables manufactured for use in duct applications as indicated. Cable must be rated 15 kV with 133 percent insulation level.

2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B conductors. Provide soft drawn copper cables complying with ASTM B3 and ASTM B8 for regular concentric and compressed stranding or ASTM B496 for compact stranding.

2.5.3 Insulation

Provide tree-retardant cross-linked thermosetting polyethylene (XLP) insulation conforming to the requirements of NEMA WC 74/ICEA S-93-639 and ICEA S-94-649.

2.5.4 Shielding

Cables rated for two kV and above must have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper tape shield for each phase.

2.5.5 Neutrals

Neutral conductors must be copper, employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable.

2.5.6 Jackets

Provide cables with a PVC jacket.

2.6 MEDIUM VOLTAGE CABLE TERMINATIONS

IEEE 48 Class 1; of the molded elastomer, prestretched elastomer, or heat-shrinkable elastomer. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations, where required, must be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor. Terminations must be provided in a kit, including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations must be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

2.6.1 Cold-Shrink Type

Terminator must be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination must not require heat or flame for installation. Termination kit must contain all necessary materials (except for the lugs). Termination must be designed for installation in low or highly contaminated indoor and outdoor locations and must resist ultraviolet rays and oxidative decomposition.

2.6.2 Heat Shrinkable Type

Terminator must consist of a uniform cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer covering that is nontracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition. Provide heat shrinkable sheds or skirts of the same material. Termination must be designed for installation in low or highly contaminated indoor or outdoor locations.

2.7 MEDIUM VOLTAGE CABLE JOINTS

Provide joints (splices) in accordance with IEEE 404 suitable for the rated voltage, insulation level, insulation type, and construction of the cable. Joints must be certified by the manufacturer for waterproof, submersible applications. Upon request, supply manufacturer's design qualification test report in accordance with IEEE 404. Connectors for joint must be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

2.7.1 Heat-Shrinkable Joint

Consists of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductor layer for shielding. Replace original cable jacket with a heavy-wall heat-shrinkable sleeve with hot-melt adhesive coating.

2.7.2 Cold-Shrink Rubber-Type Joint

Joint must be of a cold shrink design that does not require any heat source for its installation. Splice insulation and jacket must be of a one-piece factory formed cold shrink sleeve made of black EPDM rubber. Splice must be packaged three splices per kit, including complete installation instructions.

2.8 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling.

2.9 TAPE

2.9.1 Insulating Tape

Provide UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.9.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 00 00 EARTHWORK.

2.9.3 Fireproofing Tape

Provide tape composed of a flexible, conformable, unsupported intumescent elastomer. Tape must be not less than 0.030 inch thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, adhesive-free, and must not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.10 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.11 GROUNDING AND BONDING

2.11.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.11.2 Grounding Conductors

Stranded-bare copper conductors must conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

2.12 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 53 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28 calendar-day compressive strength. Concrete associated with electrical work for other than encasement of

underground ducts must be 4000 psi minimum 28 calendar-day compressive strength unless specified otherwise.

2.13 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom must consist of reinforced concrete. Walls and bottom must be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, must be adequate to accommodate the cable.

2.13.1 Cast-In-Place Concrete Structures

Concrete must conform to Section 03 30 53 CAST-IN-PLACE CONCRETE.

2.13.2 Precast Concrete Structures, Risers and Tops

Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.13.2.1 General

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28 calendar-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.13.2.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for thatparticular component.

h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.13.2.3 Construction

Structure top, bottom, and wall must be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the precaster. Size of windows must exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.13.2.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to ASTM C990. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.13.3 Manhole Frames and Covers

Provide cast iron frames and covers for manholes conforming to CID A-A-60005. Cast the words "ELECTRIC" or "TELECOMMUNICATIONS" in the

top face of power and telecommunications manhole covers, respectively.

2.13.4 Handhole Frames and Covers

Frames and covers of steel must be welded by qualified welders in accordance with standard commercial practice. Steel covers must be rolled-steel floor plate having an approved antislip surface. Hinges must be of stainless steel with bronze hinge pin ,5 inches by 5 inches by approximately 3/16 inch thick, without screw holes, and must be for full surface application by fillet welding. Hinges must have nonremovable pins and five knuckles. The surfaces of plates under hinges must be true after the removal of raised antislip surface, by grinding or other approved method.

2.13.5 Brick for Manhole Collar

Provide sewer and manhole brick conforming to ASTM C32, Grade MS.

2.13.6 Composite/Fiberglass Handholes and Covers

ANSI/SCTE 77. Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass with a design load (Tier rating) appropriate for or greater than the intended use. All covers are required to have the Tier level rating embossed on the surface and this rating must not exceed the design load of the box.

2.14 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

The metal portion of racks and arms must be zinc-coated after fabrication.

2.14.1 Cable Rack Stanchions

The wall bracket or stanchion must be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, or 4 inches by approximately 1 inch glass-reinforced nylon with recessed bolt mounting holes, 48 inches long (minimum) in manholes. Slots for mounting cable rack arms must be spaced at 8 inch intervals.

2.14.2 Rack Arms

Cable rack arms must be steel or malleable iron or glass reinforced nylon and must be of the removable type. Rack arm length must be a minimum of 8 inches and a maximum of 12 inches.

2.14.3 Insulators

Insulators for metal rack arms must be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.15 CABLE TAGS IN MANHOLES

2.15.1 General

Provide tags for each power cable located in manholes. The tags must be polyethylene. Do not provide handwritten letters. The first position on the power cable tag must denote the voltage. The second through sixth positions on the tag must identify the circuit. The next to last position must denote the phase of the circuit and include the Greek "phi" symbol. The last position must denote the cable size. As an example, a tag could

have the following designation: "11.5 NAS 1-8(Phase A)500", denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil.

2.15.2 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 75 degrees C. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties must have a minimum loop tensile strength of 175 pounds. The cable tags must have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.16 PROTECTIVE DEVICES AND COORDINATION

Provide protective devices and coordination as specified in Section 26 28 01.00 10 COORDINATED POWER SYSTEM PROTECTION.

2.17 SOURCE QUALITY CONTROL

2.17.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer must test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing tape per manufacturer's instructions. The arc and fireproofing tape must withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode must be obtained from a dc power source of 305 ampres (plus or minus 5 amperes) and 20 volts (plus or minus 1 volt). The arc must be directed toward the sample assembly accurately positioned 5 millimters (plus or minus 1 millimeter) downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Each sample assembly must be tested at three unrelated points. Start time for tests must be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time must be minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape must indicate that the test has been performed and passed by the manufacturer.

2.17.2 Medium Voltage Cable Qualification and Production Tests

Results of AEIC CS8 qualification and production tests as applicable for each type of medium voltage cable.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of

NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point five feet outside the building and projections thereof, except that conductors must be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment. Provide PVC, Type EPC-40 conduit from the supply equipment to a point five feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

3.4 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.4.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Provide a 4/0 AWG bare copper grounding conductor below medium-voltage distribution duct banks. Bond bare copper grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grouding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Provide ducts with end bells whenever duct lines terminate in structures.

Perform changes in ductbank direction as follows:

a. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.

b. The minimum manufactured bend radius must be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter.

c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of 25 feet for a change of direction of more than five degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections: 30 degrees.

3.4.2 Treatment

Ducts must be kept clean of concrete, dirt, or foreign substances during

construction. Field cuts requiring tapers must be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer must be used whenever an existing duct is connected to a duct of different material or shape. Ducts must be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts must be thoroughly cleaned before being laid. Plastic ducts must be stored on a flat surface and protected from the direct rays of the sun.

3.4.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.4.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, must be zinc-coated, rigid steel, jacked into place. Where ducts are jacked under existing pavement, rigid steel conduit must be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks must be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than four feet on centers.

3.4.5 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations must be PVC coated and must extend from at least two inches within the concrete to the first coupling or fitting outside the concrete (minimum of six inches from penetration).

3.4.6 Multiple Conduits

Separate multiple conduits by a minimum distance of three inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.4.7 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty must be provided with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having three feet of slack at each end of unused or empty conduits.

3.4.8 Conduit and Duct Without Concrete Encasement

Depths to top of the conduit must be not less than 36 inches below finished grade. Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover must be sand compacted as previously specified. The rest of the excavation must be backfilled and compacted in 3 inch to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.4.9 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Depths to top of the concrete envelope must be not less 36 inches. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and must provide at least three inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of three inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring must be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly.

3.4.9.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

3.4.9.2 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.4.10 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air, insects, and vermin.

3.5 CABLE PULLING

3.5.1 General

Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including

turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape or wire shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.5.2 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.6 CABLES IN UNDERGROUND STRUCTURES

3.6.1 General

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.6.2 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

3.7 CONDUCTORS INSTALLED IN PARALLEL

Conductors must be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.8 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination pedestals.

3.9 MEDIUM VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.10 MEDIUM VOLTAGE CABLE JOINTS

3.10.1 General

Provide power cable joints (splices) suitable for continuous immersion in

water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

3.10.2 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods must be as specified elsewhere in this section. Wire must be trained to the sides of the enclosure to prevent interference with the working area.

3.11 CABLE END CAPS

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.12 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

3.13 GROUNDING SYSTEMS

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.13.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 12 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded. If the specified ground resistance is not met, an additional ground rod must be provided in accordance with the requirements of NFPA 70 (placed not less than six feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately.

3.13.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

3.13.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.13.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.13.5 Manhole Grounding

Loop a 4/0 AWG grounding conductor around the interior perimeter, approximately 12 inches above finished floor. Secure the conductor to the manhole walls at intervals not exceeding 36 inches. Connect the conductor to the manhole grounding electrode with 4/0 AWG conductor. Connect all incoming 4/0 grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum No. 6 AWG conductor.

3.14 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 00 00 EARTHWORK.

3.14.1 Reconditioning of Surfaces

3.14.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct . Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.14.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.15 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 53 CAST-IN-PLACE CONCRETE.

3.15.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab must be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab must be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade must have 1/2 inch chamfer. Slab must be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.15.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.16 FIELD QUALITY CONTROL

3.16.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.16.1.1 Medium Voltage Cables

Perform tests after installation of cable, splices, and terminators and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Inspect for proper shield grounding, cable support, and cable termination.

(4) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.

(5) Inspect for proper fireproofing.

(6) Visually inspect jacket and insulation condition.

(7) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.

(2) Perform acceptance test on new cables before the new cables are connected to existing cables and placed into service, including terminations and joints. Perform maintenance test on complete cable system after the new cables are connected to existing cables and placed into service, including existing cable, terminations, and joints. Tests must be very low frequency (VLF) alternating voltage withstand tests in accordance with IEEE 400.2. VLF test frequency must be 0.05 Hz minimum for a duration of 60 minutes using a sinusoidal waveform. Test voltages must be as follows:

CABLE RATING AC TEST VOLTAGE for ACCEPTANCE TESTING	
5 kV	10kV rms(peak)
8 kV	13kV rms(peak)
15 kV	20kV rms(peak)
25 kV	31kV rms(peak)
35 kV	44kV rms(peak)

CABLE RATING AC TEST VOLTAGE for MAINTENANCE TESTING	
5 kV	7kV rms(peak)
8 kV	10kV rms(peak)
15 kV	16kV rms(peak)
25 kV	23kV rms(peak)
35 kV	33kV rms(peak)

3.16.1.2 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Verify tightness of accessible bolted electrical connections.

(4) Inspect compression-applied connectors for correct cable match and indentation.

(5) Visually inspect jacket and insulation condition.

(6) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 1000 volts dc for one minute.

(2) Perform continuity tests to insure correct cable connection.

3.16.1.3 Grounding System

Grounding systems shall be inspected and tested as follows:

a. Visual and Mechanical Inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance versus distance.

3.16.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given five working days advance notice of the dates and times of checking and testing.

-- End of Section --

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SUBMERSIBLE PUMP, AXIAL-FLOW AND MIXED-FLOW TYPE
02/16

PART 1 GENERAL

1.1 SUMMARY

Design, furnish, and install three axial flow, close-coupled propeller pumping units for the Pumping Station shown. Each pump shall be equipped with a 135 HP submersible electric motor connected for operation on 460 volts, three phase, 60 hertz, wire service, with an adequate length of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NECA and IEC 60034-1.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(2015) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(2014) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C200	(2012) Steel Water Pipe - 6 In. (150 mm) and Larger
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C207	(2018) Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 in. through 144 in. (100 mm through 3600 mm)
AWWA C208	(2017) Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C111	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C219	(2017) Bolted Sleeve-Type Couplings for Plain-End Pipe

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B16.5	(2017) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.1	(2016; Errata 2016) Power Piping
ASME B36.10M	(2015; Errata 2016) Welded and Seamless Wrought Steel Pipe
ASME B46.1	(2009) Surface Texture, Surface Roughness, Waviness and Lay
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M	(2017) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A240/A240M	(2018) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A242/A242M	(2013; R 2018) Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A297/A297M	(2017) Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application
ASTM A312/A312M	(2017) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320/A320M	(2017b) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A479/A479M	(2018) Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels

ASTM A516/A516M	(2017) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A668/A668M	(2017) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A743/A743M	(20172019) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM B148	(2014) Standard Specification for Aluminum-Bronze Sand Castings
ASTM B584	(2014) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM D2000	(2012; R 2017) Standard Classification System for Rubber Products in Automotive Applications
ASTM F1476	(2007; R 2013) Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications

HYDRAULIC INSTITUTE (HI)

HI 1.3	(2013) Rotodynamic (Centrifugal) Pump Applications
HI 2.3	(2013) Rotodynamic (Vertical) Applications
HI 9.1-9.5	(2000) Pumps - General Guidelines for Types, Applications, Definitions, Sound Measurements and Documentation
HI 9.6.4	(2009) Rotodynamic Pumps for Vibration Analysis and Allowable Values
HI ANSI/HI 9.8	(2014) Rotodynamic Pumps for Pump Intake Design - A123
HI ANSI/HI 14.6	(2011) Rotodynamic Pumps for Hydraulic Performance Acceptance Tests - A136

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60034-1	(2017) Rotating Electrical Machines – Part 1: Rating and Performance
IEC 61000-6-2	(2017) Electromagnetic Compatibility (EMC) - Part 6-2: Generic Standards - Immunity Standard for Industrial Environments
IEC 61000-6-3	(2010) Amendment 1 - Electromagnetic

	Compatibility (EMC) - Part 6-3: Generic Standards - Emission Standard for Residential, Commercial and Light-industrial Environments
IEC 61326-1	(2012) Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements - Part 1: General Requirements

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1	(2003; R 2008) Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ISA RP2.1	(1978) Manometer Tables

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA	Current Standards

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2018) Motors and Generators
NEMA WC 70	(2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658
NEMA WC 72	(1999; R 2015) Standard for Continuity of Coating Testing for Electrical Conductors

UNDERWRITERS LABORATORIES (UL)

UL 508C	(2002; Reprint Nov 2010) Power Conversion Equipment

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2013; with Change 1, 2016) Seismic Design of Buildings

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are forinformation only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G, DT

SD-03 Product Data

Pump Supplier Qualifications

Materials; G, DT

Equipment; G, DT

Installation Instruction Manual; G, CN

Propeller Balancing

Factory Tests

Pump Field Tests; G, DT

Spare Parts; G, DT

Storm Water Pumps; G, DT

Formed Suction Intake (FSI); G, DT

Variable Frequency Drives; G, DT

SD-05 Design Data

Computations; G, DT

SD-06 Test Reports

Factory Test Report

Installation and Start-Up Engineer

Field Test Report; G, DT

SD-07 Certificates

Qualified Welders

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G, DT

1.4 QUALITY ASSURANCE

1.4.1 Pump Supplier Qualifications

The pump manufacturer has overall responsibility to supply the pumping unit (submersible pump/motor, discharge tube, formed suction intake (FSI) device, cables, and related instrumentation and accessories) that meet the requirements of this specification. Thus, during start-up, installation, and performance evaluation, the pump manufacturer is the sole responsible party. The pump manufacturer must supply a list of installations at which pumps of his manufacture, and ones similar to those specified, have been operating for at least two years. The components and materials of the pumping unit may occur at different facilities, and be the product of other manufacturers.

