

SPECIFICATIONS

(For Construction Contract)

Solicitation Number W9128F23R0009

PH 2 Butterfly Valve Rehab

Fort Peck Dam, MT

February 2023



**US Army Corps
of Engineers**
Omaha District

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SECTION 01 12 00

CONSTRUCTION GENERAL

PART 1 GENERAL

1.1 SCOPE

The scope of this project is to refurbish the existing 216-inch diameter inlet butterfly valves and associated systems of Powerhouse 2 at Fort Peck Dam. The work covered in this section is outlined as a statement of construction requirements common to all the work. Specific requirements for materials and installations are provided under the Technical Sections herewith. No claims for extras shall be made on account of items presumed to have been omitted from this section. Work sequencing, coordination and outage requirements is defined in paragraph COORDINATION AND OUTAGES in this Section, paragraph UNIT OUTAGE COORDINATION in Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING, and elsewhere as specified.

1.2 CONSTRUCTION RIGHT-OF-WAY

The Contractor will be assigned working areas or working right-of-way limits for use in the prosecution of work under this contract, subject to the SECTION 00 72 00, GENERAL CONDITIONS (CONTRACT CLAUSES) clause entitled "Operations and Storage Areas."

1.3 PROTECTION OF EXISTING FACILITIES AND WORKS

The Contractor shall be responsible for the protection of the work area from damage and upon completion of the work shall leave existing works in a condition equal to that which existed when the work started. All work, storage of materials, and construction plant shall be kept within the limits of the areas assigned. Prior to construction operations, the Contractor shall confer with the Contracting Officer's representative to determine the proximity of any possible under-ground obstructions, pipe or equipment which could be damaged as a result of construction operations. Existing utility lines that are shown on the drawings or the locations are otherwise made known to the Contractor shall be protected from damage, and if damaged, shall be repaired by the Contractor at no additional expense to the Government. In the event that the Contractor damages any existing utility lines that are not shown or the locations of which have not been made known to the Contractor, the Contractor shall immediately notify the Contracting Officer. The Contracting Officer will review the information and discuss with the Contractor how to proceed. The Contractor will be responsible for the protection of structures from any structural damage during the construction operations. Roads and surfaces shall be protected from damage by the work or if damaged shall be repaired with equal materials at no additional expense to the Government. At all times the plant and work areas shall be kept in a condition conducive to safety of workmen and the public and neat in appearance. Waste or surplus materials shall not be allowed to accumulate in the construction areas.

1.3.1 Interruption of Electric Power

If it is necessary to cut off power in transmission lines that pass through construction areas, it shall be the Contractor's responsibility to make the necessary arrangements with the owner of the powerline, and the Contractor shall pay all costs therefore.

1.3.2 Flood Protection Works

In all cases where materials in the existing flood protection works are used or connected with the construction of new work under this contract, the work shall be so planned and executed that the new work shall be completed to provide protection equivalent to the existing protection as the existing protection is weakened or removed. These operating restrictions shall be followed in order that the new work may be tied in, or connected promptly, by the Contractor, with the existing facilities so as to furnish a continuous service in an emergency. These ties or connections shall be made during periods of suspended construction operations and the Contractor shall leave incompletd pipe outlets and other structures in such conditions as to not interfere with the natural drainage from areas served by these pipes or structures.

1.3.3 Dust Control and Removal

Special measures shall be taken to minimize air-borne dust in work areas. Dust shall not be allowed to accumulate about the powerhouse in general. Return air ducts for heating, ventilating and air conditioning shall be blocked, where practicable, or equipped with filters in areas where dust is being produced or agitated. Removal of dust shall be by sweeping with dust wetted down or overlain with sweeping compound, or by vacuum cleaner as approved. Where air-borne dust in objectionable amount is unavoidable, equipment, which contain commutators, contactors, bearing, etc., shall be covered. Adequate air filters shall be provided in covers over equipment which requires circulation of air while operating. Dust shall be removed daily on a continuing basis during the life of this contract. Dust shall be removed as directed from the interior of equipment housed in cabinets by method approved by the Contracting Officer.

1.4 CARE OF WATER

Full responsibility for care of water shall be borne by the Contractor until completion of work under this contract. The Contractor shall provide the materials and equipment and perform all work necessary to facilitate construction and to protect the work from damage by water. The Contractor shall make the needed investigations and determinations of conditions, both existing and anticipated concerning care of water. Plans for care of water are subject to approval by the Contracting Officer prior to construction. Facilities shall be removed upon completion of the work.

1.5 DISPOSITION OF CONSTRUCTION FACILITIES

All buildings and facilities constructed by the Contractor shall be maintained in a satisfactory condition with strict observance of the rules of sanitation, safety and order as may be established by the Contracting Officer. Prior to final payment under the contract, all buildings and facilities constructed by the Contractor for the Contractor's use shall be removed from the site by the Contractor.

1.6 COOPERATION WITH OTHER CONTRACTORS

The Contractor shall cooperate and coordinate work with that of others working in the area during the life of this contract. The Contractor shall coordinate work with others to avoid undue interference and shall conduct operations, other than approved required access, within the limits of the assigned construction area or construction right-of-way limits. The Contractor shall cooperate with others as necessary in the interest of timely completion of all work and in the event of disagreement the decision of the Contracting Officer shall be final.

1.7 ORDER OF WORK

All Hydraulic Power Units (HPU) and associated equipment are required to be fabricated, factory tested, and delivered onsite before any outage can occur. Exception will be any components that require final machining to finished dimensions after existing equipment is removed for dimension verification (i.e. trunnion bearings, BFV operator crank, ect).

Order of work is at Contractor's discretion. Paragraph 1.8 below details outage coordination requirements. Sequence of work should be prioritized to minimize outages. Priority should be placed on limiting the outage period for the flood tunnel and penstocks.

1.8 COORDINATION AND OUTAGES

The Contractor's employees shall not open, close or tamper with switches, valves or control devices for existing installed equipment. Only Government operating personnel will be authorized to open or close existing switches, valves and control devices to enable the Contractor to make connections or modifications to existing equipment. Work shall be coordinated and scheduled to reduce the "Outage" time of operating equipment or systems to a minimum. Work in the proximity of exposed energized equipment such as in the switchyard or work involving connections to existing energized or operating equipment or systems shall perform only under the Safe Clearance Procedures. The Contractor will be instructed by the Contracting Officer in the proper procedure for requesting clearances. Only qualified supervisory personnel will be permitted to request clearances. Request for "Outage" shall be made by the Contractor to the Contracting Officer in each instance and in sufficient time to permit adjusting power plant operations, and to coordinate outages with the dispatching agency. Request for outage must be submitted a minimum 21 days prior to the date of outage start date. Scheduling of "Outage" will be subject to the approval of the Contracting Officer.

Proposed tunnel outage is from 16 September 2024 to 10 February 2025, and is for both Unit inlet butterfly valves to be refurbished simultaneously.

1.9 Early Onsite Work Window

Powerhouse 2, Unit 4 will be offline for maintenance from 11 Sep 2023 - 29 Sep 2023; and Unit 5 will be offline for maintenance from 16 Oct 2023 - 3 Nov 2023. These two units are not open at the same time. The butterfly valves will be in a closed position during this maintenance outage to

unwater the scroll case. The tunnel upstream of the butterfly valves will not be unwatered. The scroll case access door will be opened to provide the contractor access to perform inspections and take measurements inside the scroll case and penstock downstream of the butterfly valve. Access up to the downstream face of the closed butterfly valve will be limited due to leakage past the closed butterfly valve, making conditions unsafe for personnel to approach any closer than approx. 10 feet. Contractor will coordinate with the COR to be given access to conduct the following:

1. General visual inspection and condition assessment of the work areas inside the scroll case, penstock, and access door.
2. Visual inspection and qualitative assessment of butterfly valve internal leakage locations and pattern (see Section 22 00 00.00 26 for requirements)"

1.10 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-01 Preconstruction Submittals

Proposed Methods of Operation; G-AO

Construction Right-of-Way

(Right-of-Way Agreements)

SD-02 Shop Drawings

Care of Water; G-AO

SD-11 Closeout Submittals

Warranty of Construction

(List of warranties with copy of each)

1.11 WARRANTY OF CONSTRUCTION (MAR 1994)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or

personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud. (FAR 52.246-21)

1.12 TELEPHONE/INTERNET

The Contractor is responsible for arranging telephone/Internet service for the Contractor's trailer through the local telephone company.

1.13 USE OF GOVERNMENT EQUIPMENT

1.13.1 Monorail Hoist Operation

Only Government personnel will operate the monorail hoist. The Contractor will be responsible for furnishing and performing all rigging for all lifts. The Government must inspect and approve all rigging prior to performing the lift. The Contractor will be responsible for all off-loading, movement, and loading of required construction equipment. Equipment will be lowered to and from the working level with the monorail hoist.

1.13.2 Working Hours

The Contractor shall properly prepare and plan all lifts such that Government operators are required for a minimum number of occasions. Use of the hoist will only be during normal Government working hours. A hoist operator will not be furnished on a standby basis. The Contractor shall coordinate with the powerplant superintendent, in writing 24 hours in advance, the need for a hoist operator. The Government will operate the crane during the normal daytime working hours of 7:00 am to 4:30 pm Monday thru Thursday .

1.13.3 Freight Elevator

The Contractor will be allowed to use the freight elevator to assist in transporting equipment and materials to the job site within the building. The elevator dimensions are 60" wide x 80" long x 82" high, and maximum capacity is 3,000 lbs. The location of the Elevator is shown on drawing MD101.

1.14 TOILET FACILITIES

The Contractor will be allowed to use the powerhouse restroom facilities designated for their use. The Contractor shall negotiate with the existing janitorial contractor a monthly fee for additional cleaning and supplies to maintain these facilities during their use. This fee in the past as ranged from \$100-200 per month to be paid directly to the janitorial Contractor. The Contractor and his staff are expected to be respectful of the restroom privileges. Should the restroom privileges be abused, the Contractor will be required to bring portable toilets for his staff.

1.15 FEDERAL HOLIDAYS AND WORKING HOURS

The Contractor will have access to the facility for work during normal plant business hours from 0700 to 1700 hrs Monday through Saturday, excluding any federally recognized holidays or observance days. Work hours outside 0700 to 1700 hrs Monday through Saturday may be necessary during certain phases of the work to mitigate schedule slippage risk, and must be coordinated with the COR. The Contractor shall plan all work accordingly. These hours will be strictly adhered to unless the Government determines work outside this time is beneficial to the Government or a bilateral modification for extended working hours is executed.

The following Federal legal holidays are observed by this installation:

| | |
|-------------------------------|-----------------------------|
| New Year's Day | 1 January |
| Martin Luther King's Birthday | Third Monday in January |
| President's Day | Third Monday in February |
| Memorial Day | Last Monday in May |
| Juneteenth | 19 June |
| Independence Day | 4 July |
| Labor Day | First Monday in September |
| Columbus Day | Second Monday in October |
| Veterans Day | 11 November |
| Thanksgiving Day | Fourth Thursday in November |
| Christmas Day | 25 December |

If the wage determination has a discrepancy with the above list of observed Federal holidays, then the wage determination takes precedence.

PART 2 NOT USED

PART 3 NOT USED

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01 22 00.00 26

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 GENERAL INFORMATION

a. In each instance, the Contract price for an item will constitute full compensation as herein specified, as shown, or as otherwise approved. The Contract price and payment will also constitute full compensation for all work incidental to completion of the item, unless such work is otherwise specifically mentioned for separate payment under another line item. In the event any work is required by the specifications Sections or by the Drawings and not specifically mentioned in the measurement and payment paragraphs, separate or direct payment will not be made and all costs thereof are incidental to the work and included in the Contract prices and payments for all items listed in the price schedule. Payment for work activities involving lead based paint removal and asbestos abatement will be incidental to the related Contract Line Item Number (CLIN).

b. As stated in Section 00 72 00 Contract Clause 52.236-21, SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, the word "provided" shall be understood to mean "provide complete in place," that is "furnished and installed," when used in this Section or elsewhere in the technical Sections.

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

Schedule Of Mobilization And Demobilization Costs; G

1.3 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 Section 00 10 00, PRICE SCHEDULE, and described below. The unit price and payment made for each item listed will constitute full compensation for furnishing all plant, labor, materials, and equipment; performing all associated Contractor quality control, environmental protection, commissioning, preparation of working as-built drawing redlines, O&M manuals, tests and reports, meeting safety requirements; and for performing all work required for each of the unit price items.

1.4 JOB PAYMENT ITEMS

Payment items for the work of this Contract for which Contract job payments will be made are listed in Section 00 10 00, PRICE SCHEDULE, and

described below. All costs for items of work, which are not specifically mentioned to be included in a particular job item, must be included in the listed job item most closely associated with the work involved. The job price and payment made for each item listed will constitute full compensation for furnishing all plant, labor, materials, and equipment; performing all associated Contractor quality control, environmental protection, commissioning, preparation of working as-built drawing redlines, O&M manuals, tests and reports, meeting safety requirements; and for performing all work required for which separate payment is not otherwise provided. Provide a schedule of values for job items prior to the first pay request. Update with each subsequent payment request.

MANDATORY ITEMS

1.5 MEASUREMENT AND PAYMENT

1.5.1 CLIN 0001: Mobilization and Demobilization

a. Measurement: Measurement will be made as a job for mobilizing and demobilizing all plant, equipment, fuel, supplies, materials, and personnel to and from Fort Peck Powerhouse. This CLIN applies to the Prime Contractor and all subcontractor mobilization and demobilization.

b. Payment: Payment will be made in the Contract amount under CLIN 0001 at a rate of 60 percent for mobilization and 40 percent for demobilization as defined in Contract Clause 252.236-7004, PAYMENT FOR MOBILIZATION AND DEMOBILIZATION (DEC 1991). Submit a schedule of mobilization and demobilization costs prior to submitting the first request for payment.

1.5.2 CLIN 0002: Tunnel 2, Unit 4, and Unit 5 Penstock Ultrasonic Testing

a. Measurement: Measurement will be made as a job item for providing all equipment, operations, labor, and materials required to perform inspections of tunnel 2, unit 4, and unit 5 penstocks, as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made in the Contract amount under CLIN 0002, "Tunnel 2, Unit 4, and Unit 5 Penstock Ultrasonic Testing."

1.5.3 CLIN 0003 Provide New Tunnel 2 Drain Valves

a. Measurement: Measurement will be made as a job item for providing all equipment, operations, labor, materials, and incidental design engineering required to remove and dispose of the existing manual operated gate valve and piping, heating cable and thermostat at the Tunnel 2 location upstream of the bifurcation as shown; and installation and testing of provided new manually operated tunnel drain valves, piping and insulation, heating cable and thermostat, and associated systems and components, as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made in the Contract amount under CLIN 0003, "Provide New Tunnel 2 Drain Valves."