1.4.2 Installation and Start-up Engineer

Furnish a competent installation engineer (including those from Contractor's suppliers) who is knowledgeable and experienced with the installation and start-up procedures for submersible pumps and the associated equipment specified. Submit the installation and start-up engineer's qualifications. When so requested, the installation engineer is responsible for providing complete and correct direction during installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, initial starting, and subsequent operation of equipment until field tests are completed. The installation engineer initiates instructions for actions necessary for proper receipt, inspection, handling, uncrating, assembly, and testing of equipment. Eight hours of field service shall be provided by an authorized, factory trained representative of the pump manufacturer. The installation engineer must also keep a record of measurements taken during erection and furnish one copy to the Contracting Officer upon request or upon the completion of the installation of assembly or part. The erecting engineer conducts training on the operation and maintenance features of the pump units. Submit the installation report.

1.4.3 Detail Drawings

Submit drawings of sufficient size to be easily read, within 60 calendar days of Notice of Award. Submit information in the English language. Dimension in the inch-pound-second system. Furnish the following:

a. Outline drawings of the pump showing dimensions and weight of the pump/motor.

b. Drawings showing details and dimensions of pump mounting design and layout including any embedded items and lifting connections.

c. Cross-sectional drawings of each different size of pump, showing each component, and major or complicated sections of the pump in detail. On each drawing indicate an itemized list of components showing type, grade, class of material used, and make and model of the standard component used. Include detail and assembly drawings of entire pumping unit assembly.

d. Provide drawings covering the installation that is intended for the erecting engineer.

e. Indicate efficiency, bhp, and NPSHR with the capacity-head curve.

f. Motor characteristic curves or tabulated data (test or calculated) to indicate the speed, power factor, efficiency, current, and kilowatt input, all plotted or tabulated against percent load as abscissas.

1.4.4 Welding

Weld structural members and follow qualify procedures with qualified welders in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer may be accepted as permitted by ASME B31.1. Perform welder qualification tests for each welder whose qualifications are not in compliance with the referenced standards. Notify the Contracting Officer 24 hours in advance of qualification tests. Perform the qualification tests at the work site if practical. The welder or welding operator must

apply their assigned symbol near each weld made as a permanent record.

Submit the names of all qualified welders, their identifying symbols, and the qualifying procedures for each welder including support data such as test procedures used, standards tested to.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect each pump for damage or other distress when received at the project site. Store each pump and associated equipment indoors as recommended by the pump manufacturer, protected from construction or weather hazards at the project site. Provide adequate short-term storage for each pump and equipment in a covered, dry, and ventilated location prior to installation. Follow the manufacturer's instructions for extended storage. Supply proper equipment for handling the pump and consider the equipment as special tools if not completely standard. Follow the manufacturer's recommendations for handling of the pump.

1.6 EXTRA MATERIALS

Extra materials are listed below:

a. Furnish the following spare parts:

   (1) One complete set of bearings and seals for each size pump.

   (2) Replacement wearing rings and O-rings for each size pump.

   (3) One propeller for each size pump.

b. Furnish one set of all special tools required to completely assemble, disassemble, or maintain the pumps. Special tools refers to oversized or specially dimensioned tools, special attachments or fixtures, or any similar items. Furnish lifting devices required for use in conjunction with the truck crane. Provide the tools in a toolbox or toolboxes.

c. Submit copies of manufacturer's complete parts list showing all parts, spare parts, and bulletins for each pump. Clearly show all details, parts, and adequately describe parts or have proper identification marks. Provide he parts lists on good quality 8-1/2 by 11 inch paper or on optic disk with default letter print size of, 8-1/2 by 11 inch, bound separately of the Operation and <Maintenance manual with a flexible, durable cover. Drawings incorporated in the parts lists may be reduced to page size provided they are clear and legible. Photographs or catalog cuts of components may be included for identification.

1.7 WARRANTY

Provide a manufacturer's warranty for the submersible pumps and all equipment furnished under this section against defective workmanship, materials, design, and performance for a period of five years from the date the equipment is accepted. If the equipment or any part thereof does not conform to these warranties, and the Government so notifies the manufacturer within a reasonable time after its discovery, the manufacturer must thereupon promptly correct such nonconformity by repair or replacement. Coordinate the down time for the equipment with the Government, and keep to a minimum duration that is mutually agreed to by

the manufacturer and the Government. The manufacturer is liable during the warranty period for the direct cost of removal of the equipment from the installed location, transportation to the manufacturer's factory or service shop for repair and return, and reinstallation on site. The manufacturer must be given the opportunity to perform the removal and reinstallation and to select the means of transportation. The expense of removing adjacent apparatus, installing spare equipment, costs of supplying temporary service, etc., is not included in this warranty provision.

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

2.1.1 Storm Water Pumps

Each pumping unit includes a pump/motor, discharge tube, formed suction intake (FSI) device, air vent, lifting chain, cable, and controls. Each pump must be of the axial flow submersible type for storm water, attached to the same shaft with a submersible electric motor. Use an electrically operated pump/motor installed in a discharge tube. Except as otherwise stated or noted, the terms pump and pump/motor both refer to a pump/motor integral unit.

2.1.2 General Design Requirements

General design requirements are listed below:

a. Provide the pump meeting head, capacity, speed, efficiency, pump sump design, range of operation, cavitation, and vibration requirements as specified.

b. Design the pump for runaway speed as calculated for the system shown and specified. Include water hammer calculations when long discharge lines exist. Calculate the reverse speed assuming a power failure and the discharge valves fail to close.

c. The pump must, as a minimum, meet the applicable design, materials, and manufacturing requirements of HI 1.3, HI 2.3, HI 9.1-9.5 and these specifications.

d. The pumping unit design and performance must have been demonstrated by previous successful operation of pumps of the required type and of equal design complexity by the manufacturer.

e. Operate the pump in a discharge tube that fits within the dimensions shown, and so that installation and maintenance can be carried out by an mobile crane. The weight of the pump/motor integral unit must not exceed 2870 lb.

f. Design the pump for the calculated hydraulic pressure including a water hammer to which the pump parts are exposed.

g. In addition to the specified head, take into account the pump losses when computing the pump system output.

h. The pump must have a continuously rising head characteristic with decreasing capacity over the required range of operation specified.

The pump must not have an unstable operating characteristic over the required range of operation.

i. The pump must meet all requirements for net positive suction head required (NPSHR) and operate without surging.

j. Use associated pumping equipment including, but not limited to, electrical controls, instrumentation, and pump control center that is suitable for outdoor operation.

2.1.3 Design of Discharge System

Discharge the pumping unit into the discharge chamber indicated. The system loss curve(s) furnished includes all losses beyond the pumping unit. Determine Losses within the pumping unit.

2.1.4 Operating Conditions

The pump must be capable of operating in the dry (for the purpose of maintenance and operating checks) for short periods of time as stated in the manufacturer's operating instruction.

The pump manufacturer establishes and states in the operating manual the procedures for starting and stopping the pumps, including setting of valves or any sequential operations.

2.1.5 Performance Requirements

Performance requirements are:

a. When operated in the dry, the maximum level of vibration of the assembled pumping unit cannot be greater than the value of the lower limit of the good range of the "General Machinery Vibration Severity Chart". This chart can be obtained from Entek IRD, 1700 Edison Drive, Cincinnati, Ohio 45150. Take measurements at pump operating speed during the Factory Test and the field start-up test.

b. The pump must be capable of operating without instability over the required range of head.

c. The pump unit shall be designed for installation into a discharge column onto a seat at the bottom of the column and shall be held in place by its own weight and the pumping head. The discharge column shall be permanently installed in the wet well. The design shall be such that the pump unit(s) will be automatically and firmly connected to the discharge tube when lowered into place. A locking device, located on the external surface of the pump housing, shall prohibit rotational movement of the pump/motor unit(s) within the tube(s). The pump(s) shall be easily removable for inspection or service with no need for personnel to enter the wet well. The pump(s) shall not require any bolts, nuts or fasteners for connection to the discharge column. Stiffening and guiding webs shall be provided at the pump support seat to ensure concentric positioning of pump within the discharge column. An O-ring shall be provided on the bottom of the inlet (suction) bellmouth so that the weight of the pump unit, when acting on the O-ring, will provide an effective seal between pump and discharge column.

d. The Column pipe shall be supplied and mounted on a Formed suction

inlet device (FSI) that provides optimal inflow to the propeller pump by gradually accelerating and redirecting the flow towards the pump suction.

2.1.6 Capacities

Discharge cannot be less than 40cfs against total dynamic head (TDH) of 15.5 feet with water surface in the intake sump at elevation 628 feet. Shut off head shall be 28 feet (minimum).

2.1.7 Efficiency

The pump must have an efficiency of not less than 79 percent at 15.5 feet with discharge rate of 40 cfs. The pump max efficiency must be 83 percent at 24 feet with flow rate of 36 cfs.

2.1.8 Equipment

Submit, within 60 calendar days of Notice of Award, a list of equipment as specified, the names of the manufacturers, performance capacities, and other relevant information for the machinery and other equipment contemplated to be incorporated into the work.

2.2 MATERIALS

Submit a list designating materials to be used for each pump part along with the submittal of the drawings. If deviation from specified materials is desired, submit complete specifications for the proposed deviating materials after award of the contract.

a. Provide pumps designed and manufactured by a firm that is regularly engaged in the manufacture of the type of pump described in these specifications. Provide materials and fabrication conforming to the requirements specified herein and to Section 05 50 15 CIVIL WORKS FABRICATIONS and to additional specified requirements. Classifications and grade of material incorporated in the work must be in accordance with designated specifications. Submit deviations from the specified materials in accordance with paragraph SUBMITTALS.

b. Identify the pumping unit by means of a separate nameplate permanently affixed in a conspicuous location; bearing the manufacturer's name, model designation, serial number, if applicable, and other pertinent information such as horsepower, speed, capacity, type, and direction of rotation. Make the plate of corrosion-resistant metal with raised or depressed lettering and a contrasting background.

c. Equip the pumping unit with suitably located instruction plates, including any warnings and cautions, describing any special and important procedures to be followed in starting, operating, and servicing the equipment. make plates of corrosion-resistant metal with raised or depressed lettering and a contrasting background.

d. Major pump components shall be of grey cast iron, ASTM A48/A48M, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate

primer with a polyester resin paint finish on the exterior of the pump.

e. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O-rings.

2.3 METALWORK FABRICATION

The materials of construction must comply with the following:

TABLE 1 - MATERIALS OF CONSTRUCTION	
PART	MATERIAL
Discharge Bowl	Cast iron
Suction Bell	Cast iron
Pump Bowl	Cast iron
Propeller	Stainless steel
Shaft	Cold-rolled stainless steel
Wearing Ring	Manufacturer's standard
Bolts, Key, etc.	Stainless steel
O-rings	Nitrile or Viton rubber
Mechanical seals	Tungsten carbide
Discharge tube	Steel plate
Discharge elbow	Steel plate

2.3.1 Designated Materials

Designated materials must conform to the following specifications, grades, and classifications.

MATERIALS	SPECIFICATION	GRADE, CLASS
Aluminum-Bronze	ASTM B148	Alloy No. C95500 Castings
Cast Iron	ASTM A48/A48M	Class Nos. 30A, 30B, and 30C
Cast Steel	ASTM A27/A27M	Grade 65-35, annealed
Coal Tar Protective Coatings	AWWA C203	

MATERIALS	SPECIFICATION	GRADE, CLASS
Cold-Rolled Steel Bars	ASTM A108	min, Wt. Strm 65,000 psi
Copper Alloy Castings	ASTM B584	Alloy No. C93700
Corrosion-Resistant Alloy Casting	ASTM A297/A297M	Grade CA-15, CAGNN and CF-8M
Dimensions for Steel Water Piping Fittings	AWWA C208	
Hot-Rolled Stainless	ASTM A479/A479M	S43100-T
Ring Flanges	AWWA C207	Class B
Rubber Products in Automotive Applications	ASTM D2000	
Seamless and Welded Austenitic Stainless Steel Pipe	ASTM A312/A312M	
Stainless Bars and Shapes	ASTM A276/A276M	Grades S30400 and S41000
Steel Forging	ASTM A668/A668M	Class F
Steel Pipe 6 inch and Larger	AWWA C200	
Steel Plates, Pressure Vessel	ASTM A516/A516M	Grade 55
Steel Plate	ASTM A242/A242M	
Stainless Steel Plate	ASTM A240/A240M	UNS S30400
Quality Steel	ASTM A36/A36M	
Surface Texture	ASME B46.1	

2.3.2 Bolted Connections

2.3.2.1 Bolts, Nuts, and Washers

Bolts, nuts, and washers must conform to requirements herein specified and paragraphs SUBMERSIBLE PUMP, DISCHARGE TUBE, AND DISCHARGE ELBOW, and subparagraph, NUTS AND BOLTS for types required. Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to bolt axis.

2.3.2.2 Materials Not Specifically Described

Conform materials not specifically described to the latest ASTM specification or to other listed commercial specifications covering class or kinds of materials to be used.

2.3.3 Flame Cutting of Material

Flame cutting of material, other than steel, is subject to Contracting Officer approval. Accurately perform shearing, and neatly finish all portions of work. Steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a smooth surface free from cracks and notches is secured. Prepare surfaces and edges to be welded in accordance with Section 3 of AWS D1.1/D1.1M. Chipping and grinding are not required except where specified and as necessary to remove slag and sharp edges of technically guided or hand-guided cuts not exposed to view. Chip, grind, or machine visible or exposed hand-guided cuts to metal free of voids, discontinuities, and foreign materials.

2.3.4 Alignment of Wetted Surfaces

Exercise care to ensure that the correct alignment of wetted surfaces being joined by a flanged joint is being obtained. Where plates of the water passage change thickness, provide a transition on the outer surface, leaving the inner surface properly aligned. When welding has been completed and welds have been cleaned, but prior to stress relieving, carefully check joining of plates in the presence of a Government inspector for misalignment of adjoining parts.

2.4 SUBMERSIBLE PUMP

2.4.1 Design and Manufacture

The submersible pump may be either of cast or fabricated construction. The level of manufacture skill must be consistent with the standards referenced in the specifications. All work performed in the manufacturing of the pumps must be in a skillful and workmanlike manner in accordance with the best modern shop practice and manufacturing of finished products similar in nature to those specified herein. The Government reserves the right to observe and witness the manufacturing of the pumps and to inspect the pumps for compliance with contract requirements during factory assembly.

2.4.2 Speed

2.4.2.1 Pump Speed

Rotative speed of the pump cannot be greater than 880 rpm.

2.4.2.2 Runaway Speed

Design the pump to sustain full runaway speed without damage at maximum head difference across the pump. Based on the system design as indicated, the manufacturer must compute the maximum reverse runaway speed, and design the pump and motor to sustain that reverse rotation without damage.

2.4.3 Pump Construction

2.4.3.1 General

The major pump components must be of materials as described in Table 1. Design the entire support assembly in accordance with UFC 3-310-04. All the exposed nuts and bolts must be stainless steel. Machine and fit all mating surfaces where watertight sealing is required with Nitrile or Viton rubber O-rings. The fitting must be such that the sealing is accomplished

by metal-metal contact between machined surfaces which results in controlled compression of the O-rings. Sealing compounds, grease, or secondary devices are not acceptable.

2.4.3.2 Pump Lifting Handle And Lifting Lugs

Design the lifting handle to bear the entire weight of the pumping unit at a conservative factor of safety. Provide lifting lugs where the weight of the separate part requires a lug.

2.4.3.3 Pump and Motor Bearing Arrangement

The pump and motor bearings must be the standard design of the manufacturer for the pump supplied under this specification. The type and number must be of proven design as used in previous operating units supplied by the manufacturer. Provide bearings of the grease lubricated and sealed type; having a minimum L10 bearing life of 100,000 hours. The motor bearings shall be permanently grease lubricated. Each bearing must be of the correct design to resist the radial and thrust loads applied. Provide enough bearings to ensure the pump rotating elements are supported so that the possibility of excessive vibration is eliminated. The pump shaft upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust. Single row lower bearings are not acceptable. The lower bearing housing shall include a thermal sensor (RTD) of the platinum-100 type to monitor the temperature of the thrust bearing outer race during operation. If a high temperature occurs, the sensor shall activate an alarm. The upper support bearing shall have an insulated outer ring to provide protection against electrically induced currents that can be created when the motor is used with a VFD. Conform ball and roller bearings life and load ratings to ABMA 9 and ABMA 11.

2.4.3.4 Mechanical Seals

Provide a mechanical rotating shaft seal system between the propeller and motor to ensure the motor housing is sealed properly. The mechanical seals must be in tandem, consisting of two totally independent seal assemblies, lapped and face type seals running in lubricant reservoirs for cooling and lubrication. The mechanical seals must contain both stationary and rotating tungsten carbide face rings unless otherwise specified. In order to avoid seal failure from sticking, clogging, and misalignment from elements contained in the mixed media, only the seal faces of the outer seal assembly and its retaining clips can be exposed to the mixed media. Contain all other components in the lubricant housing. All seal faces must be solid material capable of being relapped. Each seal interface shall be held in contact by its own spring system. The seals must require neither maintenance nor adjustment, nor depend on direction of rotation for sealing, but be easy to check and replace. Shaft seals without positively driven rotating members are not considered acceptable or equal.

2.4.3.5 Lubricant Housing

Provide an oil housing with oil, as recommended by the pump manufacturer, to lubricate the shaft sealing system and to dissipate the heat generated by the motor and bearings.

2.4.3.6 Propeller

The propeller design and manufacture must be the manufacturer's standard. The pump propeller shall be constructed of stainless steel ASTM A743/A743M and shall be balanced statically and dynamically to reduce vibration and wear. The propeller shall be of a four-bladed fixed pitch and factory balanced design. The blades shall be noticeably backward curved so that any clogging tendency is minimized. The propeller pump shall have seven guide vanes designed in such a way as to minimize clogging by carrying debris normally prone to clog the guide vanes from the inside of the guide vanes towards the outside of the guide vane. Here the flow shall be partially and deliberately destabilized to help material disengage itself from the vanes, to continue its passage through and out of the pump. The propeller surface must be smooth, without holes and fabrication offsets. The attachments to shaft must be with keys or other fasteners that are made of stainless steel, and of sturdy construction designed to not loosen, but be easily removed for maintenance. The propeller construction may be cast or fabricated. At the time of assembly the propeller clearances must be those shown on assembly drawings and may be checked in the field or at the factory at the Contracting Officer's option. Balance the propeller at the design operating speed. The standard balance quality grade is G6.3 in accordance with ISO 1940-1. Balance in accordance with the procedure in HI 9.6.4, except that a two-plane balance is required. Submit the results of propeller balancing. The Propeller shall be mounted on the motor shaft. Couplings or gear boxes shall not be accepted. A wear ring system shall be installed to provide sealing between the pump housing and the propeller. The wear ring shall be of stainless steel ASTM A320/A320M Type 316.

2.4.3.7 Shaft

The shaft must be one piece integral with the motor of high-strength cold-rolled stainless steel, ASTM A479/A479M with a factor of safety of five measured against the ultimate strength. Two piece shaft with couplings shall not be acceptable. If a shaft material of lower quality than stainless steel - ASTM A479/A479M S43100-T is used, a shaft sleeve of stainless steel - ASTM A479/A479M S43100-T is used to protect the shaft material. Design the shaft for all torque conditions during normal operation and for runaway speed during reverse flow.

2.4.3.8 Bowl Assembly

The bowl assembly may be of cast or fabricated manufacture. The hydraulic design must be the manufacturer's standard design as used in previous operating installations. The general manufacture quality relating to flange design, drilling, bolts, alignments, must be in accordance with industry standard practice.

2.4.4 Motor

The motor shall be submersible according standard IEC 60034-1 and protection class IP 68, and conform to the requirements of NEMA MG 1. The motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The motor shall be cooled by the pumped water flowing along the stator housing when the pump is working. A water jacket or any external cooling system shall not be considered acceptable designs.Size the motor to avoid overload when operating at any point along the characteristic curve of the pump. Provide 3-phase, 60-Hz, 460 V, squirrel cage induction type motors, NEMA

Design B Type. Insulate the stator windings and stator leads with a moisture-resistant Class H insulation with temperature resistance of 356 degrees Fahrenheit (F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 96 percent. The design shall be inverter duty rated in accordance with NEMA MG 1, Part 31. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The temperature rise above ambient for continuous full load rated conditions and for the class of insulation used cannot exceed the values in NEMA MG 1. The motor must be rated for continuous duty when submerged and also be capable of operation in the dry for short periods of time for testing and maintenance purposes. The motor shall be capable of no less than 15 evenly spaced starts per hour and be able to operate throughout the entire pump performance curve from shut-off through run-out.

2.4.4.1 Torque

Starting torque must be sufficient to start the pump, but in no case less than 60 percent of full-load torque. Break-down torque cannot be less than 150 percent of full-load torque.

2.4.4.2 Support

Provide thrust bearing support of sufficient strength and rigidity to support the weight of the entire rotating element of the motor, pump propeller and shaft, and the hydraulic thrust.

2.4.5 Cable

Cable shall conform to the following requirements:

a. Specifically design power and instrumentation cable for use with a submersible pump application and conform to the requirements of NEMA WC 70 and NEMA WC 72. Use submersible cable suitable for continuous immersion in water at the maximum depth encountered. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. Cable must have an ampacity of not less than 125 percent of the motor full load current. The cable length must be determined by the pump manufacturer for the installation shown.

b. Power and instrumentation cables must enter the motor through a sealing system that prevents water entry into the unit and provides strain relief. The cable entry may be comprised of rubber bushings, flanked by stainless steel washers, having a close tolerance fit against the cable outside diameter and the entry inside diameter for sealing by compression of the bushing, or the entry may be sealed by other gland compression methods.

2.4.6 Painting

All castings must be blasted before coating. All wet surfaces are to be coated with two-pack oxyrane ester paint. The total layer thickness should be at least 120 microns. Zink dust primer shall not be used.

2.4.7 Pump Control and Monitoring

Provide a self-contained pump control and monitoring system. The

Monitoring system shall be mounted in the cabinet and contain per pump one Base unit acting as a gateway between the Pump and the Central Monitoring and a Central Control Unit (CU). The CU shall be able to control up to 10 Pumps. The Base Unit (BU) shall be able to stop the pump if required via an interlocking relay and it shall provide connections for optional measuring modules such as a power meter and other I/O modules. The central unit (CU) shall be provided for external access and information exchange with the monitoring system via one single point. The pump shall be supplied with a Pump electronic module (PEM) mounted inside the motor. The PEM shall collect, store and digitize all measurement from all sensors and shall communicate the data in a digital format via two control leads integral to the pump power cable to a Base unit mounted in a pump control cabinet to the Central control unit.

The sump shall be equipped with a Multi-Stage Level Sensing Device or a Level transmitter designed to detect level of the storm water for pump control and liquid level display. The sensors shall be installed in the sump. The Multi-Stage Level Sensing Device shall be PVC injected to seal the unit and prevent any moisture from entering any of the sensor units. The Level transmitter shall measure the relative pressure with a ceramic diaphragm and be approved in conformity with IEC 61000-6-2, IEC 61000-6-3, IEC 61326-1. The sensors shall be wired to the pump station controller. The connection shall provide fail-safe monitoring of the probe cable and the probe assembly. The contractor shall provide a safety back-up two single Stage Level Sensing Devices (conductive level probe) for high and low liquid level at specified intervals for pump control and liquid level display. Each sensor unit within the probe assembly shall be PVC injected to seal the unit and prevent any moisture from entering any of the sensor units.

Provide independent local indication of the alarm and separate contacts for the remote indication of each alarm and local reset. Sensors must alarm and shut down the pump at an abnormal operating condition. Provide separate red alarm indicator lamps and green pump running lamps and label in the enclosure. Provide the following sensors:

2.4.7.1 Temperature Sensors

Temperature sensors in the stator windings to protect the motor against overheating.

Temperature sensors to monitor the main and support bearings.

2.4.7.2 Vibration Sensor

Vibration sensor to monitor vibration on three axes from 10 Hz to 600 Hz.

2.4.7.3 Float Switch Sensor

Float-switch sensor positioned between the bearings and the stator-end coils to detect if liquid penetrates the stator housing.

2.4.7.4 Detectors

A junction box leakage detector and a water-in-oil detector.

2.4.8 Air Vent

Provide an air vent, located as indicated, and a combination air and

vacuum valve type. The valve must be a minimum 125 lb class and sized for the design flow rate. Provide an isolation valve at the valve's inlet. Materials of construction must be cast iron for the valve body; stainless steel for the internal linkage, float, and float stem; and Buna-N for the needle and seat. The valve must provide a dual function to release air during pump start-up and to permit air to re-enter to break the vacuum during pump shutdown.

2.5 DISCHARGE COLUMN PIPE AND DISCHARGE ELBOW

2.5.1 General

General discharage tube and discharge elbow requirements are listed below:

a. Design, manufacture, and install the discharge pipe in accordance with the pump manufacturer's instructions. For purposes of performance and this specification it is treated as part of the pumping unit. Provide the discharge tube of such size to accommodate the dimensions of the pump supplied in accordance with the manufacturer's requirements. Furnish the discharge tube with lifting points to aid in the handling and installation of the tube. Permanently install it in the pump sump as indicated.

b. Design such that the pumps are automatically and firmly connected to the discharge tube when lowered into place and in accordance with the pump manufacturer's instructions. Provide a locking device that prohibits rotational movement of the pump within the tube.

c. The pumps must be easily removable for inspection or service without need to enter the pump sump. The pumps must not require any bolts, nuts, or fasteners for connection to the discharge housing. Provide stiffening, guides, or other features at the pump support to ensure concentric positioning of the pump in the discharge tube. provide means such that an effective seal is obtained between the pump and discharge pipe. Power cable penetrations must be watertight.

d. Install a sole plate as indicated. Design the entire support assembly to the requirements of UFC 3-310-04.

2.5.2 Flanged Joints

Design flanged joints to be airtight and watertight, without the use of preformed gaskets, except that the use of a gasketing compound will be permitted. Mating flanges must be male/female rabbet type or doweled with not less than four tapered dowels equally spaced around the flange. Machine flanges and drill bolt holes concentric with the centerline, having a tolerance of plus or minus 1/4 of the clearance between the bolt and the bolt hole. When fabricated from steel plate, flanges must not be less than 1-1/2 inch thick after machining. Flange machining must not vary more than 10 percent of the greatest flange thickness. Construct fabricated flanges, as a minimum, to the dimensions of AWWA C207, Class B. Connect flanges to the column tube with two continuous fillet welds, one at the inside diameter of flange-to-pump-tube and the other at the outside diameter of pump-pipe-to-flange. Weld design is the pump manufacturer's responsibility. Machine mating flanges parallel to a tolerance of 0.002 inch. Finish the machine mating flange surface to 125 microns or better.

2.5.3 Nuts and Bolts

Use hexagonal type nuts and bolts; with bolts, including assembly, anchor, harness, and dowels of 300 stainless steel. Provide bronze nuts and 300 series stainless steel washers.

2.5.4 Bolted Lid

Provide a watertight lid, hinged and bolted to the top of the discharge pipe.

2.5.5 Harnessed Coupling

Provide a flexible mechanical coupling or split-sleeve type coupling that either conforms to ASTM F1476, Type II, Class 3, stainless steel (as manufactured by Teekay or Straub Couplings), ASTM F1476, Type 1 (as manufactured by Victaulic), or Dresser Couplings style 38, or approved equal, to connect the pump discharge elbow to the discharge piping. Finish the middle ring without pipe stop to facilitate the installation and removal of the coupling. Install a minimum of four harness bolts (sized by the pump manufacturer) at each coupling.

2.5.6 Wall Thimble

Each wall thimble must have one plain end to accommodate the flexible mechanical coupling and one flanged end to mate with the flap gate. Match the plain end with the pump discharge elbow in thickness and diameter and drill the flanged end to match, and be capable of supporting without distortion, the flap gate. Provide the seal ring on the wall thimble located so that it is centered in the wall when embedded. Furnish a flanged vent nozzle equipped with an ASME B16.5 Standard 125 pound flange and locate where indicated. Fabricate the wall thimble from steel plates.

2.5.7 Discharge Column Pipe

The discharge column shall be permanently installed in the wet well. The design shall be such that the pump unit(s) will be automatically and firmly connected to the discharge tube when lowered into place. A locking device, located on the external surface of the pump housing, shall prohibit rotational movement of the pump/motor unit(s) within the tube(s). The pump(s) shall be easily removable for inspection or service with no need for personnel to enter the wet well. The pump(s) shall not require any bolts, nuts or fasteners for connection to the discharge column. Stiffening and guiding webs shall be provided at the pump support seat to ensure concentric positioning of pump within the discharge column. The discharge pipe must have pipe supports or cradles as recommended by the pump manufacturer. Locate the supports between the flexible coupling and the wall, as indicated. Provide suitably-sized thrust restraints at each flexible coupling as indicated. The supports must provide support for the weight of the pipe, the water that will pass through the pipe, and any dynamic forces that may develop due to water flowing through the pipe. The discharge pipe must be epoxy Coated or galvanized piping of welded or seamless pipe or welded steel plate. The steel pipe must conform to AWWA C200 with dimensional requirements as given in ASME B36.10M. Fittings must comply with AWWA C208.

2.5.8 Dissimilar Metals

When dissimilar metals are used in intimate contact, apply suitable

protection against galvanic corrosion. Protect the anodic member by proper electrical insulation of the joint.

2.6 VARIABLE FREQUENCY DRIVES

Provide variable frequency drive (VFD) to control the speed of the storm water pump motors. The VFD shall be solid state, with a Pulse Width Modulated (PWM) output and shall be a Direct Torque Control or sensorless vector equivalent AC to AC converter utilizing the latest isolated gate bipolar transistor technology. The drive must also provide an optional operational mode for scalar or V/Hz operation. The VFD shall be UL listed or CSA listed and comply with EMC Directive 89/336 EEC, Low Voltage Directive 73/23 EEC and shall be rated to operate from 3-phase power at 230VAC to 690VAC plus/minus (+/-) 10 percent, 50Hz to 60Hz. The VFD shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.97 at all speeds and loads.

The Drive efficiency shall be 98 percent or better at full speed and load. The overload current capacity shall be 110 percent of rated current for one minute out of five minutes.

The output frequency shall be adjustable between 0Hz and 180Hz. The drive shall have three analog inputs and two analog outputs. One input with +/- 0VAC to 10VAC signal and two inputs with 4mA to 20mA signals, all independently programmable. The two analog outputs shall provide 4mA to 20mA signals.

The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. A Modbus RTU communication shall be integrally mounted. Serial communication capabilities shall include, but not be limited to, run-stop control; set point adjustment, current limit, and acceleration/deceleration time adjustments.

The drive shall provide electronic motor overload protection qualified per UL 508C. A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load. A stall protection shall be programmable to provide a warning or stop the drive after the motor has operated above a programmed torque level for a programmed time limit. Under-load protection shall be programmable to provide a warning or stop the drive after the motor has operated below a selected under-load curve for a programmed time limit. The over-temperature protection shall provide a warning if the power module temperature is less than 5 degrees C below the over-temperature trip level. Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of two minutes.

The VFD program shall allow communicating and controlling up to a four pumps. The drives shall have a pressure boost function to compensate for additional system friction losses at higher flow rates. This function shall automatically increase the pressure set point when additional pumps are staged on.

The VFD shall have adjustable acceleration and stop ramp rates to limit the in-rush current and to protect the piping system from water hammer and shall be capable of starting into a rotating load and accelerate or decelerate to reference without safety tripping or component damage. The drive shall have the ability to automatically restart after an

overcurrent, overvoltage, under-voltage or pump protect fault. The VFD shall incorporate a "self-cleaning" function to remove debris from the impeller. The drive shall have the ability to estimate the pump flow to an accuracy of five percent of the total rated pump flow.

The following parameter selections shall be available:

a. Pump process variable in units of psig, gpm, ft, l/s, m;

b. Vibration level in units of IP/s or mm/s;

c. Energy Savings verses a constant speed pump;

d. RPM;

e. Output frequency, voltage, current and torque;

f. Input voltage, power and kilowatt hours; and

g. Heat sink temperature and DC bus voltage.

Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacement:

a. Short circuit at controller output,

b. Ground fault at controller output,

c. Open circuit at controller output,

d. Input undervoltage,

e. Input overvoltage,

f. Loss of input phase,

g. AC line switching transients,

h. Instantaneous overload,

i. Sustained overload exceeding 115 percent of controller rated current,

j. Over temperature, and

k. Phase reversal.

Provide the following operator control and monitoring devices mounted on the front panel of the VFD:

a. Manual speed potentiometer,

b. Hand-Off-Auto (HOA) switch,

c. Power on light,

d. Drive run power light, and

e. Local display.

2.7 INTAKE DESIGN

2.7.1 General

The intake sump design will be provided by the Government. Supply a pump that will meet the performance requirements without undue modifications to the sump as indicated on the drawings. Any such modifications are at no cost to the Government and must receive prior approval.

2.7.2 Formed Suction Intake (FSI)

Provide an FSI for each pump to the dimensional requirements and arrangement shown on the drawings. Connect the FSI to the inlet of the discharge tube. Use flanged joint as specified in paragraph FLANGED JOINTS as the method of connection. Assume the FSI has a K value of 0.15 for head loss calculations. Construct the FSI of fabricated steel . The FSI shall be epoxy Coated and it shall conform to paragraph "COLE TAR EPOXY PAINTING SYSTEM" spec section 33 61 13.19. Any stiffeners used must be on the outside of the FSI to allow smooth flow within. Use stainless steel bolts with bronze nuts. The minimum thickness of fabricated material must be 3/8 inch, A36 plate steel or equivalent. Provide grout holes in the floor of the FSI to permit grouting during installation. The FSI shall be comprised of two sections: diffuser and 90 degree bend. The diffuser shall incorporate inlet chamfers to minimize pre-swirl. The 90 degree bend shall be without sharp turns, to prevent turbulence and minimize dynamic losses. The bend shall be reducing in cross-section, with the inlet area not less than the outlet area. All welding shall be in accordance with American Welding Society AWS D1.1/D1.1M Structural Welding Code. All welds shall be dye penetrant tested. All welds shall be 1/2 inch size.

The contractor shall design the FSI device in accordance with HI ANSI/HI 9.8. The construction of the formed suction intake shall connect directly to the vertical discharge tube with a flanged and bolted connection.

The design of the FSI shall have been priviously verified by the pump manufacturer, through both CFD analysis and physical scale model tests. The intake shall be designed to minimize the impact of adverse flow conditions and provide an optimal inflow to the pump by gradual acceleration and redirection of the flow toward the pump inlet. The FSI shall be capable of normalizing lateral approach flows up to 1m/s, and shall produce a uniform flow distribution - with pre-swirl not to exceed three degree - at the pump propeller plane.

The FSI shall be of a design that has been used by the particular pump supplier on a minimum of at least five pumps currently installed and operating in the United States for at least three years. The pump supplier shall be required to supply a list of the installations along with the pump model, size, date of initial service and pump head and flow duty points. The FSI provided shall have been priviously verified by full-scale operation on the manufacturer's pumps. The contractor shall provide reference where similar size FSI devises, designed by the pump manufacturer supplying the storm water pumps, have been used.

2.8 PIPE COUPLING

Provide a flexible-type coupler between the discharge column takeoff and the 30 inch discharge steel pipe. The pipe coupling shall comply with the requirements of AWWA C219. Coupler must have maximum misalignment capability of three degrees angular. The coupling end rings and center ring shall be made from carbon steel with minimum yield strength of 30,000 psi. The coupler shall have Nitrile Butadiene Rubber (NBR) gasket compounded for water and sewer service also resistant to hydrocarbons. The gasket shall meet the requirements of AWWA C219 and ASTM D2000. The coupling bolts shall be trackhead with heavy hex nuts, 5/8 inch UNC rolled thread, high strength, and low alloy corrosion-resistant steel per AWWA C111. The overall length of the coupling unit including the bolts shall be 10 inches or less. The pipe coupling shall be painted in accordance with paragraph "COLE TAR EPOXY PAINTING SYSTEM" of Section 33 61 13.19 VALVES, SUMP PUMPS, AND EQUIPMENT IN VALVE MANHOLES.

2.9 SHOP ASSEMBLY

Assemble the discharge tube in the manufacturer's plant to ensure the proper fitting and alignment of all parts. Prior to disassembly, match-mark all parts to facilitate the correct assembly in the field.

2.10 FACTORY TESTS

Submit a description of the factory test setup and test procedure proposed. Submit sufficient data and drawings to demonstrate that testing is in compliance with HI ANSI/HI 14.6.

2.10.1 Performance Test

Test the pump at the manufacturer's shop to demonstrate that the proposed pump operates without instability and complies with specified performance. Instability is defined when any point in the usable range of the head-capacity curve cannot be repeated within three percent. When this occurs, rerun the test. Compliance with specifications will be determined from curves required by paragraph TEST RESULTS. Test procedures, except as herein specified, must be in accordance with applicable provisions of HI ANSI/HI 14.6, with an acceptance grade of 1U. Use water for testing at approximately the same temperature for all tests run and record it during test runs.

2.10.1.1 Performance of the Pump

Determine performance of the pump by a series of test points sufficient in number to develop a constant speed curve over the range of total heads corresponding to the requirements of paragraph CAPACITIES. The test range must include additional testing at total heads of 2 feet higher than that specified. The lowest total head for testing must be, as a minimum, the total head determined from the referenced paragraph. If the test setup permits testing at lower total heads, extend the range of total heads 2 feet lower. Testing must be inclusive for the speed involved. Perform tests using the heads and suction water elevation specified in paragraph CAPACITIES. Test results with this sump elevation must meet all specified conditions of capacity, head, and bhp. Head differentials between adjacent test points cannot exceed 3 feet, but in no case fewer than 10 points be plotted in the pumping range. If the plot of data indicates a possibility of instability or a dip in the head-capacity curve, a sufficient number of additional points on each side of the instability

must be made to clearly define the head-capacity characteristics.

2.10.1.2 Test Results

Plot test results to show the total head, static heads, bhp, and efficiency as ordinates. Plot the results against pump discharge in gpm as the abscissa. Plot curves showing pump performance to a scale tat will permit reading the head directly to 0.5 foot, capacity to 500 gpm, efficiency to one percent, and power input to 25 bhp. Establish that the performance requirements of these specifications and the warranties under this contract have been fulfilled. Perform the performance test with the pump and motor assembled as an operating unit to simulate field installation unless otherwise approved in writing by the Contracting Officer. Readings must include one point each within two percent of the rated total head, minimum expected head, and maximum expected head. Conduct the test in accordance with accepted practices at full speed; and, unless otherwise specified, conform to HI ANSI/HI 14.6 procedure and instruments.

2.10.2 Instrumentation and Procedures

Describe each instrument in detail, giving all data applicable, such as manufacturer's name, type, model number, certified accuracy, coefficient, ratios, specific gravity of manometer fluid to be used, and smallest scale division. When necessary for clarity, include a sketch of the instrument or instrument arrangement. Include a fully detailed narrative description of each proposed method of instrumentation, procedures to be used, and a sample set of computation. State the lowest equivalent static head that is obtainable with the testing when operating along the head-capacity curve of the proposed pump.

2.10.2.1 Head Measurements

Make head measurements using either a direct reading water column, mercury-air, mercury-water, a Meriam fluid manometer, or a pressure transducer. Measure vacuums with either a mercury-air manometer, a mercury-water manometer, or a pressure transducer. Dampen fluctuations sufficiently to permit column gauges or a differential pressure transducer to be read to either the closest 0.01 of one foot of water or Meriam fluid or 0.1 of one inch of mercury. Use manometers as indicated by ISA RP2.1. When pressure transducers are used, check their accuracy with a manometer.

2.10.2.2 Pump Capacity

Determine capacity by a calibrated venturi flowmeter or a long-radius ASME flow nozzle. Do not use orifice plates. Connect venturi or nozzle taps to column gauges equipped with dampening devices that permit the differential head to be determined to either the closest 0.01 of one foot or water or 0.1 of one inch of mercury. Magnetic flowmeters and flowmeters utilizing ultrasonic flow measurements will be acceptable if the calibration of the flowmeter has been completed within the last six months.

2.10.2.3 Rotational Speed of Pump

Measure rotational speed of the pump in accordance with measurement of speed in HI ANSI/HI 14.6, except do not use revolution counters. The device used must permit the speed to be determined to one rpm.

2.10.2.4 Power Input

Measure power input to the pump in accordance with power measurements in HI ANSI/HI 14.6. Use a method to permit bhp to be determined to the closest 0.5 bhp.

2.10.3 Witness Test

Perform factory tests in the presence of the Contracting Officer. When satisfied that the pump performs in accordance with the specified requirements, notify the Contracting Officer, two weeks in advance, that the witness tests are ready to be run and furnish two copies of curves required in paragraph TEST RESULTS above. If the tests reveal that the pump does not perform in accordance with the specifications, make necessary changes before again notifying the Contracting officer that witness tests are ready to be run. Provide copies of all data taken during the testing and plotted preliminary curves to the Contracting Officer with the factory test report.

2.10.4 Factory Test Report

Submit, within 30 calendar days of receipt of approval of the witnessed factory test,digital copies of a report covering test setup and performance tests. Include the specified information in the factory test report and, as a minimum, the following:

a. Statement of the purpose of the test, name of the project, contract number, and design conditions. Highlight and explain instances where guaranteed values differ from specified values.

b. Resume of preliminary studies, if such studies were made.

c. Description of pump and motor, including serial numbers, if available.

d. Description of test procedure used, including dates, test personnel, any retest events, and witness test data.

e. List of all test instruments with model numbers and serial numbers.

f. Sample computations (complete).

g. A discussion of test results.

h. Conclusions.

i. Photographic evidence in the form of either color photographs of test equipment, test setup and representative test segments, or a digital recording, at least 30 minutes in length, covering the same information as photographs. Label all photographic evidence with the contract number, location, date/time, and test activity. Voice annotate digital recordings with the same information.

j. Copies of instrument calibration.

k. Copies of all recorded test data.

l. Curves required by the paragraph TESTS RESULTS.

m. Curves showing the performance of the prototype pump.

n. Drawings of the test set-up showing all pertinent dimensions, elevations and cross section of the pump.

PART 3 EXECUTION

3.1 INSTALLATION

Perform correct installation and assembly of the pumping unit in accordance with the drawings and with the manufacturer's installation instruction manual. Submit, no later than 30 days prior to time of pump delivery, three copies of a typed and bound manual describing procedures to be followed by the installation engineer in assembling, installing, and dry- and/or wet-testing the pump. Coordinate and consolidate the description of the pump with similar descriptions for other specified pump parts. The description must be of such a nature that it may be comprehended by an engineer or mechanic without extensive experience in erecting or installing pumps of this type. The description must be a step-by-step explanation of operations required, and include, where applicable, such things as alignment procedures, bolt torque values, recommended instrument setups, recommended gauges and instruments, and similar details. Furnish all bolts, shims, tools, and other devices necessary for installing the pumping units. The manufacturer's representative(s) familiar with the equipment being installed must supervise the handling, installation, start-up, and testing of the equipment as required in the paragraph INSTALLATION AND START-UP ENGINEER.

3.2 CLEANUP PRIOR TO START

After the pumping unit is installed and prior to start-up, completely clean the sump area of any accumulated construction debris. This final cleaning of the sump area will be witnessed by a representative of the Government. Correct any damage to the pumping units or related equipment during initial start-up due to foreign objects left in the sump areas.

3.3 PUMP FIELD TESTS

Submit a field test plan prior to field testing. Field testing must be conducted by an experienced field test engineer and will be witnessed by the Contracting Officer. Before initially energizing the pump/motors, ensure that all pumping plant control, monitoring, and protective circuits have been successfully tested. This thorough electrical checkout procedure must follow a detailed step-by-step approved test plan. Also check the motor and other pumping unit elements undergoing tests at this time. Field test the plan prior to field testing.

3.3.1 Dry Test

Test each pumping unit in the dry in accordance with the pump manufacturer's instructions to determine whether it has been properly installed. Conduct such test when, and as, directed by Contracting Officer. Operate the pump at full rated speed. If tests reveal a design or installation deficiency or a manufacturing error in pumping unit components, promptly correct the problem.

3.3.2 Wet Test

Test each unit under load for a period of at least two hours or as

directed by the Contracting Officer. Conduct the tests to be witnessed by the Government. During the tests, observe, measure, and record the operation of the pumping units noise (in accordance with HI 9.1-9.5), motor-bearing temperatures, voltage, and current for each pump. Measured parameters must be within the pump manufacturer's published limits. make vibration measurements at the top of the discharge tube and flange of the discharge elbow for each pump. Vibration limits must not exceed those recommended by HI 9.6.4.

3.3.3 Field Test Report

Prepare and submit the field test report and a manual of Operating and Maintenance Instructions for the completed system. Submit the Instructions containing complete information on operation, lubrication, adjustment, routine and special maintenance disassembly, repair, reassembly, and trouble diagnostics of pump and auxiliary equipment. Provide the operation and maintenance manual and both parts lists on optical disc, formatted to print on ANSI size A 8-1/2 by 11-inch paper. Drawings incorporated in manual or parts lists, may be reduced to page size provided they are clear and legible, or may be folded into the manual to page size. Photographs or catalog cuts of components may be included for identification.

3.4 PAINTING

Paint the pump/motor in accordance with the pump manufacturer's standard coating system. Paint the discharge column, FSI, discharge pipe, and appurtenances in accordance with paragraph "COLE TAR EPOXY PAINTING SYSTEM" Section 33 61 13.19 VALVES, PIPING, SUMP PUMPS, AND EQUIPMENT IN VALVE MANHOLES.

-- End of Section --

Specification 40 95 00 – Pump Station Control System

Appendix I – Input/Output Tables

Chicago Levee 37
Pump Station Input/Output List
Analog Inputs

Point Description	Signal Range (mA)		Signal Type	Point Number
	Low	High		
Sub Level Xducer - Sump Water Level	4	20	Proportional	00
Pump 1 AFD Speed Status	4	20	Proportional	01
Pump 2 AFD Speed Status	4	20	Proportional	02
Pump 3 AFD Speed Status	4	20	Proportional	03

Chicago Levee 37
Pump Station Input/Output List
Analog Output

Point Description	Signal Range (mA)		Signal Type	Point Number
	Low	High		
Pump 1 AFD Speed Control	4	20	Proportional	00
Pump 2 AFD Speed Control	4	20	Proportional	01
Pump 3 AFD Speed Control	4	20	Proportional	02

Chicago Levee 37
Pump Station Input/Output List
Discrete Inputs

Point Description	Signal Range		Contact Type	Point Number
	Low	High	NO/NC	
PUMP 1 RUNNING - CURRENT SENSING RELAY	0	24 VDC	NO	00
PUMP 2 RUNNING - CURRENT SENSING RELAY	0	24 VDC	NO	01
PUMP 3 RUNNING - CURRENT SENSING RELAY	0	24 VDC	NO	02
SUMP PUMP RUNNING - CURRENT SENSING RELAY	0	24 VDC	NO	02

Specification 40 95 00 – Pump Station Control System

Appendix II – Control System Alarm List

Chicago Levee 37
Pump Station Alarm Points

Alarm Description on Local HMI screen/Web Based Virtual HMI	Cause
Pump Station #1	
Activation Failure - Pump #1	Discrete input from current sensing relay open, discrete output for automatic mode start closed
Activation Failure - Pump #2	Discrete input from current sensing relay open, discrete output for automatic mode start closed
Activation Failure - Pump #3	Discrete input from current sensing relay open, discrete output for automatic mode start closed
Activation Failure - Sump Pump	Discrete input from current sensing relay open, discrete output for automatic mode start closed
Pump Motor Monitoring Relay Alarm (Include Issue) - Pump #1	Discrete input from submersible pump monitoring relay closes, indicating monitoring relay sensed issue at pump
Pump Motor Monitoring Relay Alarm (Include Issue) - Pump #2	Discrete input from submersible pump monitoring relay closes, indicating monitoring relay sensed issue at pump
Pump Motor Monitoring Relay Alarm (Include Issue) - Pump #3	Discrete input from submersible pump monitoring relay closes, indicating monitoring relay sensed issue at pump
Pump Motor Monitoring Relay Alarm (Include Issue) - Sump Pump	Discrete input from motor monitoring relay closes, indicating monitoring relay sensed issue at pump
Sump High Level Alarm	Transducer indicating station sump high level has been reached.
Transducer Loss of Signal	Analog input from transducer lost

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SECTION 40 95 00

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SECTION 40 95 00

PUMP STATION CONTROL SYSTEM
10/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	((2014; Errata 2016) Electric Meters - Code for Electricity Metering

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142	(2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book
IEEE C37.90	(2005; R 2011) Standard for Relays and Relay Systems Associated With Electric Power Apparatus
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 61131-3	(2013) Programmable Controllers - Part 3: Programming Languages

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ISA 5.4	(1991) Instrument Loop Diagrams

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial

	Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 250	(1991) Calibration Services Users Guide

UNDERWRITERS LABORATORIES (UL)

UL 508	(2018) UL Standard for Safety Industrial Control Equipment
UL 1059	(2001; Reprint Dec 2017) UL Standard for Safety Terminal Blocks
UL 1203	(2013; Reprint Apr 2018) UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

1.2 DEFINITIONS

Definitions, Symbols, and engineering unit abbreviations shall conform to IEEE Stds Dictionary, as applicable.