1.5.4 CLIN 0004: Refurbish Penstock Butterfly Valves - 2 Units

a. Measurement: Measurement will be made as a job item for providing all plant, labor, materials, equipment, operations, incidentals, and supervision associated with the design engineering, manufacture, shipping, demolition, installation, and painting required to refurbish and test the Unit 4 and Unit 5 Penstock Butterfly Valves as described in these specifications and in accordance with all Federal, State, and local laws and regulations. Includes but not limited to the refurbishment of existing penstock butterfly valve bronze disc seals, installation of new stainless steel mounting/adjusting hardware, o-rings, address coating deterioration and corrosion by sand blasting and re-coating, perform non-destructive examination (NDE) of butterfly valves after blast and prior to re-coating; new bearing carrier seals, bronze shaft bearings, thrust bearing, and associated systems as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made in the Contract amount under CLIN 0004, "Refurbish Penstock Butterfly Valves - 2 Units."

1.5.5 CLIN 0005: Provide New Penstock Butterfly Valve Grease Lubrication System - 2 Units

a. Measurement: Measurement will be made as a job item for providing all equipment, operations, labor, materials, and incidental design engineering required to remove and dispose of the existing grease lubrication system and provide new penstock butterfly valve grease lubrication system for Unit 4 and Unit 5 as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made in the Contract amount under CLIN 0005, "Provide New Penstock Butterfly Valve Grease Lubrication System - 2 Units."

1.5.6 CLIN 0006 Provide New Penstock Butterfly Valve Operator, HPU and Controls - 2 Units

a. Measurement: Measurement will be made as a job item for providing all plant, labor, materials, equipment, operations, incidentals, and supervision associated with the design engineering, manufacture, shop assembly, factory testing, delivery to site, demolition of existing, installation and field testing of provided new Unit 4 and Unit 5 penstock butterfly valve operator, HPU and controls, as described in these specifications and in accordance with all Federal, State, and local laws and regulations. Includes but not limited to the new butterfly valve operator (quarter-turn hydraulic cylinder actuator) with integral mechanical locking device, hydraulic power unit (HPU) with offline oil filtering system, electrical panels, butterfly valve controls, and associated systems as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment will be made in the Contract amount under CLIN 0006, "Provide New Penstock Butterfly Valve Operator, HPU and Controls - 2 Units."

1.5.7 CLIN 0007 Provide New Penstock Butterfly Valve Bypass System and Spiral Case Drain Valve - 2 Units

a. Measurement: Measurement will be made as a job item for providing all equipment, operations, labor, materials, and incidental design engineering required to remove and dispose of the existing motorized gate valve and bypass piping, and spiral case drain valve for Unit 4 and Unit 5; and installation and testing of provided new butterfly valve bypass system (motorized gate valve, manual isolation valve, bypass piping, absolute pressure switch, equalizing line pressure monitoring system, and bypass system controls), new manual operated spiral case drain valve, piping insulation, and associated systems and components for Unit 4 and Unit 5, as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made in the Contract amount under CLIN 0007, "Provide New Penstock Butterfly Valve Bypass System and Spiral Case Drain Valve - 2 Units."

1.5.8 CLIN 0008 Provide New Penstock Butterfly Valve Maintenance Platforms, Access Ladders, Hatches, and Guardrails - 2 Units

a. Measurement: Measurement will be made as a job item for providing all equipment, operations, labor, materials, parts, and incidentals for designing, fabricating, delivery to site, removal of existing platforms and ladders, and installation of new butterfly valve maintenance platforms, access ladders, and access hatch modifications, and new guardrails for butterfly valve hatches, for Unit 4 and Unit 5 penstock butterfly valves, as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made in the Contract amount under CLIN 0008, "Provide New Penstock Butterfly Valve Maintenance Platforms, Access Ladders, Hatches, and Guardrails - 2 Units."

1.5.9 CLIN 0009 All Remaining Work

a. Payment: Payment for all remaining work will be paid for under CLIN 0009 "All Remaining Work" on the bidding schedule, made on a progressive basis, based on the percentage of work completed. Price and payment shall constitute full compensation for all work and fees including but not be limited to labor, materials, mobilization, permits, associated and incidental to the completion of the required work according to the plans and specifications not covered on the Bidding Schedule in bid items number 0001 through number 0008.

OPTIONAL ITEMS

Optional CLINs - Exercise of options. The Government may require the delivery of and/or work for the numbered line item(s) identified in the Pricing Schedule as an "Optional" item. The quantities for these items may be increased or decreased or the item(s) may not be used at all, at the discretion of the Government. The Government may exercise an option by written notice to the Contractor commencing from the date of contract award through the date the contract is closed, unless otherwise specified herein. If an option is exercised, the contract completion date will not be extended, however, with mutual agreement, the schedule of work may be

modified.

1.5.10 CLIN 0010 Penstock Paint Repairs - 10 Locations (Optional)

a. Measurement: Measurement will be made as a job item for providing all equipment, operations, labor, and materials required to perform paint repairs of the tunnel 2, unit 4, and unit 5 penstock exteriors, as described in these specifications, as shown, and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made in the Contract amount under CLIN 0010, "Penstock Paint Repairs - 10 Locations (Optional)."

1.5.11 CLIN 0011 Penstock Butterfly Valve Weld Repairs (Optional)

a. Measurement: Measurement will be made on a per linear inch of weld repair basis for providing all equipment, operations, labor, and materials required to perform weld metal excavation to sound base metal, non-destructive examination (NDE) to confirm indication removal, welding to original designed weld profile, pre and post heating requirements, and post weld NDE of repaired welds of the penstock butterfly valves, as described in these specifications and in accordance with all Federal, State, and local laws and regulations.

b. Payment: Payment will be made on a per linear inch of weld repair basis under CLIN 0011, "Penstock Butterfly Valve Weld Repairs (Optional)."

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

-- End of Section --

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DIVISION 01 - GENERAL REQUIREMENTS

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SECTION 01 30 00.24

OTHER ADMINISTRATIVE AND SPECIAL REQUIREMENTS

PART 1 GENERAL

1.1 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

In accordance with FAR 31.105(d)(2)(i)(b), for the predetermined schedule of construction equipment use rates, use Engineer Pamphlet (EP) 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule. Copies of each regional schedule may be obtained through the following internet site:

<https://www.publications.usace.army.mil/USACE-Publications/Engineer-Pamphlets/> on pages 10 and 11 of 13.

1.2 CONTRACTOR SUPPLY AND USE OF ELECTRONIC SOFTWARE FOR PROCESSING CONSTRUCTION WAGE RATE REQUIREMENTS STATUTE CERTIFIED LABOR PAYROLLS

a. The Contractor is encouraged to use a commercially-available electronic system to process and submit certified payrolls electronically to the Government. The requirements for preparing, processing and providing certified labor payrolls are established by the Wage Rate Requirements statute.

b. The Contractor is responsible for obtaining and providing for all access, licenses, and other services required to provide for receipt, processing, certifying, electronically transmitting to the Government, and storing weekly payrolls and other data required for the Contractor to comply with the Wage Rate Requirements statute. When the Contractor uses an electronic payroll system, use the electronic payroll service used by the Contractor to prepare, process, and maintain the relevant payrolls and basic records during all work under this construction contract. The electronic payroll service must be capable of preserving these payrolls and related basic records for the required three years after contract completion. The Contractor must obtain and provide electronic system access to the Government, as required to comply with the Wage Rate Requirements over the duration of the construction contract.

(c) The Contractor's provision and use of an electronic payroll processing system must meet the following basic functional criteria:

- (1) commercially available;
- (2) compliant with appropriate Wage Rate Requirements statute payroll provisions in the FAR;
- (3) able to accommodate the required numbers of employees and

subcontractors planned to be employed under the contract;

(4) capable of producing an Excel spreadsheet-compatible electronic output of weekly payroll records for export into an Excel spreadsheet to be imported into the contractor's mode of Resident Management System 3.0;

(5) demonstrated security of data and data entry rights;

(6) ability to produce Contractor-certified electronic versions of weekly payroll data;

(7) ability to identify erroneous entries and track the data/time of all versions of the certified Wage Rate Requirements statute payrolls submitted to the government over the life of the contract;

(8) capable of generating a durable record copy in a Compact Disc (CD) or Digital Versatile Disc (DVD) and Portable Document Format (PDF) file record of data from the system database at the end of the contract closeout. This durable record copy of data from the electronic payroll processing system must be provided to the Government during contract closeout.

d. All Contractor-incurred costs related to the Contractor's provision and use of an electronic payroll processing service must be included in the Contractor's price for the overall work under the contract. The costs for compliance with the Wage Rate Requirements statute by using electronic payroll processing services must not be a separately bid or reimbursed item under this contract.

1.3 VETERANS EMPLOYMENT EMPHASIS FOR U.S. ARMY CORPS OF ENGINEERS CONTRACTS

In addition to complying with the requirements outlined in FAR Part 22.13, FAR Provision 52.222-38, FAR Clause 52.222-35, FAR Clause 52.222-37, DFARS 222.13 and Department of Labor regulations, U.S. Army Corps of Engineers (USACE) contractors and subcontractors at all tiers are encouraged to promote the training and employment of U.S. 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 Veterans' Employment and Training Service (VETS):
<https://www.dol.gov/vets/>
- Federal Veteran Employment Information: <https://www.fedshirevets.gov/>
- Veterans Opportunity to Work (VOW) Program:
<https://www.benefits.va.gov/vow/>
- U.S. Army Warrior Transition Command Employment Index:
<https://wct.army.mil/modules/employers/index.html>
- Hiring Our Heroes: <https://www.uschamberfoundation.org/hiring-our-heroes>

1.4 COMPLETION OF WORK

See Section 00 73 00 SUPPLEMENTARY CONDITIONS (SPECIAL CONTRACT REQUIREMENTS), FAR 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984).

1.5 CONTRACTOR PERFORMANCE EVALUATIONS

See Federal Acquisition Regulation (FAR) Subpart 42.1502(e) for the requirements on past performance evaluations for construction contracts. For construction contracts valued at or above \$750,000.00, including all modifications, the USACE will evaluate Contractor's performance using the web-based Contractors Performance Assessment Reporting System (CPARS). After the USACE drafts an evaluation (interim or final), the Contractor will have the opportunity to access, review, comment and either concur or non-concur with the evaluation in the CPARS system for a period of 60 days. Access to the CPARS system requires either specific software called PKI certification (recommended method) or a username and password. The PKI certification is a Department of Defense recommendation and to provide security in electronic transactions. The certification software could cost approximately \$110 - \$125 per certificate per year and may be purchased from an External Certificate Authorities (ECA) vendor. Current information about the PKI certification process and contacting vendors can be found on the web site: <https://www.cpars.gov>.

1.6 ANTITERRORISM (AT)/OPERATIONS SECURITY (OPSEC) PROVISIONS

1. General security requirements and guidance:

The security requirements described below apply to all contract personnel (including employees of the prime Contractor ("Contractor") and all subcontractor employees) supporting the performance requirements of this contract. The Contractor is responsible for compliance with these security requirements. Questions regarding security matters shall be addressed to the designated Government representative (e.g., Contracting Officer Representative (COR), Requiring Activity (RA) representative, or Contracting Officer (if a COR or other RA representative is not appointed)). Contract personnel are critical to the overall security and safety of US Army Corps of Engineers (USACE) installations, facilities and activities, and security awareness training contributes to those efforts. The Department of Defense (DoD) and Army security training requirements specified below, if applicable, are performance requirements; all applicable contract personnel shall complete initial training within 30 days of contract award or the date new contract personnel begin performance on the contract. Within five business days from the completion of training, the Contractor shall provide written documentation (e.g., email or memorandum) to the Government representative. The documentation shall include the names of contract personnel trained and which training they completed; the Contractor shall maintain training records as part of their contract files and be prepared to provide copies of training certificates to the Government representative. Contractor personnel and vehicles are subject to search when entering federal installations. Additionally, all contract personnel shall comply with Force Protection Condition (FPCON) measures, Random Antiterrorism Measures (commonly referred to as "RAMs"), and Health Protection Condition (HPCON) measures. The Contractor is responsible for meeting performance requirements during elevated FPCON and/or HPCON levels in accordance with applicable RA plans and procedures-this includes identifying mission essential and non-mission essential personnel. In addition to the changes otherwise authorized by the changes clause of this contract, should the FPCON or HPCON levels at any individual facility or installation change, the Government may implement security changes that affect contract personnel. The Contractor shall ensure all contract personnel are aware of their security responsibilities, including any site-specific requirements identified in local policies or procedures.

2. Antiterrorism (AT) Level I training:

All contract personnel requiring routine access to Army installations, facilities, and controlled access areas, or requiring network access shall complete initial and annual refresher AT Level I awareness training. Online AT Level I awareness training is available at <https://jko.jten.mil/> (website subject to change).

3. Physical security and access control requirements:

All contract personnel requiring physical access to a federal installation or facility shall comply with the access control procedures of that location. Contract personnel requiring unescorted access to meet contract performance requirements on a DoD installation in the US shall be vetted by the installation/facility Provost Marshal/Directorate of Emergency Services/Security Office using the National Crime Information Center-Interstate Identification Index (commonly referred to as "NCIC-III") and Terrorist Screening Database (commonly referred to as "TSDB"). Contract personnel shall comply with all personal identity verification requirements specified in installation/facility policies and procedures. Contract personnel who do not meet requirements for unescorted access to USACE facilities shall coordinate escorted access with the Government representative, as needed. Contract personnel who receive keys, access cards, or lock combinations that provide access to government-owned property shall comply with key and lock control procedures of the RA.

3.1 Submit a complete, updated and signed, list of all Contractor and subcontractor personnel, including their titles and intended working hours, who will be working on site prior to start of work. This listing shall be revised and resubmitted when personnel changes occur. (SUBMITTAL FIO)

3.2 Personnel Requiring Access to Controlled Areas

Personnel requiring unescorted access to controlled areas or personnel requiring escorted access more than 10 hours within a 5 day period are required to pass a Government background check. These individuals will be identified at the pre-construction meeting. They will be required to complete the following forms: OF306, FD258, and SF85. They will also be required to take the training listed in Paragraph 3.5 of this section. All other employees will have background checks done in compliance with paragraph 3.3

3.3 Personnel Risk Assessment

A minimum of seven days prior to engaging in work submit, to the CO or Project POC, a Personnel Risk Assessment (PRA) for each employee requiring authorized unescorted access to the Jobsite. The Contractor employee will only be allowed authorized unescorted physical access after the PRA is submitted to and approved by the Government. Upon approved authorization by the Government, a Project Specific ID Badge will be prescribed per subparagraph entitled Identification of Employees. Immediately return all Government-prescribed identification badges to the Project Administration Office for cancellation upon the release of the employee, end of construction completion, or termination of the Contract.