1.3 SYSTEM DESCRIPTION

The instrumentation and control system shall be used to monitor and control the operation of the pumping station as specified and in accordance with the sequence of control described herein, and control schematics shown on the drawings. The control system shall provide for operator interaction, overall control system supervision, and process equipment control and monitoring. Provide hardware configured and sized to support expansion as specified and shown on the drawings.

The controller shall monitor wet well level via submersible level transducer and provide automatic control of three storm water pumps and one sump pump as indicated on the drawings.

Pump controls and alarms shall be in accordance with elevation designated by local sponsor.

The controller shall indicate and monitor wet well level, provide alarm and control set points, annunciate station alarms and indicate station status. All parameters shall be viewable and configurable from the front of the panel. Unit shall include a microprocessor based controller unit for pump control and sequencing as herein described. The

controller/telemetry unit shall also be integrated with an existing central station for remote status and control functionality. The unit shall include necessary control equipment contained in a Type 3R enclosure in accordance with NEMA 250 to provide a completely integrated control system.

1.3.1 General Requirements

The Primary control system shall consist of conrol panel complete with a pump controller, expansion I/O modules, backup control system, power supplies, control relays, circuit breakers, fusing, surge protection, mounting rails, and terminal strips, and panel heaters.

1.3.2 Operation

The control system provided under this specification shall operate using ladder logic type control to provide the required sequences of operation. Input data to the controller shall be obtained by using instruments and controls interfaced to mechanical, electrical, utility systems and other systems as shown and specified. All required setpoints, settings, alarm limits, and sequences of operation shall be as identified or determined in the field after submersible pumps have been submitted and approved. The stations' control system architecture is shown on theelectrical drawings.

1.3.3 Points

Inputs to and outputs from the control system shall be in accordance with the Input/Output (I/O) Summary Table, provided as Appendix I to this specification. Each connected analog output (AO), analog input (AI), digital output (DO), digital input (DI), or output device connected to the control system shall represent a "point" where referred to in this specification.

1.3.4 Data Transmission Systems (DTS)

Data transmission systems for communication between pump control panel and the central station are given in the paragraph titled "CONTROL PANELS" of this section, and as shown on the drawings.

1.3.5 Operation and Maintenance Data Requirements

Outline the step-by-step procedures required for system startup, operation and shutdown. Include in the instructions layout, wiring and control diagrams of the system as installed, the manufacturer's name, model number, service manual, parts list and a brief description of all equipment and their basic operating features.

List routine maintenance procedures, possible breakdowns and repairs and trouble shooting guides.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G, RO

Wiring; G, RO

SD-03 Product Data

Standard Products; G, RO

Sensors and Meters; G, RO

Performance Verification Test (PVT); G, RO

SD-05 Design Data

Control Panel Submittals; G, RO

Control Drawings; G, RO

SD-06 Test Reports

Testing, Adjusting and Commissioning; G, RO

Performance Verification Test (PVT); G, RO

Pump Control Field Testing; G, RO

SD-07 Certificates

Control and Sensor Wiring; G, RO

Ground Rods; G, RO

SD-08 Manufacturer's Instructions

Factory Test Procedure Documentation

SD-10 Operation and Maintenance Data

Training Manual; G, RO

Instrumentation and Control System; G, RO

1.5 SYSTEM INTEGRATOR RESPONSIBILITY

The contractor shall be required to hire a systems integrator for the procurement, installation, programming, and testing of the control equipment. Systems integrator shall have five years experience with the design, installation, and installation of the specified type of equipment. Addtional requirements are listed below:

a. System Integrator shall inspect equipment provided under this Section prior to shipment to Project sites.

b. System Integrator shall coordinate work with CONTRACTOR to insure that:

(1) All components provided under this Section are properly installed.

(2) All components provided under this Section are properly configured.

(3) The proper type, size, and number of control wires with conduits are furnished and installed.

(4) Proper electric power circuits are provided for all components and systems.

c. System Integrator shall be responsible for coordination of voltage levels, signal types for signals connected to Process Control System. Provide relays, signal isolators, termination or pull-up resistors, signal conditioners or other devices only as required for proper interfacing and operation of non-compatible devices.

d. System Integrator shall supply all HMI and controller software fully configured, specific to the process functions described herein.

e. System Integrator shall be responsible for establishing proper communication of all control system equipment as shown on drawings and specified.

f. System Integrator shall be responsible for the installation, wiring, and programming of all control system aspect.

g. System Integrator shall be responsible for the operational testing of the HMI and controller software programs.

h. All field located conduits, wiring and cables shall be provided under electrical specifications.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Materials and equipment shall be standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products. Units of the same type of equipment shall be products of a single manufacturer. Items of the same type and purpose shall be identical and supplied by the same manufacturer, unless replaced by a new version approved by the Government.

Submit the following standard products product data:

a. Catalog Information - Provide catalog information and descriptive literature on all equipment associated with the Control System.

b. Product Data (Specification) Sheets - Provide product data sheets for each component provided under this Section. The purpose of the data sheets is to supplement the generalized catalog information provided by citing all specific features for each specific component (e.g., scale range, materials of construction, special options included). Product Data Sheets shall follow general ISA S20 format.

2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place.

Laminated plastic nameplates shall be provided for equipment devices and panels furnished. Each nameplate shall identify the device, such as pump "P-1" or valve "VLV-402". Labels shall be coordinate with the schedules and the process and instrumentation drawings. Laminated plastic shall be 1/8 inch thick, white with black center core. Nameplates shall be a minimum of one inch by three inches with minimum 1/4 inch high engraved block lettering. Nameplates for devices smaller than one inch by three inches shall be attached by a nonferrous metal chain. All other nameplates shall be attached to the device.

2.1.3 Sensors and Meters

Submit manufacturer's descriptive and technical literature, catalog cuts, performance charts and installation instructions.

2.2 GENERAL REQUIREMENTS

Equipment and wiring must be in accordance with NFPA 70.

2.3 MONITORING AND CONTROL PARAMETERS

The control system shall be complete including sensors, transducers, control devices, engineering units conversions and algorithms for the applications; and shall maintain the specified end-to-end process control loop accuracy from sensor to display and final control element. Control equipment shall be powered by a 120 vAc, single phase, 60 Hz power source, with local transformers included as needed for signal transmission and subsystem operation. Connecting conductors shall be suitable for installed service. Enclosures shall be rated for NEMA 1.

2.3.1 Level Instrumentation

Pressure taps shall incorporate appropriate snubbers. Relays and housing shall be intrinsically safe or explosion proof as required by the NFPA hazard rating for compatibility with the contents of the sump. The instrumentation shall provide a 4-20 mAdc output signal to the pump control panel, proportional to the measured sump level.

2.3.1.1 Hydrostatic Pressure Transducer

A submersible type hydrostatic pressure transducer shall provide hydrostatic level monitoring. It shall be provided for primary level indication. It shall be suspended by the cable, with a strain relief cable grip. Instrument shall be enclosed in a titanium, NEMA 4X enclosure. The sensor shall be a stand alone system not requiring a signal converter. It shall output a 4-20 mA signal proportional to the liquid level in the sump. Sensor shall be capable of generating a failure signal. Failure signal shall be utilized for indication to smart relay for change over to back up conductive level probe system. Submersible transducer are listed below:

a. Construction: Titanium

b. Measurement Diaphram: Titanium

c. Transduction: Piezoresistive strain gauge

d. Accuracy: Plus/Minus (+/-) 0.1 Full Scale

e. Combined Non-Linearity, Hysteresis, and Repeatability: +/- 0.1 percent

f. Operating Temperature Range: Minus 5 degrees Fahrenheit (F) to 140 degrees F

g. Compensated Temperature Range: 30 degrees F to 86 degrees F

h. Output: Two-wire, 4-20mA

i. Excitation: 9-30Vdc

j. Ingress Protection: NEMA 6X (IP68) to 2300 ft H2O

k. Integral Lighting Protection Features: IEC 61000-4-5

Unit shall also have a waterproof cord good to a minimum 100 feet of water pressure.

Placement of submersible pressure transducer for each station shall be shown on drawings.

2.3.1.2 Back-Up Conductivity Level Probe

The level probe shall detect the presence of a fluid by measuring the electrical resistance between a sensor and a ground electrode. Probe shall be provided to guaranty a safety back-up two single Stage Level Sensing Devices for high and low liquid level at specified intervals for pump control and liquid level display.

Each sensor unit within the probe assembly shall be PVC injected to seal the unit and prevent any moisture from entering any of the sensor units. Each sensor on the probe shall be rotated 90 degrees horizontally from the previous sensor along the probe length to eliminate tracking between sensors. Level sensing probes shall be pressure injected with an epoxy resin at final assembly to encapsulate all internal components and connections, thereby creating a rigid, sealed, homogeneous unit.

The flexible cable used for the Level Sensing Probe shall be comprised of PVC/PVC multi-conductor construction with a common oversheath that is water and oil resistant. The multi-conductor cable shall be identified with numbering and text along the entire length of the outer sheath at required intervals. Cables shall be secured to the top of probe bodies by synthetic rubber compression fittings for strain relief. The cable shall be rated to physically support the combined weight of the level sensing probe and the suspended cable connected to the probe.

Cables shall be secured to the top of probe bodies by synthetic rubber compression fittings for strain relief. The cable shall be rated to physically support the combined weight of the sensor and long enough to reach to reach the cable connection box.

The mounting bracket shall be by stainless steel and include a wiper device that allows maintenance personnel to clean the level sensing probe when necessary.

2.3.2 Submersible Pump Monitoring System

The pump manufacturer shall supply a Control system deigned to monitor and

control the associated pumps. The Monitoring system shall be mounted in the cabinet and contain one interface moduel per pump and a base unit acting as a gateway between the pump interface modules Central Control Unit (CU). The CU shall be able to control up to 10 Pumps.

Each pump shall be connected by just two controls leads to the base unit (BU). The control leads shall be part of the Motor cable. An additional Pilot cable shall not be allowed.

The Base Unit (BU) shall be able to stop the pump if required via an interlocking relay and it shall provide connections for optional measuring modules such as a power meter and other I/O modules.

The central unit (CU) shall be provided for external access and information exchange with the monitoring system via one single point. The user should be able to connect to the CU via an RJ45 jack to Local PC point to point and Local area network.

A local operator panel shall be possible to connect to the CU via a separate RJ45 socket.

The CU shall have a functionality based on embedded web pages that can be used through a PC or operator panel that allows:

a. A graphical user interface for configuration and analysis via computer and HM,I

b. Pump status overview,

c. Alarm management,

d. Analysis through trend graphs and histograms, and

e. External communication with any SCADA via Modbus RTU or Modbus TCP.

The CU shall contain the same pump data and logged data stored in each pump electronic module for quick access and redundancy.

The system shall support the service and maintenance policy that applies to the pump by generating service reminders and graphically providing users with an overview of service status that facilitates planning of upcoming service.

The Cabinet shall be equipped with HMI Touch panel for access and interaction with the Monitoring and Control system. The panel should be at least 15 inches in size and able to show color.

When a pump related alarm is generated, the system shall support the user in the form of:

a. Measurement data linked to the specific alarm item for analysis.

b. Text information about possible root cause errors.

c. Remedial actions.

A list of alarms the monitoring system shall be able to detect at a minimum are as follows:

a. Bearing temperature alarm (number per approved pump) and

b. Seal failure.

2.4 PUMP STATION CONTROLLER

2.4.1 Controller General Requirements

Controller shall be micro-processor based, capable of receiving discrete and analog inputs and, through programming, shall be able to control discrete and analog output functions, perform data handling operations and communicate with external devices. Controller shall function properly at temperatures between 14 and 104 degrees F at 5 to 95 percent relative humidity non-condensing and shall tolerate storage temperatures between minus 40 and plus 194 degrees F at 5 to 95 percent relative humidity non-condensing.

2.4.2 Pump Controller

Pump controller shall be based on a field expandable design allowing the system to be tailored to the process control application. The system shall be expandable through the use of additional hardware and/or user software. Controller shall include an integral power supply, central processing unit (CPU), and input/output (I/O).

Controller shall provide automatic control of all pumps with a human machine interface (HMI) display. The following controller features shall be included:

a. Pump control of up to six pumps; including pump grouping and pump alternation.

b. Intelligent hand-off-auto control for each pump from the main display keypad as follows:

(1) Hand mode (semi-automatic, non-maintained manual mode), the pump switches off at the deactivation set point and then resets to Auto mode for the next pump run cycle.

(2) Hand mode (fully manual, maintained mode). To pump beyond the off (deactivation) set point, the Hand-Off-Auto button must be held down by the user for failsafe control.

c. Level set point adjustment for pump activation, deactivation and station level alarms.

d. Level device inputs shall include: 4-20mA analog signals and conductive probes.

e. Redundant level device inputs with automatic fault control (input device switching).

f. Selectable charge (fill) or discharge (empty) modes.

g. Pre-configured station optimization features shall include:

(1) Maximum pumps to run,

(2) Maximum starts per hour,

(3) Maximum pump run time,

(4) Pump maintenance run function,

(5) Blocked pump detection,

(6) Well mixer control capability,

(7) Well clean out control capability,

(8) High inflow mitigation, and

(9) Function to minimize buildup of fat or grease deposits.

h. Pump alternation modes shall include:

(1) Standard alternation of pumps,

(2) Fixed sequence pump control,

(3) User defined alternation using a (N:1) or (N:M) ratio,

(4) Alternation based on the most efficient pump,

(5) Alternation by the number of hours run, and

(6) Alternation by the number of starts within a specified time period.

i. Pump decommissioning mode to allow one or more pumps to be fully decommissioned.

j. Up to six unique user defined profiles of set points shall be available to control pumps during specific site conditions or events. Features shall include:

(1) Automatic profile change based on date and time and

(2) Profile selection option from SCADA (remote control), digital input, logic tag or local keypad.

k. Locked level alarm function to indicate a level device fault.

l. Analog input signal watcher function to monitor analog input values for control and alarm uses.

m. Level simulation function for pump station commissioning and general testing.

n. A datalogger for user-defined faults and events shall include:

(1) Recording of up to 50,000 events to internal flash memory and

(2) Download capability up to 10,000,000 events in the form of a (csv), comma delimited file.

o. Three phase supply voltage monitoring and supply fault management for the following conditions:

(1) Under-voltage, Over-voltage and

(2) Phase fail, Phase rotation.

p. Monitoring of dc power supply, battery voltage, and internal controller temperature.

q. Energy, power and pump efficiency monitoring:

(1) kW, kVA, power factor, kWHr, KVAH calculation for each pump;

(2) Pump efficiency calculation (gallons per KWHr) for each pump; and

(3) Power supply data (voltage, frequency and phase angle information).

r. Motor fault protection features:

(1) 3-phase current monitoring for each pump,

(2) Over current fault detection,

(3) Under current fault detection,

(4) Ground fault detection,

(5) Current phase imbalance fault, and

(6) Motor insulation resistance failure detection.

s. Flow measurement (when enabled by software key):

(1) Calculated flow by liquid level draw down method,

(2) Flow monitoring by inputs from a flow meter (analog input and pulsed signal input), and

(3) Flow alarms for pump(s) and total station flow.

t. VFD speed control function.

u. Fault handling functions:

(1) Pump hold out function,

(2) Automatic reset function after fault condition is no longer present, and

(3) Manual reset of fault (if user intervention of fault reset is required).

v. Remote control functions via remote telemetry (when enabled with software key):

(1) Change the operating mode of pump(s) (hand/off/auto operations),

(2) Reset of pump faults and station faults,

(3) Change pump and alarm set point values, and

(4) Change the operational profile of the pump(s).

w. Security:

(1) User defined password management for access to programming areas in the controller,

(2) Automatic data logging of personnel who have entered the programming areas,

(3) Automatic logging of all unsuccessful login attempts with a date and time stamp, and

(4) Digital input option for controlled access to programming areas.

x. SD and USB media access ports shall be available for the following operations:

(1) Firmware upgrades,

(2) Saving or loading pump controller configuration information,

(3) Exporting or importing MODBUS and DNP3 points list information, and

(4) ownloading data logs.

y. Advanced Programming Functions: The pump controller shall have the ability to be used with IEC61131-3 and IEC61499 compliant programming languages to enhance or modify existing functionality.

2.4.2.1 Central Processing Unit (CPU) Module

The CPU module shall be a self contained, microprocessor based unit that provides time of day, scanning, application (ladder rung logic) program execution, storage of application programs, storage of numerical values related to the application process and logic, I/O bus traffic control, peripheral and external device communications and self diagnostics.

The pump station controller shall be designed for following environment and performance:

a. Central Processing Unit Speed: 566MHz

b. Central Processing Unit RAM Size: 256Mbyte

c. Central Processing Unit Flash Memory Size: 64Mbyte

d. Real Time Clock: With battery backup

e. Working Temperature: 14 degrees F to 140 degrees F

f. Storage Temperature: -40 degrees F to 194 degrees F

g. Humidity: 5 percent to 95 percent (non-condensing)

h. IP Ratings: Controller Base Unit (IP20, NEMA 1)

2.4.2.2 Communications

The communication integral to the pump controller shall allow communication with the central station, or workstation.

The following data communication ports shall be integral to the controller:

a. Two (2) Ethernet ports (10Mbit/s),

b. Two (2) RS232 ports (115kBit/s),

c. Two (2) RS485 ports (115kBit/s),

d. One (1) USB device port, and

e. One (1) SD card port.

The pump controller shall support the following communication types:

a. TCP/IP Etherne,t

b. UDP,

c. RS232 Serial Data,

d. RS485 Serial Data,

e. Private radio over RS232,

f. PSTN (Dial-up),

g. Wireless LAN, and

h. Cellular Communications.

It shall be able to communicate with following protocols:

a. DNP3 (master and slave, Level 2 compliant).

b. Modbus (master and slave) as follows: Modbus TCP, Modbus RTU, Modbus ASCII.

The systems integrator shall utilize serial communications for interface with submersilbe pump monitoring system described in paragraph titled "Submersible Pump Monitoring System" for pump motors.

2.4.2.3 Power Supply Module

One or more power supply modules shall be provided as necessary to power other modules installed in the same cabinet. Power supply modules shall plug directly into the backplane. Auxiliary power supplies may be used to supply power to remote cabinets or modules.

a. Power supply modules shall use AC power with a nominal voltage of 120 vAc plus or minus five percent. The power supply module shall monitor the incoming line voltage level and shall provide over current and over voltage protection. If the voltage level is detected as being out of range the power supply module shall continue to provide power for an adequate amount of time to allow for a safe and orderly

shutdown. Power supply modules shall be capable of withstanding a power loss for a minimum of 20 milliseconds while still remaining in operation and providing adequate power to all connected modules.

b. Each power supply module shall be provided with an on-off switch integral to the module. If the manufacturer's standard power supply module is not provided with an on-off switch, a miniature toggle type switch shall be installed near the controller and shall be clearly labeled as to its function.

c. Power supply modules shall be provided with an indicating light which shall be lit when the module is operating properly.

2.4.2.4 Input/Output (I/O) Modules

The controller shall have following I/O features:

a. The pump controller inputs and outputs shall be modular and shall be expandable.

b. Available I/O types shall include:

(1) Digital Inputs (discrete, voltage free input);

(2) Digital Outputs (dry contact type, rated at 240VAC/DC, 5A resistive);

(3) Analog Inputs (10bit); and

(4) Analog Outputs (10bit).

c. Digital Inputs shall be configurable based on specific input requirements as follows:

(1) Pump sensor inputs: Conductive Seal, PTC Thermistor (overtemp);

(2) Conductive probe sensing (for liquid level monitoring); and

(3) High speed counter inputs.

2.4.3 Input/Output Characteristics

Each controller shall allow for analog input, analog output, discrete input and discrete output. The number and type of inputs and outputs for the system shall be as shown on the drawings and shall comply with the sequence of control. The system capacity shall include a minimum of 20 percent spare input and output points (no less than two points) for each point type provided. During normal operation, a malfunction in any input/output channel shall affect the operation of that channel only and shall not affect the operation of the CPU or any other channel. Analog input circuits shall be available in 4-20 mA. Discrete input circuits shall be available in 79-132 vAc. All input circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices. Analog output circuits shall be available in 4-20 mA. Discrete output circuits shall be available in 79-132 vAc. All output circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices.

2.4.4 Wiring Connections

Wiring connections shall be heavy duty, self lifting, pressure type screw terminals to provide easy wire insertion and secure connections. The terminals shall accept two #14 AWG wires. A hinged protective cover shall be provided over the wiring connections. The cover shall have write-on areas for identification of the external circuits.

2.4.5 Accuracy

Controllers shall have an accuracy of plus or minus 0.25 percent of input span.

2.5 CONTROL SOFTWARE

All controller software described in this specification shall be furnished as part of the complete control system. See paragraph titled "CENTRAL STATION" for further information.

2.5.1 Operating System

Pump controller shall be provided with the manufacturer's standard operating system software package. The controller shall maintain a point database in its memory that includes all parameters, constraints and the latest value or status of all points connected to the controller. Execution of the controller application programs shall use the data in memory resident files. The operating system shall support a full compliment of process control functions. It shall be possible to define these functions using a mix of function blocks, ladder logic diagrams, sequential function charts and text programming. Programming methods and interactions shall be based on IEC 61131-3. A combination of the programming methods shall be possible within a single controller. The operating system shall allow loading of software locally or from the central station and data files from the portable tester. It shall also support data entry and diagnostics using an operator interface panel attached directly to the controller. Controller shall be capable of operating in stand alone mode.

2.5.1.1 Startup

The controller shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A controller restart program based on detection of power failure at the controller shall be included in the controller software. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips.

2.5.1.2 Failure Mode

Upon failure for any reason, each controller shall perform an orderly shutdown and force all controller outputs to a predetermined (failure mode) state, consistent with the failure modes shown and the associated control device.

2.5.2 Functions

The controller operating system shall be able to scan inputs, control outputs, and read and write to its internal memory in order to perform the required control as indicated in the sequence of control on the drawings.

The controller shall periodically perform self diagnostics to verify that it is functioning properly.

2.5.2.1 Analog Monitoring

The system shall measure and transmit all analog values including calculated analog points.

2.5.2.2 Logic (Virtual)

Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. Logic (virtual) points shall be analog or digital points created by calculation from any combination of digital and analog points, or other data having all the properties of real points, including alarms, without the associated hardware. Logic (virtual) points shall be defined or calculated and entered into the database. The calculated analog point shall have point identification in the same format as any other analog point.

2.5.2.3 State Variables

If an analog point represents more than two (up to eight) specific states, each state shall be nameable. For example, a level sensor shall be displayed at its measured engineering units plus a state variable with named states usable in programs or for display such as low alarm/low/normal/high/high alarm.

2.5.2.4 Analog Totalization

Any analog point shall be operator assignable to the totalization program. Up to eight analog values shall be totalized within a selectable time period.

2.5.3 Alarm Processing

Pump controller shall have alarm processing software for AI,AO, DI, serial communicationsand PA alarms for all real and virtual points connected to that controller. Required alarms for each station shall be listed in appendix II of this specification. Alarms shall sound audible horn and be displayed on station HMI, display at the central station, and illuminate alarm indication light.

2.5.4 Control Sequences and Control Loops

Control sequence shall include manual and automatic functions for pump control. Project personnel shall be able to choose the desired control scheme via a virtual Hand Off Auto selector switch. Hand (manual control) shall allow the operator to activate the pump via a "Pump Activation" pushbutton. Deactivation shall be controlled via a "Pump Deactivation" pushbutton, or by a low level cutout signal determined by the submersible pressure transducer. Automatic functionality shall include pump activation via the pump controller at predetermined sump water levels. Sequence shall rotate activation of pumps with similar horsepowers in order to obtain similar runtimes. A variable speed control function shall also be developed to allow for changing the speed of the pumps related to the inflow/outflow rate of the stormwater to/from the station.Control system shall determine sump level via combination of submersible level transducer and conductive level probe indication. Sump pumps shall not be

included in the automatic activation control scheme.

2.5.5 Command Priorities

A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. Override commands entered by the operator shall have higher priority than those emanating from applications programs.

2.5.6 Resident Application Software

Provide resident applications programs developed to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the process systems connected to the control system. All application programs shall be resident in the controller and shall execute in the controller, and shall coordinate with each other, to insure that no conflicts or contentions remain unresolved.

2.5.6.1 Program Inputs and Outputs

Use program inputs listed for each application program to calculate the required program outputs. Where specific program inputs are not available, a "default" value or virtual point appropriate for the equipment being controlled and the proposed sequence of operation shall be provided to replace the missing input, thus allowing the application program to operate.

2.6 BACKUP PUMP CONTROL

The pump station shall be provided with a backup control system via a leveling relay. Leveling relay shall have the following features:

a. The control relay shall accept two or three level inputs from a conductive level probe.

b. The following settings shall be dip switch programmable from the front panel:

(1) Conductive probe sensitivity adjustment,

(2) Activation Delays,

(3) Charge/Discharge selection, and

(4) Level Alarm Output.

c. Mounting and Installation: DIN Rail or 2 x #6 screws Base Mount

d. Output Contact Rating: 250VAC, 5 Amps Resistive, 2 Amps Inductive

Each stormwater pump shall be provided with its own leveling relay. Level inputs shall be provided via the backup conductivity level probe specified in paragraph titled "Back Up Conductivitiy Level Probe".

2.7 CONTROL PANELS

2.7.1 Components

2.7.1.1 Enclosures

The control panel shall be installed on a level which cannot be flooded even by storm water.

Panel shall be manufactured in accordance with ISO 9000:2001 specifications and shall be so constructed for the application of a UL Listing Label by an approved UL Control Panel Assembly Facility.

All electrical connections shall be properly inspected and torqued in compliance with ISO specifications. External connections to the control panel shall be by way of numbered terminal blocks.

Control Panels shall be properly checked and load tested with power applied. A control panel test log shall be supplied with the control panel.

Control Panels shall be supplied from a UL approved control panel assembly facility with all of the required labels properly attached.

Enclosures shall be Type NEMA 3R and shall meet the following requirements.

a. Enclosure shall be sized according to physical and functional device requirements.

b. Enclosure seams shall be continuously welded and ground smooth.

c. Enclosure door opening flange trough shall exclude liquids and contaminants.

d. Enclosure shall include an integral body grounding stud and sub-panel mounting studs and be wall mounted, unless otherwise specified.

e. Enclosure door shall have hidden hinges for a clean, aesthetic appearance.

f. Enclosure door opening angle shall be standard, full access, 135 degree opening radius.

g. Enclosure door shall be interchangeable and removable by pulling a hinge pin.

h. Enclosure door shall have a high-impact thermoplastic data pocket mounted on the inner side of the enclosure door and shall have a seamless, foam-in-place, one-piece gasket to provide an oil-tight, dust-tight seal against contaminants.

i. Enclosure shall have a three-point latching system with a zinc die-cast handle that is painted with black textured polyester powder paint.

j. Enclosure handles shall be capable of being padlocked.

k. Steel sub-panel shall be white.

l. When enclosure cut-outs for instruments and other devices are required, holes shall be cut, punched, or drilled and finished with rounded edges.

2.7.1.2 Controllers

Controllers shall be in accordance with paragraph titled "PUMP STATION CONTROLLER" of this specification.

2.7.1.3 Standard Indicator Light

Indicator lights shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Lights shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. Indicator lights shall be LED type and shall operate at 120 vAc or 24 vDc. Long life bulbs shall be used. Indicator light shall be provided with a legend plate labeled as shown on the drawings. Lens color shall be as indicated on the drawings. Lights shall be push to test (lamp) type.

2.7.1.4 Selector Switches

Selector switches shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Selector switches shall be heavy duty, round . The number of positions shall be as indicated on the drawings. Switches shall be non-illuminated. Switches shall be rated for 600 volts, 10 amperes continuous. Selector switches shall be provided with a legend plate labeled as shown on the drawings. Where indicated or required, dual auxiliary contacts shall be provided for the automatic position to provide position sensing at the central station or workstation. Auxiliary contacts shall be rated for 120 vAc, 1A as a minimum. Where indicated on the drawings, switches shall be key operated. All keys shall be identical.

2.7.1.5 Push Buttons

Push buttons shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Push buttons shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. The number and type of contacts shall be as indicated on the drawings or required by the Sequence of Control. Push buttons shall be rated for 600 volts, 10 amperes continuous. Push buttons shall be provided with a legend plate labeled as shown on the drawings.

2.7.1.6 Relays

Relays shall comply with IEEE C37.90 and derated for altitude above 1,500 meters. Relays shall be as required by the Sequence of Control. Relay coil shall be 120 vAc for Stations 2, 6, and 11, and 24 vDc for Stations 1, 3, 4, 5, 7, 9, 12, and 14. Relays shall be provided with matching mounting socket. Power consumption shall not be greater than 3 watts.

2.7.1.7 Terminal Blocks

Terminal blocks shall comply with NEMA ICS 4 and UL 1059. Terminal blocks for conductors exiting control panels shall be two-way type with double terminals, one for internal wiring connections and the other for external wiring connections. Terminal blocks shall be made of bakelite or other suitable insulating material with full deep barriers between each pair of terminals. A terminal identification strip shall form part of the terminal block and each terminal shall be identified by a number in accordance with the numbering scheme on the approved wiring diagrams.

2.7.1.8 Human Machine Interface (HMI)

The pump controller shall include a separate user interface (HMI display) keypad for configuration settings, control operations, and advanced programming.

The following parameters shall be displayed on the main screen:

a. Liquid level in percent, meters, feet, inches or other custom defined units;

b. Set points for pump control and level alarms;

c. Pump status (running, stopped or next to run);

d. Pump availability indication;

e. Pump fault indication; and

f. Three user configurable lines of information to display pump station status and data.

The main screen shall include an INFO button to view the following pump station information:

a. Hours Run counter for each pump and the pump station to include:

(1) Minutes run for last pump cycle;

(2) Total minutes (hourly);

(3) Total hours today, total hours yesterday;

(4) Total hours this week, total hours last week; and

(5) Total accumulated hours.

b. Pump Start counter for each pump and the pump station including:

(1) Pump starts this hour, pump starts last hour;

(2) Pump starts today, pump starts yesterday;

(3) Pump starts this week, pump starts last week; and

(4) Total accumulated pump starts.

c. Flow Values (when enabled by software key):

(1) Station inflow rate;

(2) Pump flow rate;

(3) Total station volume; and

(4) Overflow data (including overflow start time, duration, estimated volume).

d. Power and Efficiency:

(1) Pump efficiency in gallons or litres per KWHr - or KVAh;

(2) Power in kW, KVA;

(3) Power factor; and

(4) Energy accumulators per pump in KWHr and KVAH.

e. Insulation resistance value for each pump motor in Ohms.

f. I/O Status:

(1) Digital I/O status and accumulated values;

(2) Analog I/O status with a value in (mA) and a scaled value; and

(3) 3-phase voltage, frequency, phase angle, power factor.

g. Database viewer function to review statistics and tag data information in real time.

h. Communications information and statistics.