3.4 Authorized Unescorted Access Requirements

Perform a PRA on all Contractor personnel that require authorized unescorted access to the Jobsite. Costs associated with the execution of the PRA shall be at the expense of the Contractor. The content of the PRA is defined by the requirements as follows:

- a. Criminal Check - Obtain a criminal background check, completed within the last seven years, on all Contractor personnel that require authorized unescorted access to the Jobsite. A minimum of a 7-year criminal background check with the state patrol office shall be performed from all states of residence and employment, for the past seven years. The Project Security Officer through the Contacting Officer will approve, disapprove, or revoke authorized unescorted access to the Jobsite as a result of the seven-year background check.
 - b. Identity Verification - Contractor employees shall provide positive verification of individual identity prior to authorized unescorted access to the Jobsite. Acceptable forms of identity verification are documents issued by a federal Government agency that include: the individual's photograph, name, and date of birth, such as a passport or military identification (ID) card. Additionally, a state issued driver's license or ID card is acceptable for identity verification.
 - c. The Criminal Check and Identity Verification shall be updated at least every seven years for each employee requiring authorized unescorted access to the Jobsite.
 - d. Escort Requirements - Contractor personnel not cleared for authorized access to the Jobsite may be escorted by Government or Contractor personnel that have authorized unescorted access to the Jobsite. All costs related to the escorting of non-cleared personnel shall be at the expense of the Contractor. Additional burden shall not be placed upon the Government to provide these escorts. Prior to access, coordination with the Project Security Officer is required, including but not limited to:
 - (1) Verification of identity with photo identification
 - (2) Name of escorting individual and verification of unescorted status
 - (3) Time of entry into the Jobsite
 - (4) Time exiting the Jobsite.
- 3.5 NERC Training: Submit and maintain an annual North American Electric Reliability Corporation (NERC) Mandated Cyber Infrastructure Protection Training Program. When the Contract requires the Contractor employee to have authorized unescorted access to the Control Room/Computer Room, the USACE NERC Mandated Cyber Infrastructure Protection Training shall be completed by the employee prior to authorized unescorted physical or authorized cyber access to the Control Room/Computer Room. The COR will furnish the training curriculum, materials, and supplies. Costs associated with the execution of this training shall be at the expense of the Contractor. A minimum of seven days prior to engaging in work, submit a complete, signed and dated, listing of all personnel who have successfully completed the USACE NERC Mandated Cyber Infrastructure Protection Training. Submit a revised listing within seven calendar days of any personnel changes.

4. Not Used

5. Not Used

6. Suspicious Activity Reporting training (e.g. iWATCH, CorpsWatch, or See Something, Say Something):

All contract personnel shall receive initial and annual refresher training from the RA representative on the local suspicious activity reporting program. This locally developed training provides contract personnel with general information on suspicious behavior, and guidance on reporting suspicious activity to the project manager, security representative or law enforcement entity.

This training shall be completed within 10 days prior to mobilization and within 30 calendar days of new employees commencing performance with the results reported to the COR. (submittal: iWATCH and/or CorpsWatch Training

Sign In Sheets).

http://www.myarmyonesource.com/cmsresources/Army%20OneSource/Media/Videos/Family%20Programs%20and%20Services/iWatch_Program/iWATCH%2060_4streaming.wmv

7. Not Used

8. Not Used

9. Training requirements for the protection of sensitive information:

All contract personnel with access to critical information (as identified in the RA's OPSEC Program) shall complete initial and annual refresher OPSEC Level I Awareness training, which is available at the following websites: <https://www.iad.gov/ioss/>, or <http://www.cdse.edu/catalog/operations-security.html> (websites subject to change). All contract personnel with access to Controlled Unclassified Information (CUI) shall complete initial and annual refresher CUI training in accordance with applicable Army policy.

10. Not Used

11. Not Used

12. Not Used

13. Not Used

14. Pre-screen candidates using E-Verify Program: Contractors shall comply with the requirements set forth in FAR clause 52.222-54 Employment Eligibility Verification and FAR Subpart 22.18 in using the E-Verify Program at (<https://www.e-verify.gov/>) (website subject to change) to meet the contract employment eligibility requirements. Contractors are encouraged to cooperate with Federal and State agencies responsible for enforcing labor requirements to include eligibility for employment under United States immigration laws in accordance with FAR 22.102-1(i). An initial list of verified/eligible candidates shall be provided 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, and submit it to the Contracting Officer to become part of the official contract file.

15. Not Used

16. Not Used

1.7 CONTRACT DRAWINGS AND SPECIFICATIONS

1.7.1 SETS FURNISHED

Utilize the bid drawings and specifications as amended in the performance of the work until the electronic Adobe Acrobat.pdf conformed specifications and contract drawings (i.e., bid drawings that have been posted with all amendment changes) are sent electronically to the Contractor. The work must conform to the contract drawings, set out in the drawing index, all of which form a part of these specifications. The work must also conform to any of the standard details bound or referenced herein. The Contractor shall be responsible for making copies of all plans and specifications as needed for the duration of the contract.

1.7.2 DISTRIBUTION

The Government will provide the Contractor with a CD-ROM or DVD-ROM or sent electronically containing Adobe Acrobat.pdf contract drawings and conformed specification sets and editable CAD file drawings (format defined in Section 01 78 39.00 24 AS-BUILT DRAWINGS. Prepare final record or as-built drawings as defined in Section 01 78 39.00 24 AS-BUILT DRAWINGS.

1.7.3 NOTIFICATION OF DISCREPANCIES

Check all electronically sent drawing files furnished by the government immediately upon their receipt and promptly notify the Contracting Officer of any discrepancies. Follow dimensions marked on drawings in lieu of scale measurements. Enlarged plans and details govern where the same work is shown at smaller scales. All scales shown are based on a standard drawing size of 22" x 34". If any other size drawings are furnished or plotted adjust the scales accordingly. The Contractor must also advise his sub-contractors of the above. The Contractor must compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

1.7.4 OMISSIONS

Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, does not relieve the Contractor from performing such omitted or misdescribed details of the work but work must be performed as if fully and correctly set forth and described in the drawings and specifications.

1.8 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 items below in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

AT Level I Training Sign In Sheets;

Sign In Sheets for all employee training required for AT Level I Training, see OPSEC paragraphs, subparagraph 2

Security Personnel List; G-PO

Security Personnel list as described in Access and General Protection/Security Policy and Procedures see OPSEC paragraphs, subparagraph 3.1.

Personnel Risk Assessment; G-PO

Provide Personnel Risk Assessment for each employee requiring authorized unescorted access to the Jobsite. See OPSEC paragraphs, subparagraph 3.2

iWATCH and/or CorpsWatch Training Sign In Sheets;

Sign In Sheets for all employee training required for iWATCH and/or CorpsWatch Training, see OPSEC paragraphs, subparagraph 6

OPSEC Training Sign In Sheets;

Sign In Sheets for all employee training required for OPSEC Training, see OPSEC paragraphs, subparagraph 9

E-Verify;

Provide E-Verify completion sheets required for OPSEC, see OPSEC paragraphs, subparagraph 14

1.9 PAYMENT

1.9.1 PROMPT PAYMENT ACT

Pay requests authorized in GENERAL CONDITIONS (CONTRACT CLAUSES) clause: "Payments Under Fixed-Price Construction Contracts", will be paid pursuant to the clause, "Prompt Payment for Construction Contracts". Submit pay requests on ENG Form 93 and 93a, "Payment Estimate-Contract Performance" and "Continuation". All information and substantiation required by the identified contract clauses must be submitted with the ENG Form 93, and the required certification included on the last page of the ENG Form 93a, signed by an authorized contractor official and dated when signed. The designated billing office is the Office of the Area Engineer.

1.9.2 PAYMENT FOR MATERIALS DELIVERED OFFSITE

a. Pursuant to Federal Acquisition Regulation (FAR) 52.232-5, Payments Under Fixed Price Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments, if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site are limited to:

(1) Materials required by the technical provisions; or

(2) Materials that have been fabricated to the point where they are identifiable to an item of work required under this contract; or

(3) Items specifically listed below in paragraph b.

b. Payment for materials delivered off-site must be made only after receipt of paid invoices listing the value of material and labor incorporated in the items along with a canceled check showing the prime contractor's title to the items delivered off site. Payment for materials delivered off-site must be limited to the following items: None .

1.10 AVAILABILITY AND USE OF UTILITY SERVICES

a. The Government will make available, from existing outlets and supplies, all reasonably required amounts of water, compressed air and electricity (120v, 240v, 480v) required in the performance of the work without charge to the Contractor.

b. Carefully conserve utilities furnished without charge. The

Contractor, at his own expense and in a workmanlike manner satisfactory to the Contracting Officer, must install and maintain all necessary temporary connections and distribution, and remove the same prior to final acceptance of the construction.

1.11 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

a. This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the GENERAL CONDITIONS (CONTRACT CLAUSES) clause entitled "Default: (Fixed-Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) 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.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

b. 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 WORK DAYS BASED ON (5) DAY WORK WEEK

| | |
|-----|----|
| Jan | 17 |
| Feb | 15 |
| Mar | 8 |
| Apr | 4 |
| May | 6 |
| Jun | 5 |
| Jul | 3 |
| Aug | 4 |
| Sep | 2 |
| Oct | 3 |
| Nov | 7 |
| Dec | 17 |

c. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the contractor will record on the RMS daily CQC report, any occurrence of adverse weather and resultant impact to normally scheduled work, within 24 hours of the event. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day. Describe in the RMS daily CQC reports the critical path item that is being affected and provide the critical path activity number(s) from the current schedule. The COR must acknowledge and accept the agreed upon occurrence of each adverse weather delay in RMS for the delays to be considered as adverse weather delays.

At the end of each month, identify the number of actual adverse weather

delay days that includes days impacted by actual adverse weather (even if adverse weather occurred in previous month), calculated chronologically from the first to the last day of each month, and recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph b. above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the GENERAL CONDITIONS (CONTRACT CLAUSES) clause entitled "Default (Fixed Price Construction)". (ER 415-1-15)

1.12 INSURANCE REQUIRED

In accordance with GENERAL CONDITIONS (CONTRACT CLAUSES) clause: "Insurance Work on a Government Installation," procure the following minimum insurance:

| Type | Amount |
|---|--|
| Workmen's Compensation and Employer's Liability Insurance | \$100,000 |
| General Liability Insurance | \$500,000 per occurrence |
| Automobile Liability Insurance | |
| Bodily injury | \$200,000 per person and \$500,000 per occurrence |
| Property damage | \$ 20,000 per occurrence |

(Coverages per FAR 28.307-2)

1.13 CONTRACTOR PERSONNEL

1.13.1 PROJECT MANAGER

The Contractor shall employ a Project Manager for this contract who meets the qualifications outlined in Section 00 22 00, paragraph 12, Personnel Qualifications and Experience. In the event that the Project Manager identified in the Contractor's proposal is unavailable for this project, replacement personnel with similar skills and experience shall be presented for acceptance and written approval by the Contracting Officer not less than 30 days prior to the start of work. The Project Manager shall be the Contractor's Agent and have full authority to negotiate and sign all contract modifications. The Contractor shall employ a competent agent or fully authorized alternate to receive such orders as may be given for the proper continuance of the work. Written notice to do any work, to alter any work, or to cease work which the Contractor is obligated to do or concerning any imperfections in work, or any material furnished, when given to the agent in charge of the work shall be considered as notice to the Contractor. The Project Manager shall be fluent in the spoken and written English language. The Project Manager Agent shall not perform Project Superintendent, Site Safety and Health Officer, or CQC System Manager duties.

1.13.2 PROJECT SUPERINTENDENT

The Contractor shall employ a Project Superintendent for this contract who meets the qualifications outlined in Section 00 22 00, paragraph 12,

Personnel Qualifications and Experience. In the event that the Project Superintendent identified in the Contractor's proposal is unavailable for this project, replacement personnel with similar skills and experience shall be presented for acceptance and written approval by the Contracting Officer not less than 30 days prior to the start of work. At least one (1) full-time employee of the Contractor shall be available at the worksite to supervise and direct all work any time other Contractor or subcontractor personnel are on site. The Project Superintendent shall be present at the site at all times during work and shall be responsible for providing complete and correct direction of all construction activities, the initial starting, and all subsequent operation of the equipment until tests are completed. The Project Superintendent shall be responsible for following the project's Safe Clearance Procedure. The Project Superintendent shall initiate instructions for all actions necessary for the proper inspection, handling, assembly, and testing of the equipment. The Project Superintendent shall keep a daily record of all work accomplished and all measurements taken during construction activities and shall provide copies on request or on completion of installation of the equipment associated with one generating unit. The Project Superintendent shall keep all as-built drawings current and provide copies upon completion of the work as directed in Section 01 78 39.00 24. The Project Superintendent shall report immediately in writing to the Contracting Officer any work not in accordance with the manufacturer's recommendation or any special conditions which may result in completion of work not meeting the requirements of the contract. The Superintendent shall be fluent in the spoken and written English language. The Project Superintendent shall not perform Project Manager, Site Safety and Health Officer, or CQC System Manager duties.

1.13.3 CONTRACTOR QUALITY CONTROL (CQC)

See Section 01 45 00.00 10 QUALITY CONTROL.

1.14 NONDOMESTIC CONSTRUCTION MATERIALS

The list of excepted nondomestic construction materials or their components referenced in the Buy American Construction Material Contract Clauses includes the list set forth in paragraph 25.104 of the Federal Acquisition Regulation.

1.15 DAILY WORK SCHEDULES AND WEEKLY COORDINATION MEETINGS

In order to closely coordinate work under this contract, prepare a written agenda/meeting minutes and attend a weekly coordination meeting with the Contracting Officer and Using Service at which time the Contractor must submit for coordination and approval, their proposed daily work schedule for the next two week period. Provide a copy of modifications (MODs), Serial Letters, Requests for Information (RFIs) and any other information that is needed in the minutes of the meeting. Include required temporary utility services, time and duration of interruptions, and protection of adjoining areas with the Contractor's proposed 2-week work schedule. At this meeting, the Contractor must also submit their schedule of proposed dates and times of all preparatory inspections to be performed during the next 2 weeks. All schedules shall be in developed in accordance with Section 01 32 01.00 10 PROJECT SCHEDULE Coordination action by the Contracting Officer relative to these schedules will be accomplished during these weekly meetings. Daily reports must be completed and given to the Contracting Officer or Representative within 24 hours of work. All official correspondence such as serial letters and

RFIs, with attachments are to be provided in one hardcopy original with original signatures and one electronic (Adobe pdf format) copy by email. The Government will consider the correspondence to be received when the official hardcopy or electronic copy is received by the designated office.

1.16 AS-BUILT DRAWINGS

See SECTION 01 78 39.00 24 - AS-BUILT DRAWINGS.

1.17 ASBESTOS AND LEAD

a. The Contractor is warned that inhalation of asbestos and lead has been associated with health hazards.

b. Asbestos-containing materials have been identified in area(s) where contract work is to be performed. All contract work activities where the potential exists for worker exposure to airborne asbestos fibers shall be performed in accordance with the requirements set forth in Section 02 82 00 ASBESTOS REMEDIATION.

c. Lead has been determined to be present in some painted surfaces which are scheduled for removal/renovation. See Section 02 83 00 LEAD REMEDIATION for locations and proper procedures.