The main screen shall include a FAULT button to view fault information as follows:

a. The fault screen will provide fault details along with a date/time stamp and

b. A fault reset option shall be presented to the user.

The main screen shall include a HISTORY button to browse history information as follows:

a. View all recorded pump station events along with a date/time stamp and

b. The history log shall be capable of being filtered to display individual events.

The main screen shall include a SETTINGS button to configure the pump controller as follows:

a. Set point programming of pump activation values and level alarm values;

b. Enable/Disable level alarms, faults and historical data recording;

c. Configuration of Inputs and Outputs;

d. Setup parameters for each type of fault available in the pump controller;

e. Set alternation mode for pumps;

f. Configure station optimization parameters;

g. Configure voltage supply monitoring parameters;

h. Configure motor monitoring parameters;

i. Configure communications parameters;

j. Configure data logging parameters;

k. Enable level simulation session;

l. Create or restore backup copies of the pump controller configuration settings; and

m. Restart the pump controller.

The display shall be rated IP65/ NEMA 4.

2.7.1.9 Alarm Horns

Alarm horns shall be provided on left side of control system enclosure. Horns shall be vibrating type and shall comply with UL 508. Horns shall provide 85 dB at 10 feet. Exterior mounted horns shall be weather proof by design or shall be mounted in a weather proof enclosure that does not reduce the effectiveness of the horn.

2.7.2 Electrical Requirements

Each panel shall be powered by a dedicated 120 volts ac circuit, sized as recommended by the equipment manufacturer, and a disconnect switch located inside the panel. Wiring shall terminate inside the panel on terminal blocks. Electrical work shall be as specified and as shown on the drawings.

2.7.3 Power Line Conditioner

Each control panel shall be provided with a power line conditioner to provide both voltage regulation and noise rejection. The power line conditioner shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The power line conditioner shall be sized for 125 percent of the actual connected kva load. Characteristics of the power line conditioner shall be as follows:

2.7.3.1 85 Percent Load

At 85 percent load, the output voltage shall not deviate by more than plus or minus one percent of nominal voltage when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal voltage.

2.7.3.2 Load Changes

During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus three percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within five cycles, and 95 percent correction shall be accomplished within two cycles of the onset of the disturbance.

2.7.4 Grounding

Control panel enclosures shall be equipped with a solid copper ground bus or equivalent. The ground bus shall be securely anchored to the enclosure so as to effectively ground the entire structure. Clamp-type terminals

sized large enough to carry the maximum expected current shall be provided on the ground bus for grounding cables. Where a definite circuit ground is required, a single wire not less than #10 AWG shall run independently to the panel ground bus and shall be fastened to the ground bus with a bolted terminal lug. Cases of instruments, relays and other devices shall be effectively grounded through the enclosures steel structure unless otherwise indicated. Insulated wiring having a continuous rated current of not less than the circuit fuse rating shall be used for grounding. Grounding terminals of power receptacles shall be solidly grounded to the panel enclosure.

2.7.5 Convenience Outlet

A 120 volt ac, 20 amp, ground fault interruption (GFI) type duplex convenience outlet shall be provided inside the panel. The outlet circuit shall be separate from the panel power circuit.

2.7.6 Panel Interior Light

Control panel shall be provided with a 60 watt equivalent LED light. The light shall be operated by a manual on-off switch mounted on the interior door of the enclosure. The light shall be powered by the same circuit as the convenience outlet.

2.7.7 Ventilation System

Each control panel shall be provided with two single phase, 120 volt ac ventilation fans. Each fan shall supply a minimum of 100 cfm of ventilation air through the enclosure. Each fan shall be provided with a line voltage thermostat. Thermostat setpoints shall be adjustable in a range of 70 to 140 degrees F as a minimum. Each supply and exhaust grille shall contain a filter that is easily removed for cleaning or replacement.

2.7.8 Heating System

Each control panel(s) shall be provided with a thermostatically controlled electric heater capable of maintaining an enclosure temperature of 40degrees F when continuously exposed to an ambient temperature of 00 degrees F.

2.7.9 Control Panel Submittals

2.7.9.1 General

Drawings shall show all panel mounted devices to scale and dimensioned and shall include legend and bill of materials. Drawings shall include ancillary devices such as additional terminal strips, relays, fuses, utility lights and receptacles, fans, heaters, etc. Typical drawings for multiple circuits or systems are not acceptable.

Submit manufacturer's descriptive and technical literature, performance charts and installation instructions. Product specific catalog cuts shall be in booklet form, indexed to the unique identifiers, and shall consist of data sheets that document compliance with the specification. Where multiple components are shown on a catalog cut, the application specific component shall be marked.

2.7.9.2 Loop Panel Wiring Diagrams

Ladder diagram format depicting all circuit elements included in panel. Diagrams shall include following at minimum:

a. Incoming power feed supply and distribution.

b. DC power supplies and distribution.

c. Circuit breakers and fuses.

d. Station controller and I/O module power supplies.

e. Heaters, fans, convenience receptacles.

f. All controller input and output signals.

g. Control relays, timers, indicating lights, alarm horn, connections to motor control devices.

h. Relay contacts, field mounted control devices, motor control device monitoring signals. Relay and other device contacts to be cross referenced to intitiating device.

i. Analog monitoring and control circuits.

j. Identification of wire numbers, terminal numbers, device terminal numbers or identification, ladder rung voltages.

k. Terminals located within Pump Control Panel and external panels shall be differentiated, with terminal symbology depicted on wiring legend.

l. Wiring legend shall utilize industry accepted symbology for depiction of level, pressure, flow switches, relay coils, relay and timer contacts, and other devices used on drawings. Legend to include description of wire color versus function.

m. Communications devices.

a. Diagrams: Drawings shall consist of wiring diagrams for each analog and discrete loop showing all controller input/output module terminations, terminal numbers, location of dc power supplies, location of current boosting and interposing relays, and common dropping resistors. The loop diagrams shall meet the minimum requirements of ISA 5.4.

b. Controller Equipment Layout Drawing: Include processing equipment, I/O components, power supplies, and peripheral devices.

c. Controller Data Base List: List with I/O module cross reference identification for control system processor.

d. Controller Documentation: Describe memory type, size and structure; listing of I/O; data table memory and size of memory available for all programs.

e. Electrical Power, Grounding, and DC Power Schematics: Electrical power, grounding, and DC power schematics for all equipment.

f. Heat Calculations: Heat calculations for all enclosures.

g. Electrical Distribution Diagrams: Electrical distribution diagrams identifying Motor Control Center equipment and Power Panels associated with each new electrical connection.

h. Wire Label Tags: Wire labeling tags shall be indicated all submitted drawings. Wire tag requirements apply to both internal panel wiring and connections to external devices.

2.8 CENTRAL STATION

2.8.1 Control Interface

SCADA monitoring and control interface shall be cloud based.

2.8.1.1 Human Machine Interface

The HMI will be based on a well-supported global SCADA platform and accessible via mobile devices such as tablets and smart phones as well as any PC running Internet Explorer version five or higher.

2.8.1.1.1 System Configuration/Daily Operations

Software configuration and operational actions shall be protected from unauthorized access by a password/pass-code security system. The security model must be centralized, such that each user may use the same password to access the following SCADA features:

a. Development environment,

b. Runtime displays,

c. Alarm management, and

d. Alarm dialer (incoming and outgoing calls).

Software help manuals shall be provided to assist operators and administrative personnel with daily operations and software configuration. The latest versions of all manuals shall be made available for download from the software manufacturer's website.

2.8.1.1.2 Graphics and Displays

Software shall support both animated and static graphic objects. Animated graphic objects shall provide real-time process information to the user via displays. Alarms and process data depicted on displays shall be updated immediately upon receiving new data.

Standard tag types with graphics shall be provided for the following:

a. Analog/discrete inputs.

b. Analog/discrete outputs. Outputs sent to field devices must include feedback

c. Multi-position switches. Position changes sent to field devices must include feedback of status received and verification of field action taken. For example, a switch intended to turn on a pump shall

generate an alarm if the pump running status is not received within a predefined timeout.

d. Alarms.

Software shall include pre-built displays for standard HMI features. The following pre-built displays shall be provided as a minimum:

a. Alarm display that can be filtered by name and includes current, unacknowledged, disabled and history;

b. Trending/Tabular viewing of historical data; and

c. Report creator.

Software shall include a menu for navigating from one display to another. Menu shall be configurable to allow logical grouping of displays where necessary.

Operators, with sufficient security privileges, shall have access to system setpoints and control points and shall have the ability to modify these points.

It shall be possible to determine the properties of any I/O value displayed by selecting it with the mouse. This shall be done in real-time and shall display the following data:

a. Name, description and logical system area;

b. Scaling of field data;

c. I/O address; and

d. Alarm properties.

Software shall support background bitmaps on graphical pages.

Software shall be capable of displaying multiple graphical windows simultaneously.

2.8.1.1.3 Historical and Real-Time Data Management

Software shall provide historical data storage. A synchronization scheme shall be included, ensuring an exact copy of all historical data resides on three server workstations. In the event that the primary or backup historical data storage servers are not synchronized, the outdated server will backfill all missing data from the server with the most recent historical data.

The system will maintain all tag properties in a relational database.

Software shall display historical and real-time data in both plot and tabular format. Historical and real-time plotted values shall be shown in a continuous, uninterrupted, scrolling fashion. These shall be displayed in strip-chart style with the vertical axis depicting the variable value and the horizontal axis representing time. Each display shall be scaled in appropriate coordinates for the specific tag being monitored. The plot's time frame shall be operator selectable from a minimum of one second to five years. Time intervals shall be clearly marked on the

x-axis with date/time stamps and shall scroll with the data.

User shall be able to see the value of plotted tags for any selected point in time.

Software shall be capable of displaying an unlimited number of analog and digital tag plots on a single display. Color shall be used to differentiate between tags. Means must be provided to quickly determine the name and description of each tag displayed.

Scaling of each displayed tag plot shall, at the user's choice, be either independently configurable or shall follow the scaling of the tag. Changing the scaling of the tag plot shall not affect the scaling of the tag.

Where data is not available over duration for a particular variable, data plots shall show no data. At no time shall the gap be replaced with a connection between the last good value and the next good value.

Means must be provided to do the following:

a. Stop the plots from scrolling;

b. Zoom in both the time (x) and value (y) axis;

c. Pan/Scroll along the time axis or select a particular date to display;

d. Move analog tag plots vertically (in the value axis), either individually or as a group; and

e. Display statistical data, including average, minimum and maximum values, for each plot.

Ability to print displayed plots shall be provided.

Presently viewed plot values shall be exportable to comma separated value (.csv) file or directly to a database, for use by third-party data analysis software.

Software shall be capable of saving groups of tags for later recall. There shall be no limit to the number of these groups.

2.8.1.1.4 Alarm and Event Management

A minimum of the last 10,000 alarms and events shall be stored. A synchronization scheme shall be included, ensuring an exact copy of all alarm history resides on three server workstations. In the event that the primary or backup alarm history storage servers are not synchronized, the outdated server will backfill all missing data from the server with the most recent alarm history.

Alarms and events records shall include:

a. Time/Date stamp,

b. The name and description of the alarm tag, and

c. Priority.

d. Status of Alarm (i.e. Active, Acknowledged, Cleared). Alarm Acknowledgement records shall include the name of the user.

When an alarm condition occurs, the following sequence shall be provided:

a. An audible tone shall annunciate from each of the clients that have access to this alarm. This audible tone shall repeat until the alarm is acknowledged.

b. The alarm shall be added to the alarm history.

c. In the event the alarm has not been acknowledged within a user configurable time period, a telephone dialer shall begin notifying users on predefined rosters.

Software shall provide user-configurable settings for deadband and delay on analog alarms.

Users must be notified, both visibly and audibly, of the occurrence of an alarm, regardless which display is presently being viewed.

An alarm shall be acknowledged by selecting the alarm event from the alarm summary interface and then choosing an "Acknowledge" button . Alarms shall not be acknowledged simply by clicking on the alarm event. This two-step approach alleviates inadvertent alarm acknowledgement actions.

Alarm acknowledgement shall immediately be propagated to all user interfaces.

Operators shall be able to filter the alarms display to show current, unacknowledged, disabled or historical alarm. Alarms shall be filterable by priority or by alarm areas/groups.

Software shall allow the project to be split into functional areas such that the alarms a user sees/acknowledges are determined by the areas to which the user has access.

The application shall include a telephone dialer. The dialer shall support text-to-speech, and be automatically synchronized with the tag database at all times.

The telephone dialer shall share the SCADA system security, requiring users to enter a security code from a telephone keypad to access data and to acknowledge alarms. All alarm acknowledgements shall be recorded in the application event log.

The telephone dialer shall be capable of contacting different groups of system users based upon the service needs of the alarm. Each group should be capable of making up to 30 actions (email, SMS or text-to-speech phone call) to up to 30. Once the list of actions is complete, it must be able to repeat or activate another group of actions. Systems shall be able to make groups active/inactive to allow for shift changes and duty rosters. Changes to users in groups and active/inactive status changes shall be made without stopping and restarting the application or computer. There shall be no limit to the number of active and inactive groups. The telephone dialer must be able to switch between groups based on time of day or changes in system values. Changes to these groups shall require sufficient user privileges.

The software must be configurable to detect rapid changes in value or lack of change over a defined period.

2.8.1.1.5 Report Generation System

Software shall be capable of producing reports using historical data. Reports may be created for one-time use.

Report generation shall be invoked either on demand, by a monitored event, or on a scheduled basis.

The report generation system shall be field configurable, allowing an operator to create, modify and generate reports and export data to third party software. The report generation system shall be capable of displaying reports to the user interface display or of exporting files per the following:

a. To a comma separated value (.csv) file,

b. To a text file,

c. Directly to a new MS Excel spreadsheet, and

d. Via e-mail.

Reports generated via an Internet client shall be able to be printed to a local printer.

Reports shall be able to display any analog, digital or calculated tag data from the historical database.

2.8.1.1.6 Application Upgrades/Support/Diagnostics/Debugging

Users shall be notified of application upgrades and the user shall not incur a cost for the upgrade.

Support must include phone and email contact.

Training shall be available for users of all levels (i.e., Operators, Developers, Administrators).

2.8.1.1.7 Security

A password protected security system shall support an unlimited number of users, each user having a set of configurable privileges. Privileges for system configuration, data viewing, and operational activities shall be enabled or disabled on an individual user basis

User accounts shall be able to be duplicated and assigned to new users.

User passwords shall be encrypted using an algorithm that shall render their file storage unreadable.

User passwords must be configurable to exceed a minimum length, contain alphabetic, numeric or special characters, or expire after a pre-set period.

System shall allow creation of additional security privileges where necessary. The system shall allow an unlimited number of additional

privileges.

Changes to user access privileges can be made while the application is running and shall become effective immediately. Networked users whose accounts have been altered shall be affected by the changes immediately, not after stopping and starting the application.

Security system shall be multi-session. It will validate multiple users simultaneously and record their session activity concurrently for all users.

2.8.1.1.8 Internet Connectivity and Handheld Device Support

Internet connectivity shall not require the installation or configuration of a third party Internet Server product (e.g., Miscrosoft IIS, Apache).

On-line configuration changes shall be pushed immediately to all Internet client interfaces without requiring the browser interface to be restarted or refreshed.

Internet clients shall require the latest version Microsoft Internet Explorer, Google Chrome or Modzilla Firefox to communicate with the application. Internet clients shall require no software to be manually installed. Upon first contact with the Internet server serving the application, the Internet client shall automatically synchronize with the application and download any necessary files. All subsequent connections to the server shall synchronize the Internet client with the server.

Internet client shall cache displays in order to reduce display access time.

Internet client interfaces shall have graphical displays identical to the standard client and server interfaces and shall not require separate development time or a separate development interface. The automatic display generation process shall not distort the graphical layout of any display.

Software shall support access to alarms and real-time status information via hand-held devices.

2.8.1.1.9 Redundancy and Load Sharing

Software shall support a minimum of three levels of redundancy for I/O communications (i.e., primary server, 1st backup server, 2nd backup server). Software shall support a minimum of two levels of redundancy for all other services. In the event of primary server failure, software shall be capable of automatic fail-over to a backup server. No manual intervention shall be required.

Software shall support distribution of services across any number of computers to facilitate load sharing.

All servers shall be aware of which server is in control of each software process. No two servers shall perform the same function at the same time. This ensures efficient use of network communications and connections to I/O devices.

Software must not require each redundant server to use a second network card to monitor the status of the primary server.

Backup servers shall be capable of load-sharing the various system operations (including I/O communications and data logging, alarm management, network communications management, security management).

2.8.1.2 Pre-built for pump stations

The supplied HMI will have the following features already setup:

2.8.1.2.1 Screens

Provide station overview, including:

a. Summary alarms including level alarm, level device fault, WAN comms fault, supply fault;

b. Numbers of pumps and pump summary alarm;

c. Comms statistics;

d. Three-phase voltage;

e. Level; and

f. Station name and id.

Provide pump status, including:

a. Auto / off / manual (hand).

b. Detailed pump fault status:

(1) Thermal,

(2) Seal,

(3) Delay fail input,

(4) Critical fault,

(5) Non-critical fault,

(6) Under-current,

(7) Over-current,

(8) Phase fail, and

(9) Earth fault.

c. Control for:

(1) Pump mode - auto / off/ manual (hand) and

(2) Pump fault reset.

d. Detailed pump data:

(1) 3-phase currents (where available at site) and

(2) Ower and kWh (where current monitoring module installed at site).

e. Flow data.

f. Derived flow data (if module installed in field hardware).

g. From flow meter, if installed.

2.8.1.2.2 Configuration

Provide configuration screens for:

a. Changing setpoints of all pumps and alarms and

b. Changing between profiles in the field hardware.

2.8.1.2.3 Pre-Configured Reports

The system will include standard reports relevant to pump station networks, including:

a. Daily station report and

b. Monthly station report.

2.8.2 Communication and Programming Device

Communications from the pump controller shall be via cellular network. The contractor shall be responsible for all startup fees associated with service procurement.

2.9 DATA COMMUNICATION REQUIREMENTS

Communications between the pump station controller and the central station shall be via cellular network. Control system data communications shall support the specified functions and control system configuration shown on the drawings.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION REQUIREMENTS

3.1.1 Installation

Install system components and appurtenances in accordance with the manufacturer's instructions and provide necessary interconnections, services, and adjustments required for a complete and operable system. Adjust or replace devices not conforming to the required accuracies. Replace factory sealed devices, rather than adjusting.

a. Install instrumentation and communication equipment and cable grounding as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

b. Install wiring in exposed areas, including low voltage wiring, in metallic raceways or EMT conduit. Wiring in air plenum areas installed without conduit shall be plenum-rated in accordance with

NFPA 70.

c. Submit detail drawings containing complete piping, wiring, schematic, flow diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Piping and Instrumentation (P&ID) drawings (prepared using industry recognized device symbols, clearly defined and describing piping designations to define the service and materials of individual pipe segments and instrument tags employing Instrument Society of America suggested identifiers). Include in the Drawings, as appropriate: product specific catalog cuts; a drawing index; a list of symbols; a series of drawings for each control system using abbreviations, symbols, nomenclature and identifiers as shown; valve schedules; compressed instrument air station schematics and ASME air storage tank certificates for each type and make of compressed instrument air station.

3.1.1.1 Isolation, Penetrations and Clearance from Equipment

Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exteriors shall be made watertight. Holes in concrete, brick, steel and wood walls shall be drilled or core drilled with proper equipment; conduits installed through openings shall be sealed with materials which are compatible with existing materials. Openings shall be sealed with materials which meet the requirements of NFPA 70. Installation shall provide clearance for control-system maintenance. Control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.1.2 Device Mounting

Devices shall be installed in accordance with manufacturers' recommendations and as shown. Control devices to be installed in piping shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Any deviations shall be documented and submitted to the Government for approval prior to mounting. Damaged insulation shall be replaced or repaired after devices are installed to match existing work. Damaged galvanized surfaces shall be repaired by touching up with zinc paint.

3.1.1.3 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be the products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded.

3.1.1.4 Wiring Shop Drawings

Submit detail drawings containing complete piping, wiring, schematic, flow diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Piping and

Instrumentation (P&ID) drawings (prepared using industry recognized device symbols, clearly defined and describing piping designations to define the service and materials of individual pipe segments and instrument tags employing Instrument Society of America suggested identifiers). Include in the Drawings, as appropriate: product specific catalog cuts; a drawing index; a list of symbols; and a series of drawings for each control system using abbreviations, symbols, nomenclature and identifiers.

3.1.2 Sequences of Operation

Study the operation and sequence of local equipment controls, as a part of the conditions report, and note any deviations from the described sequences of operation on the contract drawings. Perform necessary adjustments to make the equipment operate in an optimum manner and shall fully document changes made.

3.1.3 Factory Test Procedure Documentation

Submit documentation containing factory test methods and procedures.

3.2 INSTALLATION OF EQUIPMENT

Install equipment as specified, as shown and as required in the manufacturer's instructions for a complete and fully operational control system.

3.2.1 Control Panels

Control panels shall be located as indicated on the drawings. Devices located in the control panels shall be as shown on the drawings or as needed to provide the indicated control sequences.

3.2.2 Level Instruments

3.2.2.1 Submersible Pressure Transducer

Pressure transducer shall be mounted in accordance with manufacturer's published instructions. Procedures shall be those used for equipment in hazardous locations. Instrument shall be mounted within a 2 inch PVC stilling basin mounted to side of pump station sump. Stilling basin shall be bracketed to side of sump wall and have 1/2-inch diameter holes drilled throughout length for ease of liquid to enter.

3.2.2.2 Conductive Level Probe

Probe shall be mounted in accordance with manufacturer's published instructions. Procedures shall be those used for equipment in hazardous locations.

3.2.2.3 Conductivity Switch

Level switches shall be installed vertically and in accordance with the manufacturer's instructions. Switches shall be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, a mounting bracket shall be provided for connection to the inside tank wall, maintaining the minimum recommended distance from the tank fill opening.

3.2.3 Temperature Instrument Installation

3.2.3.1 Temperature Switches

Temperature switches shall be installed as specified for RTDs. Temperature switches shall come integral to submersible type pumps and be adjusted to the proper setpoint and shall be verified by calibration. Switch contact ratings and duty shall be selected for the application.

3.2.4 Electric Power Devices

3.2.4.1 Potential and Current Transformers

Install potential and current transformers in enclosures unless otherwise shown. Current transformer leads shall be shorted when they are not connected to the measurement circuits.

3.2.4.2 Hour Meters

Pump controller shall monitor activation of pumps, and record the elapsed time for each pump. Elapsed time shall be accessable via the HMI screen.

3.2.4.3 Transducers

Transducers shall be wired in accordance with the manufacturer's instructions, and installed in enclosures.

3.2.4.4 Current Sensing Relays and Current Transducers for Motors

When used to sense meter/fan/pump status, current sensing relays shall be used for applications under five hp. Applications over five hp shall use a current transducer.

3.2.5 Output Devices

Output devices (transducers, relays, contactors, or other devices) which are not an integral part of the control panel, shall be mounted in an enclosure mounted adjacent to the control panel, unless otherwise shown. Where H-O-A and/or override switches on the drawings or required by the control sequence, the switches shall be installed so that the control system controls the function through the automatic position and other controls work through the hand position.

3.2.6 Enclosures

All enclosure penetrations shall be from the bottom of the enclosure, and shall be sealed to preclude entry of water using a silicone rubber sealant. Conduit entries at Station 10 shall be provided with a seal off conduit fitting. Seal off fittings shall have the following characterists:

Class I, Division 1, Groups B, C, D, UL 1203.

3.2.7 Transformers

Transformers for control voltages below 120 vAc shall be fed from the nearest power panel or motor control center, using circuits provided for the purpose. Provide a disconnect switch on the primary side and a fuse on the secondary side. Transformers shall be enclosed in a steel cabinet with conduit connections.

3.3 WIRE, CABLE AND CONNECTING HARDWARE

3.3.1 Metering and Sensor Wiring

Metering and sensor wiring shall be installed in accordance with the requirements of ANSI C12.1 and NFPA 70.

3.3.1.1 Power Line Surge Protection

Control panels shall be protected from power line surges. Protection shall meet the requirements of IEEE C62.41.1 and IEEE C62.41.2. Fuses shall not be used for surge protection.

3.3.1.2 Sensor and Control Wiring Surge Protection

Digital and analog inputs shall be protected against surges induced on control and sensor wiring. Protect digital and analog outputs against surges induced on control and sensor wiring installed outdoors and as shown. Fuses shall not be used for surge protection. Test the inputs and outputs in both the normal and common mode using the following two waveforms: The first waveform shall be 10 microseconds by 1000 microseconds with a peak voltage of 1500 volts and a peak current of 60 amperes. The second waveform shall be 8 microseconds by 20 microseconds with a peak voltage of 1000 volts and a peak current of 500 amperes. Submit certified test results for surge protection.

3.4 SOFTWARE INSTALLATION

Load software required for an operational control system, including databases (for points specified and shown), operational parameters, and system, command, and application programs. Adjust, tune, debug, and commission all software and parameters for controlled systems to assure proper operation in accordance with the sequences of operation provided on the drawings.

3.5 CONTROL DRAWINGS

Control drawings, reproducible, with corresponding CADD files, shall be provided for equipment furnished and for interfaces to equipment at each respective equipment location. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system manually shall be prepared in typed form, reproducible, with corresponding word processor files and posted beside the diagrams. Diagrams and instructions shall be submitted prior to posting. The framed instructions shall be posted before acceptance testing of the system.

3.6 FIELD TESTING AND ADJUSTING EQUIPMENT

Provide personnel, equipment, instrumentation, and supplies necessary to perform site testing. The Government will witness the PVT, and written permission shall be obtained from the Government before proceeding with the testing. Original copies of data produced, including results of each test procedure, during PVT shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test. The test procedures shall cover actual equipment and functions specified for the project.

3.6.1 Testing, Adjusting and Commissioning

After successful completion of the factory test as specified, the Contractor will be authorized to proceed with the installation of the system equipment, hardware, and software. Once the installation has been completed, test, adjust, and commission each control loop and system in accordance with NIST SP 250 and shall verify proper operation of each item in the sequences of operation, including hardware and software. Calibrate field equipment, including control devices, adjust control parameters and logic (virtual) points including control loop setpoints, gain constants, constraints, and verify data communications before the system is placed online. Test installed ground rods as specified in IEEE 142 and submit certification stating that the test was performed in accordance with IEEE 142. Calibrate each instrumentation device connected to the control system control network by making a comparison between the reading at the device and the display at the workstation, using a standard at least twice as accurate as the device to be calibrated. Check each control point within the control system control network by making a comparison between the control command at the central station and field-controlled device. Deliver trend logs/graphs of all points showing to the Government that stable control has been achieved. Points on common systems shall be trended simultaneously. Verify operation of systems in the specified failure modes upon Control system network failure or loss of power, and verify that systems return to control system control automatically upon a resumption of control system network operation or return of power. Deliver a report describing results of functional tests, diagnostics, calibrations and commissioning procedures including written certification to the Government that the installed complete system has been calibrated, tested, adjusted and commissioned and is ready to begin the PVT. The report shall also include a copy of the approved PVT procedure.

3.6.2 Performance Verification Test (PVT)

Submit test procedures for the PVT. The test procedure shall describe all tests to be performed and other pertinent information such as specialized test equipment required and the length of the PVT. The test procedures shall explain, in detail, step-by-step actions and the expected results, to demonstrate compliance with all the requirements of the drawings and this specification. The test procedure shall be site specific and based on the inputs and outputs, required calculated points and the sequence of control. Refer to the actions and expected results to demonstrate that the control system performs in accordance with the sequence of control. Include a list of the equipment to be used during the testing plus manufacturer's name, model number, equipment function, the date of the latest calibration and the results of the latest calibration.

Demonstrate that the completed Control system complies with the contract requirements. All physical and functional requirements of the project including communication requirements shall be demonstrated and shown. Demonstrate that each system operates as required in the sequence of operation. The PVT as specified shall not be started until after receipt of written permission by the Government, based on the written report including certification of successful completion of testing, adjusting and commissioning as specified, and upon successful completion of training as specified. Upon successful completion of the PVT, furnish test reports and other documentation.

The performance verification test procedure; it shall refer to the actions

and expected results to demonstrate that the control system performs in accordance with the sequence of control. Include a list of the equipment to be used during the testing plus manufacturer's name, model number, equipment function, the date of the latest calibration and the results of the latest calibration.

3.6.3 Pump Control Field Testing

The pump control field test shall be used to demonstrate the overall system reliability of the completed system. This test shall not be started until the Government notifies the Contractor in writing that the PVT is satisfactorily completed, training as specified has been completed, outstanding deficiencies have been satisfactorily corrected, and that the Contractor has permission to start the pump control field testing.

3.6.3.1 Assessment

After the conclusion of the pump control field testing, identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than five business days after receipt of the report by the Government. As a part of this test review meeting, demonstrate that failures have been corrected by performing appropriate portions of the performance verification test. The Government reserves the right to cancel the test review meeting if no failures or deficiencies occur during the Phase I testing. If the Government chooses to do so, the Contractor will be notified in writing. Based on the Contractor's report and the test review meeting, the Government will determine if retesting is necessary and the restart point. The Government reserves the right to require that the Phase I test be totally or partially rerun. Do not commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the assessment shall be repeated.

3.6.3.2 Exclusions

The Contractor will not be held responsible for failures resulting from the following: Outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the control system performed as specified. Failure of a Government furnished communications link, provided that the controller automatically and correctly operates in the stand-alone mode as specified, and that the failure was not due to Contractor furnished equipment, installation, or software. Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.

3.7 MANUFACTURERS' FIELD SERVICES

Obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installing, adjusting, and testing of the equipment.

3.8 FIELD TRAINING

Field training oriented to the specific system shall be provided for designated personnel. Furnish a copy of the training manual for each trainee plus two additional copies. Manuals shall include an agenda, the defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Furnish audiovisual equipment and other training supplies and materials. Copies of the audiovisuals shall be delivered with the printed training manuals. The Government reserves the right to videotape training sessions for later use. A training day is defined as eight hours of classroom instruction, excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. Submit the training manual and schedule to receive approval from the Government at least 30 calendar days before the training.

3.8.1 Preliminary Operator Training

Prior to the start of field testing, preliminary operator training shall be taught at the project site for two consecutive training days. Upon completion of this course, each student, using appropriate documentation, should be able to perform elementary operations with guidance and describe the general hardware architecture and functionality of the system. This course shall include: general system architecture; functional operation of the system, including workstations; operator commands; application programs, control sequences, and control loops; database entry and modification; reports generation; alarm reporting; diagnostics; and historical files.

3.8.2 Additional Operator Training

Following the field testing, additional classroom training for operators shall be taught for two consecutive training days; individual instruction sessions of eight-hour periods. Individual instruction shall consist of "hands-on" training under the constant monitoring of the instructor. Classroom training shall include instruction on the specific hardware configuration of the installed control system and specific instructions for operating the installed system. Schedule activities during this period so that the specified amount of time on the equipment will be available for each student. The final session will address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should be fully proficient in system operation and have no unanswered questions regarding operation of the installed control system. Each student should be able to start the system, operate the system, recover the system after a failure and describe the specific hardware architecture and operation of the system and be fully proficient in all system operations. Report the skill level of each student at the end of this course.

3.8.3 Maintenance Training

A minimum period of two training days shall be provided by a factory representative or a qualified Contractor trainer for five designated personnel on maintenance of the equipment. The training shall include: physical layout of each piece of hardware, calibration procedures, preventive maintenance procedures, schedules, troubleshooting, diagnostic procedures and repair instructions.

-- End of Section --