1.18 PROFIT

a. Use the weighted guidelines method of determining profit on any equitable adjustment change order or modification issued under this contract. The profit factors must be as follows:

| Factor | Rate | Weight | Value |
|-----------------------------|------|----------|-------|
| Degree of Risk | 20 | See Item | |
| Relative difficulty of work | 15 | b. below | |
| Size of Job | 15 | | |
| Period of performance | 15 | | |
| Contractor's investment | 5 | | |
| Assistance by Government | 5 | | |
| Subcontracting | 25 | | |
| | 100 | | |

b. Based on the circumstances of each procurement action, each of the above factors must be weighted from .03 to .12 as indicated below. Obtain the value by multiplying the rate by the weight. The value column when totaled indicates the fair and reasonable profit percentage under the circumstances of the particular procurement.

(1) Degree of Risk. Where the work involves no risk or the degree of risk is very small, the weighting should be .03; as the degree of risk increases, the weighting should be increased up to a maximum of .12. Lump sum items will have, generally, a higher weighted value than the unit price items for which quantities are provided. Other things to consider: the portion of the work to be done by subcontractors, nature of work, where work is to be performed, reasonableness of negotiated costs, amount of labor included in costs, and whether the negotiation is before or after performance of work.

(2) Relative Difficulty of Work. If the work is most difficult and complex, the weighting should be .12 and should be proportionately

reduced to .03 on the simplest of jobs. This factor is tied in to some extent with the degree of risk. Some things to consider: the nature of the work, by whom it is to be done, where, and what is the time schedule.

(3) Size of Job. All work not in excess of \$100,000 shall be weighted at .12. Work estimated between \$100,000 and \$5,000,000 shall be proportionately weighted from .12 to .05.

(4) Periods of Performance. Jobs in excess of 24 months are to be weighted at .12. Jobs of lesser duration are to be proportionately weighted to a minimum of .03 for jobs not to exceed 30 days. No weight where additional time not required.

(5) Contractor's Investment. To be weighted from .03 to .12 on the basis of below average, average, and above average. Things to consider: amount of subcontracting, mobilization payment item, Government furnished property, equipment and facilities, and expediting assistance.

(6) Assistance by Government. To be weighted from .12 to .03 on the basis of average to above average. Things to consider: use of Government-owned property, equipment and facilities, and expediting assistance.

(7) Subcontracting. To be weighted inversely proportional to the amount of subcontracting. Where 80 percent or more of the work is to be subcontracted, the weighting is to be .03 and such weighting proportionately increased to .12 where all the work is performed by the Contractor's own forces.

1.19 LABOR CONDITIONS APPLICABLE TO TEMPORARY FACILITIES

It is the position of the Department of Defense that the Davis-Bacon Act, 40 U.S.C. 276a is applicable to temporary facilities such as job headquarters, tool yards, batch plants, borrow pits, sandpits, rock quarries, and similar operations, provided they are dedicated exclusively, or nearly so, to performance of the contract or project, and provided they are adjacent or virtually adjacent to the site of the work and are established after receipt of the proposal or bid. Clause "Payrolls and Basic Records" of the GENERAL CONDITIONS (CONTRACT CLAUSES) is applicable to such operations.

1.20 DRAWING SCALES

All scales shown are based on a standard drawing size of 22" x 34". If any other size drawings are furnished or plotted, the contractor adjust the scales accordingly. The Contractor must also advise their sub-contractors of the above.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

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PROJECT SCHEDULE

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.

AACE INTERNATIONAL (AACE)

| | |
|-------------|---|
| AACE 29R-03 | (2011) Forensic Schedule Analysis |
| AACE 52R-06 | (2006) Time Impact Analysis - As Applied in Construction |

U.S. ARMY CORPS OF ENGINEERS (USACE)

| | |
|-----------|---|
| ER 1-1-11 | (1995) Administration -- Progress, Schedules, and Network Analysis Systems |
|-----------|---|

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G, AO

Preliminary Project Schedule; G, AO

Initial Project Schedule; G, AO

Periodic Schedule Update; G, AO

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating and production of reports. The authorized representative must have a minimum of 2-years experience scheduling construction projects similar in size and nature to this project with scheduling software that meets the requirements of this specification. Representative must have a comprehensive knowledge of CPM scheduling principles and application.

PART 2 PRODUCTS

2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this specification.

2.1.1 Government Default Software

The Government default software is Primavera P6.

2.1.2 Contractor Software

Scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdef file must be created and supported by the software manufacturer.

2.1.2.1 Primavera

If Primavera P6 is selected for use, provide the "xer" export file in a version of P6 importable by the Government system.

2.1.2.2 Other Than Primavera

Use of software other than Primavera P6 must be approved by the Contracting Officer. If a different software system is approved, the Contracting Officer may require the Contractor to provide for the Government's use up to two licenses, two computers, and training for two Government employees in the use of the software. These computers will be stand-alone and not connected to Government network. Computers and licenses will be returned at project completion.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15 Schedules for Construction Contracts. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. Subcontractors and suppliers working on the project must also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN must equal the value of the CLIN.

3.2.1 Activity Cost Loading

Activity cost loading must be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

3.2.2 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the project schedule have been made.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities may have Original Durations (OD) greater than 20 work days or 30 calendar days.

3.3.3 Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

3.3.4 Mandatory Tasks

Include the following activities/tasks in the initial project schedule and all updates.

- a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).
- b. Submission, review and acceptance of features require design completion
- c. Submission of mechanical/electrical/information systems layout drawings.
- d. Long procurement activities

- e. Submission and approval of O & M manuals.
- f. Submission and approval of as-built drawings.
- g. Submission and approval of DD1354 data and installed equipment lists.
- h. Submission and approval of testing and air balance (TAB).
- i. Submission of TAB specialist design review report.
- j. Submission and approval of fire protection specialist.
- k. Submission and approval of Building Commissioning Plan, test data, and reports: Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the contract commissioning requirements. All tasks associated with all building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.
- l. Air and water balancing.
- m. Building commissioning - Functional Performance Testing.
- n. Controls testing plan submission.
- o. Controls testing.
- p. Performance Verification testing.
- q. Other systems testing, if required.
- r. Contractor's pre-final inspection.
- s. Correction of punch list from Contractor's pre-final inspection.
- t. Government's pre-final inspection.
- u. Correction of punch list from Government's pre-final inspection.
- v. Final inspection.

3.3.5 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: approvals, environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.6 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11. This exact structure is mandatory. Develop and assign all Activity Codes to activities as detailed herein. A template SDEF compatible schedule backup file is available on the web site: <http://rms.usace.army.mil>.

The SDEF format is as follows:

| Field | Activity Code | Length | Description |
|--|---------------|--------|---------------------|
| 1 | WRKP | 3 | Workers per day |
| 2 | RESP | 4 | Responsible party |
| 3 | AREA | 4 | Area of work |
| 4 | MODF | 6 | Modification Number |
| 5 | BIDI | 6 | Bid Item (CLIN) |
| 6 | PHAS | 2 | Phase of work |
| 7 | CATW | 1 | Category of work |
| 8 | FOW | 20 | Feature of work* |
| *Some systems require that FEATURE OF WORK values be placed in several activity code fields. The notation shown is for Primavera P6. Refer to the specific software guidelines with respect to the FEATURE OF WORK field requirements. | | | |

3.3.6.1 Workers Per Day (WRKP)

Assign Workers per Day for all field construction or direct work activities, unless directed otherwise by the Contracting Officer. Workers per day is based on the average number of workers expected each day to perform a task for the duration of that activity.

3.3.6.2 Responsible Party Coding (RESP)

Assign responsibility code for all activities to the Prime Contractor, Subcontractor(s) or Government agency(ies) responsible for performing the activity.

- a. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Property/Equipment (GFP) and Notice to Proceed (NTP) for phasing requirements.
- b. Activities cannot have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE).

3.3.6.3 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or

craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

Not all activities are required to be Work Area coded. A lack of Work Area coding indicates the activity is not resource or space constrained.

3.3.6.4 Modification Number (MODF)

Assign a Modification Number Code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer. Key all Code values to the Government's modification numbering system. An activity can have only one Modification Number Code.

3.3.6.5 Bid Item Coding (BIDI)

Assign a Bid Item Code to all activities using the Contract Line Item Schedule (CLIN) to which the activity belongs, even when an activity is not cost loaded. An activity can have only one BIDI Code.

3.3.6.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are procurement phase and construction phase. Each activity can have only one Phase of Work code.

- a. Code proposed fast track design and construction phases proposed to allow filtering and organizing the schedule by fast track design and construction packages.
- b. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

3.3.6.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to construction submittal, procurement, fabrication, weather sensitive installation, non-weather sensitive installation, start-up, and testing activities. Each activity can have no more than one Category of Work Code.

3.3.6.8 Feature of Work Coding (FOW)

Assign a Feature of Work Code to appropriate activities based on the Definable Feature of Work to which the activity belongs based on the approved QC plan.

Definable Feature of Work is defined in Section 01 45 00.00 10 QUALITY CONTROL. An activity can have only one Feature of Work Code.

3.3.7 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float

constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or effect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case by case basis.

3.3.7.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

3.3.7.2 End Project Finish Milestone and Constraint

The last activity in the schedule must be a finish milestone titled "End Project."

Constrain the project schedule to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path. The Government is under no obligation to accelerate Government activities to support a Contractor's early completion.

3.3.7.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

3.3.7.3.1 Start Phase

Use a start milestone as the first activity for a project phase. Call the start milestone "Start Phase X" where "X" refers to the phase of work.

3.3.7.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

3.3.8 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop sSeasonal Calendar(s) and assign to seasonally affected activities as applicable.

If an activity is weather sensitive it should be assigned to a calendar showing non-work days on a monthly basis, with the non-work days selected at random across the weeks of the calendar, using the anticipated adverse weather delay work days provided in the Special Contract Clauses . Assign non-work days over a seven-day week as weather records are compiled on seven-day weeks, which may cause some of the weather related non-work days

to fall on weekends.

3.3.9 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP Acknowledged" may have no predecessor logic, and the last activity -"End Project" may have no successor logic.

Predecessor open ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

3.3.10 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process must match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF dates in the Daily Quality Control report will result in disapproval of the Contractor's schedule.

3.3.11 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address out of sequence progress or logic changes in the Narrative Report and in the periodic schedule update meetings.

3.3.12 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

3.3.13 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approved by the Contracting Officer.

3.3.14 Leads, Lags, and Start to Finish Relationships

Lags must be reasonable as determined by the Government and not used in place of realistic original durations, must not be in place to artificially absorb float, or to replace proper schedule logic.

- a. Leads (negative lags) are prohibited.
- b. Start to Finish (SF) relationships are prohibited.

3.3.15 Retained Logic

Schedule calculations must retain the logic between predecessors and

successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequence progress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

3.3.16 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management.

3.3.17 Remaining Duration

Update the remaining duration for each activity based on the number of estimated work days it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete.

3.3.18 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 1 percent of the present contract value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

3.3.18.1 As-Built Drawings

If there is no separate contract line item (CLIN) for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than \$35,000 or 1 percent of the present contract value, whichever is greater, up to \$200,000. Activity will be declared 100 percent complete upon the Government's approval.

3.3.18.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than \$20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

3.3.19 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

- a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and manhours) and the Government agreeing that the schedule is reasonable and achievable.
- b. The Government is under no obligation to accelerate work items it is responsible for to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The files, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, then the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged submit the Preliminary Project Schedule defining the planned operations detailed for the first 90 calendar days for approval. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of all early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design package(s) and all other specified Program and Plan approvals must occur prior to any planned construction activities. Activity code any activities that are summary in nature after the first 90 calendar days with Bid Item (CLIN) code (BIDI), Responsibility Code (RESP) and Feature of Work code (FOW).

3.4.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. No payment will be made for work items not fully detailed in the Project Schedule.

3.4.3 Periodic Schedule Updates

Update the Project Schedule routinely at an interval approved by the Contracting Officer or designated representative. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in the paragraph PERIODIC SCHEDULE UPDATE MEETINGS. These updates will enable the Government to assess Contractor's progress.

- a. Update information including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete is subject to the approval of the Government at the meeting.
- b. AS and AF dates must match the date(s) reported on the Contractor's Quality Control Report for an activity start or finish.

3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

3.5.1 Submission

Submit the current project schedule, the narrative report and all required schedule reports electronically using the project submittal/transmittal process or by serialized letter. Each schedule must have a unique file name and use project specific settings.

3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for any problems, either current or potential, which are revealed through that analysis. Include the following information as minimum in the Narrative Report:

- a. Identify and discuss the work scheduled to start in the next update period.
- b. A description of activities along the two most critical paths where the total float is less than or equal to 20 work days.
- c. A description of current and anticipated problem areas or delaying factors and their impact and an explanation of corrective actions taken or required to be taken.
- d. Identify and explain why activities based on their calculated late dates should have either started or finished during the update period but did not.
- e. Identify and discuss all schedule changes by activity ID and activity name including what specifically was changed and why the change was needed. Include at a minimum new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.
- f. Identify and discuss out-of-sequence work.

3.5.3 Schedule Reports

The format, filtering, organizing and sorting for each schedule report will be as directed by the Contracting Officer or designated representative. Typically, reports contain Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. The following reports are required for schedule submission reviews unless directed otherwise by the Contracting Officer.

3.5.3.1 Activity Report

List of all activities sorted according to activity number.

3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

3.5.3.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date, which reflects the earnings of activities based on the agreements made in the schedule update meeting defined herein. Provided a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. Provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report must contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

3.5.3.5 Schedule Log

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

3.5.3.6 Critical Path

Provide an Adobe .pdf report showing the critical path.

3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

3.5.4.4 Banding

Organize activities using the WBS or as otherwise directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

3.5.4.5 Cash Flow / Schedule Variance Control (SVC) Diagram

With each schedule submission, provide a SVC diagram showing 1) Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates, and 2) Earned Value to-date.

3.6 PERIODIC SCHEDULE UPDATE

3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings for the purpose of reviewing the proposed percent complete, Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly and within five days of the proposed schedule data date. The Contractor may be requested to provide a computer with the scheduling software loaded and a projector which allows all meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real time and interactive basis. The meeting will last no longer than 8 hours. The Contractor's Project Manager and scheduler must attend the meeting with the authorized representative of the Contracting Officer.

Superintendents, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work. Following the periodic schedule update meeting, make updates to the draft submission. Include only those items approved by the Government in the submission. Upon Government approval of the schedule submission, submit an invoice for payment.

3.6.2 Update Submission Following Progress Meeting

Submit the complete Periodic Schedule Update of the Project Schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 work days after the periodic schedule update meeting.

3.7 WEEKLY PROGRESS MEETINGS

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph entitled PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address the status of RFIs, RFPs and Submittals.

3.8 REQUESTS FOR TIME EXTENSIONS

Provide a justification of delay to the Contracting Officer in accordance

with the contract provisions and clauses for approval within 10 days of a delay occurring. Also prepare a time impact analysis for each Government request for proposal (RFP)/ All time impact analysis must be resource loaded and to the same level of detail as the schedule.

3.8.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact to the work. As part of the description, identify all schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date or interim completion date(s). Evaluate multiple impacts chronologically; each with its own justification of delay. With multiple impacts consider any concurrency of delay. A time extension and the schedule fragnet becomes part of the project schedule and all future schedule updates upon approval by the Contracting Officer.

3.8.2 Time Impact Analysis (Prospective Analysis)

Prepare a time impact analysis for approval by the Contracting Officer based on industry standard AACE 52R-06. Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If Contracting Officer determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes may be incorporated into the schedule being used to justify the time impact.

3.8.3 Forensic Schedule Analysis (Retrospective Analysis)

Prepare an analysis for approval by the Contracting Officer based on industry standard AACE 29R-03.

3.8.4 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis consisting of a sequence of new activities that are proposed to be added to the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet is to be tied into the project schedule including all predecessors and successors to the fragnet activities. The proposed fragnet must be approved by the Contracting Officer prior to incorporation into the project schedule.

3.8.5 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

3.8.6 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. The Contractor must show that an early completion was achievable had it not been for the impact.

3.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

3.9.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

3.9.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

3.9.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

3.10 OWNERSHIP OF FLOAT

Except for the provision given in the paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule, at any time, may not be considered for the exclusive use of either the Government or the Contractor including activity and/or project float. Activity float is the number of work days that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the contract completion date milestone.

3.11 TRANSFER OF SCHEDULE DATA INTO RMS

Once the schedule is approved by the Government via submittal or serialized letter, upload the schedule data (SDEF) into the Resident

Management System - Contractor Module (RMS CM) unless directed otherwise by the Contracting Officer. The contractor will then create the invoice and complete the Prompt Payment certificate and submit to the Government. After this is complete, create the invoice, complete the Prompt Payment certificate and submit to the Government. This data is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 Payments under Fixed-Price Construction Contracts and FAR 52.232-27 Prompt Payment for Construction Contracts.

3.12 PRIMAVERA P6 MANDATORY REQUIREMENTS

The following settings are mandatory and required in all schedule submissions to the Government, if Primavera P6 is used:

- a. Activity Codes must be Project Level, not Global or EPS level.
- b. Calendars must be Project Level, not Global or Resource level.
- c. Activity Duration Types must be set to "Fixed Duration & Units".
- d. Percent Complete Types must be set to "Physical".
- e. Time Period Admin Preferences must remain the default "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days.
- f. Set Schedule Option for defining Critical Activities to "Longest Path".
- g. Set Schedule Option for defining progressed activities to "Retained Logic".
- h. Set up cost loading using a single lump sum labor resource. The Price/Unit must be \$1/hr, Default Units/Time must be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" selected.
- i. Activity ID's must not exceed 10 characters.
- j. Activity Names must have the most defining and detailed description within the first 30 characters.

-- End of Section --

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

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

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Contractor's Quality Control (CQC) System Manager and the Designer of Record, if applicable, 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; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval are to be scheduled and made prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

A submittal register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register".

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to start of construction (work). issuance of contract notice to proceed.or commencing work on site.or the start of the next major phase of the construction on a multi-phase contract, includes schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates of insurance

Surety bonds

List of proposed Subcontractors

List of proposed products

Construction progress schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices or Earned Value Report

Health and safety plan

Work plan

Quality Control(QC) 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 by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into

the project and those which 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.

Design submittals, design substantiation submittals and extensions of design submittals.

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

Report which 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 (MSDS) 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 that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be 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. For example, Record Drawings and as-built drawings. Also, 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 submittal.

1.2.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, except those SD-01 Pre-Construction Submittals noted above, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor QC approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register[; G[, [____]]]

1.4 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.4.1 Designer of Record Approved (DA)

Designer of Record (DOR) approval is required for extensions of design, critical materials, any deviations from the solicitation, the accepted proposal, or the completed design, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." Contractor to provide the Government with the number of copies designated hereinafter of all DOR approved submittals. The Government may review any or all Designer of Record approved submittals for conformance to the Solicitation, Accepted Proposal and the completed design. The Government will review all submittals designated as deviating from the Solicitation or Accepted Proposal, as described below. Design submittals to be in accordance with Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD). Generally, design submittals should be identified as SD-05 Design Data submittals.

1.4.2 Government Approved (G)

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Government approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings."

1.4.3 Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) covers the design submittal and review process in detail. Review will be only for conformance with the applicable codes, standards and contract requirements. Design data includes the design documents described in Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD). Generally, design submittals should be identified as SD-05 Design Data submittals.

1.4.4 Designer of Record Approved/Government Conformance Review (DA/CR)

1.4.4.1 Deviations to the Accepted Design

Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the

right to review the submittal before providing an opinion, if deemed necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

1.4.4.2 Substitutions

Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted contract proposal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information and the DOR's approval, as meeting the contract requirements and that it is equal in function, performance, quality and salient features to that in the accepted contract proposal. If the Contract otherwise prohibits substitutions of equal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, the request is considered a "variation" to the contract. Variations are discussed below in paragraphs: "Designer of Record Approved/Government Approved" and "VARIATIONS."

1.4.5 Designer of Record Approved/Government Approved (DA/GA)

In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a contract modification are required before the Contractor is authorized to proceed with material acquisition or installation for any proposed variation to the contract (the solicitation and/or the accepted proposal), which constitutes a change to the contract terms. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." The Government reserves the right to accept or reject any such proposed deviation at its discretion.

1.4.6 For Information Only

Submittals not requiring Government approval will be for information only. For Design-build construction all submittals not requiring Designer of Record or Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4.7

Sustainability Reporting Submittals (S)

Submittals for Guiding Principle Validation (GPV) or Third Party Certification (TPC) are indicated with an "S" designation. Submit the information required by the technical sections that demonstrates compliance with the sustainable requirement, and for inclusion in the Sustainability Notebook as required by Section 01 33 29 SUSTAINABILITY REPORTING. A full submittal for an item may be provided under another SD; however, for the "S" submittal, only provide that portion of the submittal that demonstrates compliance with the sustainable requirement. If the sustainable submittal does require Government Approval, it may be tagged

under another SD with a "G."

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

1.5 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.5.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to the [Commander, NAVFAC [____], Code CI4[____], [____]] [Architect-Engineer: [____],] submittals required in the technical sections of this specification, including shop drawings, product data and samples. Forward one copy of the transmittal form for all submittals to the Resident Officer in Charge of Construction.

[The Architect-Engineer for this project] [NAVFAC [____]] will review and approve for the Contracting Officer those submittals reserved for Contracting Officer approval to verify submittals comply with the contract requirements.

1.5.1.1 O&M Data

[The Architect-Engineer for this project] [NAVFAC [____]] will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.5.1.2 Submittals Reserved for NAVFAC [____] Approval

As an exception to the standard submittal procedure specified above, submit the following to the Commander, NAVFAC [____], Code CI4[____], [____]:

- [a. Section [____] [____]: Pile driving records
-] [b. Section [____] [____]: All fire protection system submittals
-] [c. Section [____] [____]: All fire alarm system submittals
-] [d. Section 23 09 53.00 20 SPACE TEMPERATURE CONTROL SYSTEMS: SD-06 field test report submittals
-] [e. Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC: SD-06 field test report submittals
-] [f. Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC: All submittals
-] [g. Section 23 08 01.00 20 TESTING INDUSTRIAL VENTILATION SYSTEMS: All submittals
-] [h. Section 26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS: All

submittals

-] [i. Section 26 12 21 SINGLE-PHASE PAD-MOUNTED TRANSFORMERS: All submittals
-] [j. Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION: Transformer submittals
-] [k. Section 26 11 16 SECONDARY UNIT SUBSTATIONS: Transformer submittals
-] [l. Section 26 11 13.00 20 PRIMARY UNIT SUBSTATION: Transformer submittals
-] [1.5.1.3 Overseas Shop Drawing Submittals

Send all submittals via overnight express mail service. All costs associated with the overnight express mail service shall be borne by the construction Contractor. Costs associated with the overnight express mail of submittals related to proposed submittal variances of resubmittals necessary as a result of noncompliant or incomplete Contractor submittals are the responsibility of the Contractor.

] 1.6 PREPARATION

1.6.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to office of [approving authority]. Transmit submittals with transmittal form prescribed by Contracting [Officer] [Administrator] and standard for project. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph IDENTIFYING SUBMITTALS. Process transmittal forms to record actions regarding sample[s] [installations] [panels].

Use the attached sample transmittal form in Appendix B ENG Form 4025-R for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms [will be furnished to the Contractor][are included in the QCS 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.

1.6.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Date of the drawings and revisions.

- d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other subcontractor associated with the submittal.
- e. Section number of the specification section by which submittal is required.
- f. Submittal description (SD) number of each component of submittal.
- g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.
- h. Product identification and location in project.

1.6.3 Format for SD-02 Shop Drawings

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

Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

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. [Contractors may use their own number system.] Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than [_____] inches on the right hand side of each sheet for the Government disposition stamp.

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.

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

Submit drawings in PDF format.

1.6.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

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

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

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

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. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and 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.

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and 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 construction effort.

Submit manufacturer's instructions prior to installation.

1.6.5 Format of SD-04 Samples

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

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
- c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 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 of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 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: 4 by 4 feet.

h. Sample Installation: 100 square feet.

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.

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

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

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

1.6.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.6.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

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

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

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.6.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

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

1.6.10 Source Drawings for Shop Drawings

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

1.6.10.1 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 shall be 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 sub consultants 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. 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. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of 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 indicia of ownership (seals, logos, signatures, initials and dates).

1.6.11 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. [In addition to the electronic submittal, provide [three] [_____] hard copies of the submittals.] Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, coordinate the file naming convention with the Contracting Officer. 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 both 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 scan of a signature.

Email electronic submittal documents fewer than 10MB to an email address as directed by the Contracting Officer. Provide electronic documents over 10MB on an optical disc, or through an electronic file sharing system such as the AMRDEC SAFE Web Application located at the following website: <https://safe.amrdec.army.mil/safe/>.

Provide hard copies of submittals when requested by the Contracting Officer. Up to [_____] additional hard copies of any submittal may be

requested at the discretion of the Contracting Officer, at no additional cost to the Government.

1.7 QUANTITY OF SUBMITTALS

1.7.1 Number of Copies of SD-02 Shop Drawings

Submit [six][_____] copies of submittals of shop drawings requiring review and approval only by QC organization and [seven][_____] copies of shop drawings requiring review and approval by Contracting Officer.

1.7.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.7.3 Number of Samples SD-04 Samples

- a. Submit [two][_____] samples, or [two][_____] sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.
- b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of non-solid materials.

1.7.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.7.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.7.6 Number of Copies of SD-10 Operation and Maintenance Data

Submit [five][three][_____] copies of O&M Data to the Contracting Officer for review and approval.

1.7.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit [two][three] sets of administrative submittals.

1.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only

submittals. The Government reserves the right to 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. For design-build construction the Government will retain [_____] copies of information only submittals.

1.9 SUBMITTAL REGISTER AND DATABASE

Prepare and maintain submittal register, as the work progresses. Use electronic submittal register program furnished by the Government or any other format. 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.

The database and submittal management program will be furnished to Contractor on a Writable Compact Disk (CD-R), for operation on Windows based personal computer.

[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.
]

The Designer of Record develops a complete list of submittals during design and identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all inclusive and additional submittals may be required by other parts of the contract. Complete the submittal register and submit it to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. Coordinate the submit dates and need dates with dates in the Contractor prepared progress schedule. Submit monthly or until all submittals have been satisfactorily completed, updates to the submittal

register showing the Contractor action codes and actual dates with Government action codes. Revise the submittal register when the progress schedule is revised and submit both for approval.

1.9.1 Use of Submittal Register

Submit submittal register as an electronic database, using submittals management program furnished to Contractor. 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 database 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.

1.9.2 Contractor Use of Submittal Register

Update the following fields[in the Government-furnished submittal register program or equivalent fields in program utilized by Contractor] 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.

1.9.3 Approving Authority Use of Submittal Register

Update the following fields[in the Government-furnished submittal register program or equivalent fields in program utilized by Contractor].

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.

1.9.4 Action Codes

Entries for columns (j) and (o), are to be used are as follows (others may be prescribed by Transmittal Form):

1.9.4.1 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"

1.9.4.2 Contractor Action Codes

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.9.5 Copies Delivered to the Government

Deliver one copy of submittal register updated by Contractor to Government with each invoice request. Deliver in electronic format, unless a paper copy is requested by Contracting Officer.

1.10 VARIATIONS

Variations from contract requirements require both Designer of Record (DOR) and Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.10.1 Considering Variations

Discussion with Contracting Officer prior to submission, after consulting with the DOR, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which 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 deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.10.2 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.

1.10.3 Warranting that Variations are Compatible

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

1.10.4 Review Schedule Extension

In addition to normal submittal review period, a period of [10] [_____] working days will be allowed for consideration by the Government of submittals with variations.

1.11 SCHEDULING

Schedule and submit concurrently 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. An additional [_____] calendar days will be allowed and shown on the register for review and approval of submittals for [food service equipment] [and] [refrigeration and HVAC control systems].

- 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."
- e. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least [15] [_____] working days for submittals for QC Manager approval and [20] [_____]

working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from QC organization.

- f. For submittals requiring review by fire protection engineer, allow review period, beginning when Government receives submittal from QC organization, of [30][_____] working days for return of submittal to the Contractor.
- g. Period of review for each resubmittal is the same as for initial submittal.

[Within [30][15] calendar days of notice to proceed][At the Preconstruction conference], provide, for approval by the Contracting Officer, the following schedule of submittals:

- a. A schedule of shop drawings and technical submittals required by the specifications and drawings. Indicate the specification or drawing reference requiring the submittal; the material, item, or process for which the submittal is required; the "SD" number and identifying title of the submittal; the Contractor's anticipated submission date and the approval need date.
- b. A separate schedule of other submittals required under the contract but not listed in the specifications or drawings. Schedule will indicate the contract requirement reference; the type or title of the submittal; the Contractor's anticipated submission date and the approved need date (if approval is required).

1.11.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is QC Manager unless otherwise specified for specific submittal. At each "Submittal" paragraph in individual specification sections, a notation "G," following a submittal item, indicates Contracting Officer is approving authority for that submittal item. Use the "S" Classification only in SD-11 Closeout Submittals. An "S" following a submittal item, indicates that the QC Manager is the approving authority, and that a copy of the approved submittal must be provided to the Designer of Record.

1.11.2 Constraints

Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.11.3 QC Organization Responsibilities

- a. Note date on which submittal was received from Contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC organization's review of submittal.
 - (1) When QC Manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph APPROVED[/ACCEPTED] SUBMITTALS.
 - (2) When Contracting Officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.
- e. Ensure that material is clearly legible.
- f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.
 - (1) When approving authority is Contracting Officer, QC organization will certify submittals forwarded to Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number [____], is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC Manager _____, Date _____"
(Signature)

- (2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with contract Number [____], is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Approved by QC Manager _____, Date _____"
(Signature)

- g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.
- h. Update submittal register [database]as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.
- i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.
- j. For "S" submittals, provide a copy of the approved submittal to the Designer of Record.

1.11.4 Government Reviewed Design

The Government will review design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) covers the design submittal and review process in detail. Government review is required for deviation from the completed design. Review will be only for conformance with the contract requirements. Included are only those construction submittals for which the Designer of Record design documents do not include enough detail to ascertain contract compliance. The Government may, but is not required, to review extensions of design such as structural steel or reinforcement shop drawings.

1.12 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

- a. Note date on which submittal was received from QC Manager.
- b. Review submittals for approval within 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 markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. [_____] copies of the submittal will be retained by the Contracting Officer and [_____] copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be so identified and returned, as described above.

1.12.1 Review Notations

Contracting Officer review will be completed within [_____] calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" or "accepted" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
- c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.
- d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.13 DISAPPROVED[OR REJECTED] 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; notice as required under the FAR clause entitled CHANGES, is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

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

1.14 APPROVED[/ACCEPTED] SUBMITTALS

The Contracting Officer's approval or acceptance 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. design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal.

Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work.

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.

1.15 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, the Contractor to assure 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 which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved 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 of that material. Government reserves the right to disapprove any material or equipment which previously has 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. Contractor to 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.

1.16 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any 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.

1.17 PROGRESS SCHEDULE

1.17.1 Bar Chart

- [a. Submit the progress chart, for approval by the Contracting Officer, at the Preconstruction Conference in one reproducible and 4 copies.
- b. Prepare the progress chart in the form of a bar chart utilizing form "Construction Progress Chart" or comparable format acceptable to the Contracting Officer.
- c. Include no less than the following information on the progress chart:
 - (1) Break out by major headings for primary work activity.
 - (2) A line item break out under each major heading sufficient to track the progress of the work.

- (3) A line item showing contract finalization task which includes punch list, clean-up and demolition, and final construction drawings.
 - (4) A materials bar and a separate labor bar for each line item. Both bars will show the scheduled percentage complete for any given date within the contract performance period. Labor bar will also show the number of men (man-load) expected to be working on any given date within the contract performance period.
 - (5) The estimated cost and percentage weight of total contract cost for each materials and labor bar on the chart.
 - (6) Separate line items for mobilization and drawing submittal and approval. (These items are to show no associated costs.)
- d. Update the progress schedule in one reproduction and 4 copies every 30 calendar days throughout the contract performance period.

]1.17.2 Project Network Analysis

[Submit the initial progress schedule within 21 calendar days of notice to proceed. Schedule is to be updated and resubmitted monthly beginning 7 calendar days after return of the approved initial schedule. Updating to entail complete revision of the graphic and data displays incorporating changes in scheduled dates and performance periods. Redlined updates will only be acceptable for use as weekly status reviews.

Contractor to provide a single point contact from his on-site organization as his Schedule Specialist. Schedule Specialist is to have the responsibility of updating and coordinating the schedule with actual job conditions. Schedule Specialist to participate in weekly status meetings and present current information on the status of purchase orders, shop drawings, off-site fabrication, materials deliveries, Subcontractor activities, anticipated needs for Government furnished equipment, and any problem which may impact the contract performance period.

Include the following in the project network analysis:

- a. Graphically display with the standard network or arrow diagram capable of illustrating the required data. Drafting to be computer generated on standard 24 by 36 inch (nominal size) drafting sheets or on small 11 by 17 inch minimum sheets with separate overview and detail breakouts. Provide a project network analysis that is legible with a clear, consistent method for continuations and detail referencing. Clearly delineate the critical path on the display. Clearly indicate the contract milestone date on the project network analysis graphic display.
- b. Data is to be presented as a separate printout on paper or, where feasible, may be printed on the same sheet as the graphic display. Data is to be organized in a logical coherent display capable of periodic updating.
- c. Include within the data verbal activity descriptions with a numerical ordering system cross referenced to the graphic display. Additionally, costs (broken down into separate materials and costs), duration, early start date, early finish date, late start date, late finish date, and float are to be detailed for each activity. A

running total of the percent completion based on completed activity costs versus total contract cost is to be indicated. A system for indicating scheduled versus actual activity dates and durations is also to be provided.

- d. Sufficient detail to facilitate the Contractor's control of the job and to allow the Contracting Officer to readily follow progress for portions of the work should be shown within the schedule.]

1.18 STATUS REPORT ON MATERIALS ORDERS

Within [_____] calendar days after notice to proceed, submit, for approval by the Contracting Officer, an initial material status report on all materials orders. This report will be updated and re-submitted every [_____] calendar days as the status on material orders changes.

Report to include list, in chronological order by need date, materials orders necessary for completion of the contract. The following information will be required for each material order listed:

- a. Material name, supplier, and invoice number.
- b. Bar chart line item or CPM activity number affected by the order.
- c. Delivery date needed to allow directly and indirectly related work to be completed within the contract performance period.
- d. Current delivery date agreed on by supplier.
- e. When item d exceeds item c, the effect that delayed delivery date will have on contract completion date.
- f. When item d exceeds item c, a summary of efforts made by the Contractor to expedite the delayed delivery date to bring it in line with the needed delivery date, including efforts made to place the order (or subcontract) with other suppliers.

1.19 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

| | |
|------------------|---|
| CONTRACTOR | |
| (Firm Name) | |
| _____ | Approved |
| _____ | Approved with corrections as noted on submittal data and/or attached sheets(s) |
| SIGNATURE: _____ | |
| TITLE: _____ | |
| DATE: _____ | |

For design-build construction, both the Contractor Quality Control System Manager and the Designer of Record are to stamp and sign to certify that the submittal meets contract requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SUBMITTAL REGISTER

CONTRACT NO.

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Rehab Butterfly Valves, Fort Peck Dam, MT

CONTRACTOR

| ACTIVITY NO | TRANSMITTAL NO | SPEC SECT | DESCRIPTION ITEM SUBMITTED | PARAGRAPH | GOVT CLASS SIF ACTION REVIEW OR E | CONTRACTOR: SCHEDULE DATES | | | CONTRACTOR ACTION | | DATE FWD TO APPR AUTH/ | APPROVING AUTHORITY | | | | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS |
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| | | 01 12 00 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Proposed Methods of Operation | | G AO | | | | | | | | | | | | |
| | | | Construction Right-of-Way | 1.2 | | | | | | | | | | | | | |
| | | | SD-02 Shop Drawings | | | | | | | | | | | | | | |
| | | | Care of Water | 1.4 | G AO | | | | | | | | | | | | |
| | | | SD-11 Closeout Submittals | | | | | | | | | | | | | | |
| | | | Warranty of Construction | 1.11 | | | | | | | | | | | | | |
| | | 01 22 00.00 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Schedule Of Mobilization And | 1.5.1 | G | | | | | | | | | | | | |
| | | | Demobilization Costs | | | | | | | | | | | | | | |
| | | 01 30 00.24 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | AT Level I Training Sign In | | | | | | | | | | | | | | |
| | | | Sheets | | | | | | | | | | | | | | |
| | | | Security Personnel List | | G PO | | | | | | | | | | | | |
| | | | Personnel Risk Assessment | | G PO | | | | | | | | | | | | |
| | | | iWATCH and/or CorpsWatch | | | | | | | | | | | | | | |
| | | | Training Sign In Sheets | | | | | | | | | | | | | | |
| | | | OPSEC Training Sign In Sheets | | | | | | | | | | | | | | |
| | | | E-Verify | | | | | | | | | | | | | | |
| | | 01 32 01.00 10 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Project Scheduler Qualifications | 1.3 | G AO | | | | | | | | | | | | |
| | | | Preliminary Project Schedule | 3.4.1 | G AO | | | | | | | | | | | | |
| | | | Initial Project Schedule | 3.4.2 | G AO | | | | | | | | | | | | |
| | | | Periodic Schedule Update | 3.6.2 | G AO | | | | | | | | | | | | |
| | | 01 33 00 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Submittal Register | 1.9 | G | | | | | | | | | | | | |

SUBMITTAL REGISTER

CONTRACT NO.

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|---|----------------|----------------|---|-----------|---------------------|-------------------------------|--------------------|--------------------|-------------------|----------------|------------------------|----------------------------|----------------------------|-------------|----------------|------------------------|---------|
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| | | 01 35 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | ACCIDENT PREVENTION PLAN | | G AO | | | | | | | | | | | | |
| | | | Accident Prevention Plan (AAP) - Construction | | G AO | | | | | | | | | | | | |
| | | | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Monthly Exposure Reports | 1.4 | | | | | | | | | | | | | |
| | | | Notifications and Reports | 1.12 | | | | | | | | | | | | | |
| | | | Accident Reports | 1.12.2 | G AO | | | | | | | | | | | | |
| | | | LHE Inspection Reports | 1.12.3 | | | | | | | | | | | | | |
| | | | SD-07 Certificates | | | | | | | | | | | | | | |
| | | | Crane Operators/Riggers | 1.6.1.4 | | | | | | | | | | | | | |
| | | | Standard Lift Plan | 1.7.3.2 | G AO | | | | | | | | | | | | |
| | | | Critical Lift Plan | 1.7.3.3 | G AO | | | | | | | | | | | | |
| | | | Activity Hazard Analysis (AHA) | 1.8 | | | | | | | | | | | | | |
| | | | Confined Space Entry Permit | 1.9.1 | | | | | | | | | | | | | |
| | | | Hot Work Permit | 1.9.1 | | | | | | | | | | | | | |
| | | | Certificate of Compliance | 1.12.4 | | | | | | | | | | | | | |
| | | | License Certificates | 1.14 | | | | | | | | | | | | | |
| | | 01 45 00.00 10 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Contractor Quality Control (CQC) Plan | 3.2 | G AO | | | | | | | | | | | | |
| | | | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Verification Statement | 3.9 | | | | | | | | | | | | | |
| | | 01 57 20.00 10 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Environmental Protection Plan | 1.8 | G FP | | | | | | | | | | | | |

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| | | 01 78 23 | SD-10 Operation and Maintenance Data | | | | | | | | | | | | | | |
| | | | O&M Database | | G G-AO | | | | | | | | | | | | |
| | | 01 78 39.00 24 | SD-03 Product Data | | | | | | | | | | | | | | |
| | | | 50 Percent Preliminary As-Built Drawings | 1.7.2 | G DO | | | | | | | | | | | | |
| | | | 100 Percent Preliminary As-Built Drawings | 1.7.3 | G DO | | | | | | | | | | | | |
| | | | SD-11 Closeout Submittals | | | | | | | | | | | | | | |
| | | | Final As-Built Drawings | 1.7.4 | G DO | | | | | | | | | | | | |
| | | 02 82 00 | SD-03 Product Data | | | | | | | | | | | | | | |
| | | | Safety Data Sheets (SDS) for All Materials | 1.3.9 | G PO | | | | | | | | | | | | |
| | | | Respirators | 3.1.2.1 | G PO | | | | | | | | | | | | |
| | | | Local Exhaust Equipment | 3.1.7 | G PO | | | | | | | | | | | | |
| | | | Vacuums | 3.1.8 | G PO | | | | | | | | | | | | |
| | | | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Air Sampling Results | 1.5.5 | G PO | | | | | | | | | | | | |
| | | | Clearance Sampling | 3.2.7.3 | G PO | | | | | | | | | | | | |
| | | | SD-07 Certificates | | | | | | | | | | | | | | |
| | | | Employee Training | 1.3.4 | G PO | | | | | | | | | | | | |
| | | | Notifications | | G PO | | | | | | | | | | | | |
| | | | Respiratory Protection Program | 1.3.7 | G PO | | | | | | | | | | | | |
| | | | Asbestos Hazard Abatement Plan | 1.3.10 | G PO | | | | | | | | | | | | |
| | | | Testing Laboratory | 1.3.11 | G PO | | | | | | | | | | | | |
| | | | Landfill Approval | 1.3.12 | G PO | | | | | | | | | | | | |

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| | | 02 82 00 | Delivery Tickets | 1.3.12 | G PO | | | | | | | | | | | | |
| | | | Waste Shipment Records | 1.3.12 | G PO | | | | | | | | | | | | |
| | | | Medical Certification | 1.3.14 | G PO | | | | | | | | | | | | |
| | | | Private Qualified Person | 1.5.1 | G PO | | | | | | | | | | | | |
| | | | Documentation | | | | | | | | | | | | | | |
| | | | Designated Competent Person | | G PO | | | | | | | | | | | | |
| | | | Worker's License | 1.5.3 | G PO | | | | | | | | | | | | |
| | | | Contractor's License | 1.5.4 | G PO | | | | | | | | | | | | |
| | | | Vacuums | 3.1.8 | G PO | | | | | | | | | | | | |
| | | | SD-11 Closeout Submittals | | | | | | | | | | | | | | |
| | | | Respirator Program Records | 1.3.7.1 | G PO | | | | | | | | | | | | |
| | | 02 83 00 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Competent Person | 1.5.1.1 | G PO | | | | | | | | | | | | |
| | | | Lead Waste Management Plan | 1.5.2.5 | G PO | | | | | | | | | | | | |
| | | | Lead Compliance Plan | 1.5.2.2 | G PO | | | | | | | | | | | | |
| | | | Written Evidence of TSD | 3.4.2.1 | G PO | | | | | | | | | | | | |
| | | | Approval | | | | | | | | | | | | | | |
| | | | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Sampling and Analysis | 1.3.3 | G | | | | | | | | | | | | |
| | | | Sampling Results | | G PO | | | | | | | | | | | | |
| | | | SD-11 Closeout Submittals | | | | | | | | | | | | | | |
| | | | Hazardous Waste Manifest | 3.4.2.1 | G PO | | | | | | | | | | | | |
| | | | Turn-In Documents or Weight | 3.4.2.1 | G PO | | | | | | | | | | | | |
| | | | Tickets | | | | | | | | | | | | | | |
| | | 03 60 00.01 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Concrete Imaging Report | 3.4.1 | G HDC | | | | | | | | | | | | |

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| | | 05 05 23.13 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Personnel Qualification | 1.4.1 | G HDC | | | | | | | | | | | | |
| | | | Inspection Plan | 1.5 | G HDC | | | | | | | | | | | | |
| | | | SD-03 Product Data | | | | | | | | | | | | | | |
| | | | Ultrasonic Equipment | 2.1 | G HDC | | | | | | | | | | | | |
| | | | Couplant | 2.1.1 | G HDC | | | | | | | | | | | | |
| | | | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Equipment Qualifications | 1.4.2 | G HDC | | | | | | | | | | | | |
| | | | Inspection Report | 1.6 | G HDC | | | | | | | | | | | | |
| | | 05 05 23.17 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Fabricator's Welding Quality | 1.4.1 | G EC | | | | | | | | | | | | |
| | | | Control Plan | | | | | | | | | | | | | | |
| | | | Witness Points | 1.4.1.2 | G EC | | | | | | | | | | | | |
| | | | Welding Procedure Specifications (WPS) | 1.4.2 | G EC | | | | | | | | | | | | |
| | | | Procedure Qualification Records (PQR) | 1.4.2 | G EC | | | | | | | | | | | | |
| | | | Welder Performance Qualification Records (WPQR) | 1.4.3 | G EC | | | | | | | | | | | | |
| | | | Butterfly Valve Weld Repair Plan | 3.10.1 | G HDC | | | | | | | | | | | | |
| | | | SD-03 Product Data | | | | | | | | | | | | | | |
| | | | Nonconformance Reports | 3.5.1 | G EC | | | | | | | | | | | | |
| | | | Pre-Qualified Welding Procedures | 1.4.2.2 | G EC | | | | | | | | | | | | |
| | | | Welding Electrodes and Rods | 2.2 | G | | | | | | | | | | | | |
| | | | Shielding Gas | 2.2 | G | | | | | | | | | | | | |

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| | | 05 05 23.17 26 | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Test and Inspection Report | 3.5.1 | G EC | | | | | | | | | | | | |
| | | | NDT Equipment Calibration | 1.4.1.1 | | | | | | | | | | | | | |
| | | | Records | | | | | | | | | | | | | | |
| | | | SD-07 Certificates | | | | | | | | | | | | | | |
| | | | Inspector Qualifications | 1.4.4 | G EC | | | | | | | | | | | | |
| | | 05 05 23.18 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Fabricator's Welding Quality | 1.5.1 | G EC | | | | | | | | | | | | |
| | | | Control Plan | | | | | | | | | | | | | | |
| | | | Witness Points | 1.5.1.2 | G EC | | | | | | | | | | | | |
| | | | Welding Procedure Specifications | 1.5.2 | G EC | | | | | | | | | | | | |
| | | | (WPS) | | | | | | | | | | | | | | |
| | | | Procedure Qualification Records | 1.5.2 | G EC | | | | | | | | | | | | |
| | | | (PQR) | | | | | | | | | | | | | | |
| | | | Welder Performance Qualification | 1.5.3 | G EC | | | | | | | | | | | | |
| | | | Records (WPQR) | | | | | | | | | | | | | | |
| | | | Weld Tracking | 3.2.1.1 | G EC | | | | | | | | | | | | |
| | | | SD-03 Product Data | | | | | | | | | | | | | | |
| | | | Nonconformance Reports | 3.6.1 | G EC | | | | | | | | | | | | |
| | | | Welding Electrodes and Rods | 2.2 | G EC | | | | | | | | | | | | |
| | | | Shielding Gas | 2.2 | G EC | | | | | | | | | | | | |
| | | | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Test and Inspection Report | 3.6.1 | G EC | | | | | | | | | | | | |
| | | | NDT Equipment Calibration | 1.5.1.1 | G EC | | | | | | | | | | | | |
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| | | 05 05 23.18 26 | Inspector Qualifications | 1.5.4 | G EC | | | | | | | | | | | | |
| | | 05 50 04.00 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Inspector Qualifications | 3.1.2 | G HDC | | | | | | | | | | | | |
| | | | SD-03 Product Data | | | | | | | | | | | | | | |
| | | | Mechanical Anchors | 2.1.10 | G HDC | | | | | | | | | | | | |
| | | | Adhesive Anchors | 2.1.11 | G HDC | | | | | | | | | | | | |
| | | | SD-06 Test Reports | | | | | | | | | | | | | | |
| | | | Post-Installed Anchor Inspection | 3.1.2.3 | | | | | | | | | | | | | |
| | | | Reports | | | | | | | | | | | | | | |
| | | | Materials | 2.1 | G HDC | | | | | | | | | | | | |
| | | | SD-08 Manufacturer's Instructions | | | | | | | | | | | | | | |
| | | | Manufacturer's Installation | 3.1.2 | G HDC | | | | | | | | | | | | |
| | | | Instructions | | | | | | | | | | | | | | |
| | | 05 51 33.00 26 | SD-02 Shop Drawings | | | | | | | | | | | | | | |
| | | | Shop Drawings | 1.3.2 | G HDC | | | | | | | | | | | | |
| | | | SD-03 Product Data | | | | | | | | | | | | | | |
| | | | Ladders | 2.3 | | | | | | | | | | | | | |
| | | | Ladder Safety Devices | 2.3.1 | | | | | | | | | | | | | |
| | | | SD-05 Design Data | | | | | | | | | | | | | | |
| | | | Design Package | 1.3.2 | G HDC | | | | | | | | | | | | |
| | | 09 97 02.00 26 | SD-01 Preconstruction Submittals | | | | | | | | | | | | | | |
| | | | Interpretation of Safety, Health, | 1.4 | G | | | | | | | | | | | | |
| | | | and Environmental Requirements | | | | | | | | | | | | | | |
| | | | Accident Prevention Plan | 1.4.1 | G | | | | | | | | | | | | |
| | | | Ventilation Assessment Plan | 1.4.1 | G | | | | | | | | | | | | |
| | | | Confined Spaces Plan | 1.4.1.6 | G | | | | | | | | | | | | |

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CONTRACTOR

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| U.S. Army Corps of Engineers (USACE) 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 <i>(This section will be initiated by the contractor)</i> | | | | | | | | |
| TO: | | | FROM: | | CONTRACT NO. | | CHECK ONE: <input type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____ | |
| SPECIFICATION SEC. NO. <i>(Cover only one section with each transmittal)</i> | | | PROJECT TITLE AND LOCATION | | | THIS TRANSMITTAL IS FOR: <i>(Check one)</i> <input type="checkbox"/> FIO <input type="checkbox"/> GA <input type="checkbox"/> DA <input type="checkbox"/> CR <input type="checkbox"/> DA/CR <input type="checkbox"/> DA/GA | | |
| ITEM NO. <i>(See Note 3)</i> a. | DESCRIPTION OF SUBMITTAL ITEM <i>(Type size, model number/etc.)</i> b. | SUBMITTAL TYPE CODE <i>(See Note 8)</i> c. | NO. OF COPIES d. | CONTRACT DOCUMENT REFERENCE | | CONTRACTOR REVIEW CODE g. | VARIATION <i>Enter "Y" if requesting a variation (See Note 6)</i> h. | USACE ACTION CODE <i>(Note 9)</i> i. |
| | | | | SPEC. PARA. NO. e. | DRAWING SHEET NO. f. | | | |
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| 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 <i>(List by item No.)</i> | | | 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 the 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. | F -- Receipt acknowledged. |
| B -- Approved, except as noted on drawings. Resubmission not required. | X -- Receipt acknowledged, does not comply with contract requirements, as noted. |
| C -- Approved, except as noted on drawings. Refer to attached comments. Resubmission required. | G -- Other action required (<i>Specify</i>) |
| D -- Will be returned by separate correspondence. | K -- Government concurs with intermediate design. (<i>For D-B contracts</i>) |
| E -- Disapproved. Refer to attached comments. | R -- Design submittal is acceptable for release for construction. (<i>For D-B contracts</i>) |
10. Approval of items does not relieve the contractor from complying with all the requirements of the contract.

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SECTION 01 35 26

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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 MECHANICAL ENGINEERS (ASME)

| | |
|-------------|--|
| ASME B30.3 | (2020) Tower Cranes |
| ASME B30.5 | (2018) Mobile and Locomotive Cranes |
| ASME B30.8 | (2020) Floating Cranes and Floating Derricks |
| ASME B30.9 | (2018) Slings |
| ASME B30.20 | (2018) Below-the-Hook Lifting Devices |
| ASME B30.22 | (2016) Articulating Boom Cranes |
| ASME B30.26 | (2015; R 2020) Rigging Hardware |

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

| | |
|-------------|---|
| ASSP A10.34 | (2021) Protection of the Public on or Adjacent to Construction Sites |
| ASSP A10.44 | (2020) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations |
| ASSP Z244.1 | (2016) The Control of Hazardous Energy Lockout, Tagout and Alternative Methods |
| ASSP Z359.0 | (2018) Definitions and Nomenclature Used for Fall Protection and Fall Arrest |
| ASSP Z359.1 | (2020) The Fall Protection Code |
| ASSP Z359.2 | (2017) Minimum Requirements for a Comprehensive Managed Fall Protection Program |
| ASSP Z359.3 | (2019) Safety Requirements for Lanyards and Positioning Lanyards |
| ASSP Z359.4 | (2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components |

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|--------------|--|
| ASSP Z359.6 | (2016) Specifications and Design Requirements for Active Fall Protection Systems |
| ASSP Z359.7 | (2019) Qualification and Verification Testing of Fall Protection Products |
| ASSP Z359.11 | (2014) Safety Requirements for Full Body Harnesses |
| ASSP Z359.12 | (2019) Connecting Components for Personal Fall Arrest Systems |
| ASSP Z359.13 | (2013) Personal Energy Absorbers and Energy Absorbing Lanyards |
| ASSP Z359.14 | (2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems |
| ASSP Z359.15 | (2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems |
| ASSP Z359.16 | (2016) Safety Requirements for Climbing Ladder Fall Arrest Systems |
| ASSP Z359.18 | (2017) Safety Requirements for Anchorage Connectors for Active Fall Protection Systems |

ASTM INTERNATIONAL (ASTM)

| | |
|-----------|---|
| ASTM F855 | (2019) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment |
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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

| | |
|-----------|--|
| IEEE 1048 | (2016) 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 | (2018; ERTA 1-2 2018) Standard for Portable Fire Extinguishers |
| NFPA 51B | (2019; TIA 20-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work |
| NFPA 70 | (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code |

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| NFPA 70E | (2021) Standard for Electrical Safety in the Workplace |
| NFPA 241 | (2019) Standard for Safeguarding Construction, Alteration, and Demolition Operations |
| NFPA 306 | (2019) Standard for the Control of Gas Hazards on Vessels |

U.S. ARMY CORPS OF ENGINEERS (USACE)

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|------------|--|
| 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 1910.1000 | Air Contaminants |
| 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 1926.16 | Rules of Construction |
| 29 CFR 1926.450 | Scaffolds |
| 29 CFR 1926.500 | Fall Protection |
| 29 CFR 1926.1400 | Cranes and Derricks in Construction |
| 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, 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 ASSP 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.

1.2.5 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 including 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.

1.2.6 Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the training 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.

1.2.7 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.

1.2.8 High Visibility Accident

A High Visibility Accident is any mishap which may generate publicity or high visibility.

1.2.9 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).

1.2.10 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 when provided by a physician or registered personnel.

1.2.11 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).

1.2.12 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.

1.2.13 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.

1.2.14 Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the definition requirements of EM 385-1-1 Appendix Q, and ASSP Z359.2 standard, having 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.

1.2.15 Recordable Injuries or Illnesses

Recordable Injuries or Illnesses are any work-related injury or illness that results in:

- a. Death, regardless of the time between the injury and death, or the length of the illness;
- b. Days away from work (any time lost after day of injury/illness onset);
- c. Restricted work;
- d. Transfer to another job;
- e. Medical treatment beyond first aid;
- f. Loss of consciousness; or
- g. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (f) above

1.2.16 Government 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 (Available at local USACE Safety Office).

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; G, AO

Accident Prevention Plan (AAP) - Construction; G, AO

SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G, AO

LHE Inspection Reports

SD-07 Certificates

Crane Operators/Riggers

Standard Lift Plan; G, AO

Critical Lift Plan; G, AO

Activity Hazard Analysis (AHA)

Confined Space Entry Permit

Hot Work Permit

Certificate of Compliance

License Certificates

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 not 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 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.

Since this work involves operations that handle combustible or hazardous materials, this person must have the ability to understand and follow through on the air sampling, Personal Protective Equipment (PPE), and instructions of a Marine Chemist, Coast Guard authorized persons, or

Certified Industrial Hygienist. Confined space and enclosed space work must comply with NFPA 306, OSHA 29 CFR 1915, Subpart B, "Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment," or as applicable, 29 CFR 1910.147 for general industry.

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, 21.B.03, 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 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. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, designate crane operators qualified by a source that qualifies crane operators (i.e., union, a Government agency, or an organization that tests and qualifies crane operators). 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 or any other required duties are not being effectively carried out. If either the 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

- a. 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).

- b. 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 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.
- c. 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 until an APP is established that is acceptable to the Contracting Officer.

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 at 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 7 calendar days in advance.

1.7 ACCIDENT PREVENTION PLAN (APP)

1.7.1 ACCIDENT PREVENTION PLAN (AAP)

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 ASSP A10.34), and the environment.

The Contactors ACCIDENT PREVENTION PLAN will also need to be approved by the site's Maintenance and Operations Manager.

Fort Peck's Maintenance and Operations Manager is Dale Pugh,
Dale.E.Pugh@usace.army.mil.

1.7.2 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.

1.7.3 Plans

Provide plans in the APP in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

1.7.3.1 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.)

1.7.3.2 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.

1.7.3.3 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.

1.7.3.3.1 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.

1.7.3.3.2 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.

1.7.3.4 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.

1.7.3.5 Fall Protection and Prevention (FP&P) Plan

The plan must be in accordance with the requirements of EM 385-1-1, Section 21.D and ASSP 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 6 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 Fall Protection and Prevention 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 Fall Protection and Prevention Plan documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Plan documentation in the Accident Prevention Plan (APP).

1.7.3.6 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and ASSP 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.

1.7.3.7 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, ASSP Z244.1, and ASSP 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.

1.7.3.8 Lead, Cadmium, and Chromium Compliance Plan

Identify the safety and health aspects of work involving lead, cadmium and chromium, and prepare in accordance with Section 02 83 00 LEAD REMEDIATION.

1.7.3.9 Asbestos Hazard Abatement Plan

Identify the safety and health aspects of asbestos work, and prepare in accordance with Section 02 82 00 ASBESTOS REMEDIATION.

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 working 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

Prior to 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;
- 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 in accordance with EM 385-1-1. 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 (for example, 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

- a. 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 ENG Form 3394, and provide the report to the Contracting Officer within 5 calendar days of the accident. The Contracting Officer will provide copies of any required or special forms.

- b. Near Misses: For Army projects, report all "Near Misses" to the GDA, using local mishap reporting procedures, within 24 hrs. The Contracting Officer will provide the Contractor the required forms. Near miss reports are considered positive and proactive Contractor safety management actions.
- c. 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 Contracting Officer's representative. 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 knowledge of emergency response plan and emergency phone numbers/contacts. REPORT ANY FIRE, NO MATTER HOW SMALL, TO THE RESPONSIBLE FIRE DEPARTMENT OR CONTRACTING OFFICER 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.

1.15 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 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must comply with the applicable Storm Plan and:

- 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
- 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. Develop an employee check-in/check-out communication procedure 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 1910.1000). If material(s) that may be hazardous to human health upon disturbance are encountered during construction operations, stop that portion of work, notify the Contracting Officer immediately and 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 UTILITY OUTAGE REQUIREMENTS

Apply for utility outages per Section 01 30 00.24 OTHER ADMINISTRATIVE AND SPECIAL REQUIREMENTS. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill energy isolation requirements in accordance with EM 385-1-1, Section 11.A.02 (Isolation). Some examples of energy isolation devices and procedures are highlighted in EM 385-1-1, Section 12.D. In accordance with EM 385-1-1, Section 12.A.01, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

These activities include, but are not limited to, a review of HECF and HEC procedures, as well as applicable Activity Hazard Analyses (AHAs). In accordance with EM 385-1-1, Section 11.A.02 and NFPA 70E, work on energized electrical circuits must not be performed without prior Government authorization. Government permission is considered through the permit process and submission of a detailed AHA. Energized work permits are considered only when de-energizing introduces additional or increased hazard or when de-energizing is infeasible.

3.3 OUTAGE COORDINATION MEETING

After the utility outage request is approved and prior to beginning work on the utility system requiring shut-down, conduct a pre-outage coordination meeting in accordance with EM 385-1-1, Section 12.A. This meeting must include the Prime Contractor, the Prime and subcontractors

performing the work, the Contracting Officer, and the Installation representative. All parties must fully coordinate HEC activities with one another. During the coordination meeting, all parties must discuss and coordinate on the scope of work, HEC procedures (specifically, the lock-out/tag-out procedures for worker and utility protection), the AHA, assurance of trade personnel qualifications, identification of competent persons, and compliance with HECP training in accordance with EM 385-1-1, Section 12.C. Clarify when personal protective equipment is required during switching operations, inspection, and verification.

3.4 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, ASSP A10.44, NFPA 70E, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

3.4.1 Safety Preparatory Inspection Coordination Meeting with the Government or Utility

For electrical distribution equipment that is to be operated by Government or Utility personnel, the Prime Contractor and the subcontractor performing the work must attend the safety preparatory inspection coordination meeting, which will also be attended by the Contracting Officer's Representative, and required by EM 385-1-1, Section 12.A.02. The meeting will occur immediately preceding the start of work and following the completion of the outage coordination meeting. Both the safety preparatory inspection coordination meeting and the outage coordination meeting must occur prior to conducting the outage and commencing with lockout/tagout procedures.

3.4.2 Lockout/Tagout Isolation

Where the Government or Utility performs equipment isolation and lockout/tagout, the Contractor must place their own locks and tags on each energy-isolating device and proceed in accordance with the HECP. Before any work begins, both the Contractor and the Government or Utility must perform energy isolation verification testing while wearing required PPE detailed in the Contractor's AHA and required by EM 385-1-1, Sections 05.I and 11.B. Install personal protective grounds, with tags, to eliminate the potential for induced voltage in accordance with EM 385-1-1, Section 12.E.06.

3.4.3 Lockout/Tagout Removal

Upon completion of work, conduct lockout/tagout removal procedure in accordance with the HECP. In accordance with EM 385-1-1, Section 12.E.08, each lock and tag must be removed from each energy isolating device by the authorized individual or systems operator who applied the device. Provide formal notification to the Government (by completing the Government form if provided by Contracting Officer's Representative), confirming that steps of de-energization and lockout/tagout removal procedure have been conducted and certified through inspection and verification. Government or Utility locks and tags used to support the Contractor's work will not be removed until the authorized Government employee receives the formal notification.

3.5 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 ASSP Z359.2 and EM 385-1-1, Sections 21.A and 21.D.

3.5.1 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 and using personal fall protection equipment. 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 ASSP Z359.2 in the AHA.

3.5.2 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, ASSP Z359.0, ASSP Z359.1, ASSP Z359.2, ASSP Z359.3, ASSP Z359.4, ASSP Z359.6, ASSP Z359.7, ASSP Z359.11, ASSP Z359.12, ASSP Z359.13, ASSP Z359.14, ASSP Z359.15, ASSP Z359.16 and ASSP Z359.18.

3.5.2.1 Additional Personal Fall Protection Measures

In addition to the required fall protection systems, other protective measures 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 21.0 through 21.0.06. 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.

3.5.2.2 Personal Fall Protection Equipment

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 carabineers 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 lbs 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 6 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. Equip all full body harnesses 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.

3.5.3 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 2 (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.

3.5.4 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.

3.5.5 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 be in accordance with the requirements of EM 385-1-1, ASSP Z359.2, and ASSP Z359.4.

3.6 WORK PLATFORMS

3.6.1 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, and provide 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 4 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 (2 in x 10 in x 8 in 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 6 feet.
- k. Delineate fall protection requirements when working above 6 feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.6.2 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.

3.7 EQUIPMENT

3.7.1 Material Handling Equipment (MHE)

- a. 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.
- b. 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.

- c. Operators of forklifts or power industrial trucks must be licensed in accordance with OSHA.

3.7.2 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 be in accordance with OSHA, ASME B30.9 Standards and federal, state, and local 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. As applicable, 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. As applicable, 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.
- q. Follow FAA guidelines when required based on project location.

3.7.3 Machinery and Mechanized Equipment

- a. Proof of qualifications for operator must be kept on the project site for review.
- b. 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.

3.7.4 Use of Explosives

Explosives must not be used or brought to the project site.

3.8 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, 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 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.

-- End of Section --

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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.

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Internet: <http://www.aacei.org>

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Fax: 631-923-2875
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Internet: <http://asa.aip.org>

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Internet: <http://www.aia-aerospace.org>

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 Schaumburg, IL 60195
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 E-mail: info@flexibleduct.org
 Internet: <http://www.flexibleduct.org>

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 Internet: <http://www.amca.org>

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ASSOCIATION OF THE WALL AND CEILING INDUSTRY (AWCI)
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Internet: <http://www.bacnetlabs.org>

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Woodland, CA 95695
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Internet: <http://www.wmmmpa.com>

WOOLMARK COMPANY (WBI)
Level 30, HSBC Centre
580 George St
Sydney NSW 2000
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Ph: 61 2 8295 3100
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E-mail: feedback@wool.com
internet: <http://www.woolmark.com>

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

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QUALITY CONTROL

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 D3740 (2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM E329 (2020) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include all associated costs in the applicable Pricing Schedule item.

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

Contractor Quality Control (CQC) Plan; G, AO

SD-06 Test Reports

Verification Statement

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Submit Quality Control Personnel experience as submitted per the requirements of PROPOSAL INSTRUCTIONS, SUBMISSION REQUIREMENTS,

EVALUATION, AND BASIS FOR AWARD. If, because of reasons beyond the control of the Contractor, the named individuals are not able to fulfill this obligation, present replacement personnel with equal or better skills and experience for acceptance by the Contracting Officer. Obtain the Contracting Officer's written consent before making any substitution for these designated personnel.

Establish and maintain an effective quality control (QC) system that complies with the Contract Clause titled "Inspection of Construction." QC consist of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all construction operations, both onsite and offsite, and be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CONTRACTOR QUALITY CONTROL (CQC) PLAN

Submit no later than 15 calendar days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

The Contractors Quality Control Plan will also need to be approved by the site's Maintenance and Operations Manager.

Fort Peck's Maintenance and Operations Manager is Dale Pugh,
Dale.E.Pugh@usace.army.mil.

3.2.1 Content of the CQC Plan

Include, as a minimum, the following to cover all construction-operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions

of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer.

- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer are required to be used.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.2 Acceptance of Plan

Acceptance of the CQC plan is required prior to start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in the Contractor Quality Control(CQC) Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.3 Notification of Changes

After acceptance of the CQC Plan, notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system.

Submit the CQC Plan a minimum of 10 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Contractor, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC System Manager is required to be a construction person with a minimum of 5 years in related work. This CQC System Manager is on the site at all times during construction and is employed by the prime Contractor. The CQC System Manager is assigned no other duties. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

3.4.3 CQC Personnel

Maintain a staff under the direction of the CQC system manager to perform all QC activities. The staff must be of sufficient size to ensure adequate QC coverage of all work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities. Clearly state the duties and

responsibilities of each staff member in the QC Plan. Other technical specifications may specify individuals for maintaining quality control for specific areas of work.

3.4.4 Assignment of CQC System Manager, Project Superintendent, and SSHO Responsibilities

The CQC System Manager, Project Superintendent, and SSHO may not share duties and are required to be separate individuals.

3.4.5 Construction Quality Management Course- COVID-19 Restrictions

In addition to the above experience and education requirements, the Contractor Quality Control(CQC) System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Contractors course.

Contractor personnel who otherwise fulfill all requirements for designation as a CQC Manager, but have not had the opportunity to obtain a CQM certificate due to COVID-19 restrictions, shall be permitted to serve as Quality Control Managers conditioned upon obtaining a CQM-C certificate within 120 days of USACE lifting current in person learning restrictions.

CQC Managers who were in possession of valid CQM certificate (i.e. not delinquent on the 5 year course renewal requirement) as of 01-Mar-2020 will have a grace period for obtaining the CQM renewal training of 6-months from the lifting of COVID-19 restrictions and USACE being able to provide face to face CQM training.

This course is periodically offered at offices indicated at the following web site:

<http://www.nwo.usace.army.mil/BusinessWithUs/Contracting/QualityManagement.aspx>

The exact date and location for the sessions will be determined approximately 30 calendar days in advance by the trainer (POC). Cost varies by location per student.

The Construction Quality Management Training certificate expires after 5 years. If the CQC System Manager's certificate has expired, retake the course to remain current.

The Government reserves the right to recognize certificates issued as a result of virtual training by a certified instructor as valid.

3.4.6 Construction Quality Management Course - Post-COVID-19 Restrictions

In addition to the above experience and education requirements, the Contractor Quality Control(CQC) System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Contractors course. If the CQC System Manager does not have a current certification, obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered at offices indicated at the following web site:

<http://www.nwo.usace.army.mil/BusinessWithUs/Contracting/QualityManagement.aspx>

The exact date and location for the sessions will be determined approximately 30 days in advance by the trainer (POC). Cost varies by location per student.

The Construction Quality Management Training certificate expires after 5 years. If the CQC System Manager's certificate has expired, retake the course to remain current.

3.4.7 Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, have to comply with the requirements in Section 01 33 00 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00.15 TOTAL BUILDING COMMISSIONING are included in the contract, the submittals required by those sections have to be coordinated with Section 01 33 00 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

3.6.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
- b. Review of the Contract drawings.
- c. Check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary

work has been completed and is in compliance with the Contract.

- f. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. Review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government needs to be notified at least 48 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

- a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing are in compliance with the contract.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government needs to be notified at least 48 hours in advance of beginning the initial phase for definable feature of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases.
- g. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality

standards are not being met.

3.6.3 Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. Procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

3.7.2 Testing Laboratories

All testing laboratories must be validated by the USACE Material Testing Center (MTC) for the tests to be performed. Information on the USACE MTC with web-links to both a list of validated testing laboratories and for the laboratory inspection request for can be found at:
<https://mtc.erdcdren.mil/>

Click on "Lab Validation"
Search for a Validation

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed the actual cost for the recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Conduct an inspection of the work by the CQC System Manager near the end of the work, or any increment of the work established by a time stated in the SUPPLEMENTARY CONDITIONS (SPECIAL CONTRACT REQUIREMENTS), "Commencement, Prosecution, and Completion of Work", or by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final 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. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be

scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative is required to be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands can also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the Contract, will be complete and acceptable 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 Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the Contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

- a. The name and area of responsibility of the Contractor/Subcontractor.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions. Include information identified by the "Responsible Individual(s)" for Safety as outlined in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

- i. Instructions given/received and conflicts in plans and/or specifications.
- k. Verification Statement.

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Contracting Officer's Representative on the first day following the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. The Government may elect to process these records electronically. Coordinate with the Contracting Officer's Representative. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the Contractor Quality Control(CQC) System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

Generate daily quality control reports using the Government-furnished Construction Contractor Module of RMS specified in Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM).

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

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SECTION 01 45 00.15 10

RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)

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 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 FAR 52.236-15 Schedules for Construction Contracts; FAR 52.232-27 Prompt Payment for Construction Contracts; FAR 52.232-5 Payments Under Fixed-Priced Construction Contracts; Section 01 32 01.00 10 PROJECT SCHEDULE; Section 01 33 00 SUBMITTAL PROCEDURES; Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS; and Section 01 45 00.00 10 QUALITY CONTROL.

1.4 RMS SOFTWARE

RMS is a web based application. Download, install and be able to utilize the latest version of RMS within 7 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 (<https://rms.usace.army.mil>). 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 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.

1.6 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:

1.6.1 Administration

1.6.1.1 Contractor Information

Enter all current Contractor administrative data and information into RMS within 7 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.

1.6.1.2 Subcontractor Information

Enter all missing subcontractor administrative data and information into RMS CM within 7 calendar days of receiving access to the contract in RMS or within 7 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.

1.6.1.3 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".

1.6.1.4 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.

1.6.1.5 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.

1.6.1.6 Request For Information (RFI)

Create and track all Requests For Information (RFI) in the RMS Administration Module for Government review and response.

1.6.2 Finances

1.6.2.1 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.

1.6.2.2 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.

1.6.3 Quality Control (QC)

Enter and track implementation of the 3-phase QC 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 7 calendar days of Government acceptance of the CQC Plan.

1.6.3.1 Quality Control (QC) Reports

The Contractor's Quality Control (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.

1.6.3.2 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.

1.6.3.3 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.

1.6.3.4 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.

1.6.3.5 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.

1.6.3.6 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.

1.6.3.7 Activity Hazard Analysis

Import activity hazard analysis electronic document files into the RMS QC Module utilizing the document package manager.

1.6.4 Submittal Management

Enter all current submittal register data and information into RMS within 7 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.

1.6.5 Schedule

Enter and update the contract project schedule in RMS by either manually entering all schedule data or by importing the Standard Data Exchange Format (SDEF) file, based on the requirements in Section 01 32 01.00 10 PROJECT SCHEDULE.

1.6.6 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.

1.7 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.

1.8 NOTIFICATION OF NONCOMPLIANCE

Take corrective action within 7 calendar days after receipt of notice of RMS non-compliance by the Contracting Officer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 57 20.00 10

ENVIRONMENTAL PROTECTION

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)

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

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 performance.

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 performance. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners, excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

1.2.4 Project Pesticide Coordinator

The Project Pesticide Coordinator (PPC) is an individual that resides at a Civil Works Project office and that is responsible for oversight of pesticide application on Project grounds.

1.2.5 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" must occur. Land Application must be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.6 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

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.

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

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 performance 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. Any delays resulting from failure to comply with environmental laws and regulations will be the Contractor's responsibility.

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. Payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor, and payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations are the Contractor's responsibility. All costs associated with this section must be included in the contract price.

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Pre-Performance Submittals

Environmental Protection Plan; G, FP

The environmental protection plan.

1.7 ENVIRONMENTAL COORDINATION, PERMITS, NOTICES, REVIEWS AND/OR APPROVALS

The Contractor shall be responsible for contacting the appropriate Federal, State, Regional, and local environmental agencies to identify all required environmental permits (performance and operating), notices, reviews, and approvals required for the project. Once the requirements are identified, the Contractor shall be responsible for coordinating the requirements with the Contracting Officer in regard to implementation for the project. The Contractor shall ensure that all coordination, permits, notices, reviews and/or approvals are completed and submitted with each applicable phase of the design. Prior to performance starting for any phase, the Contractor shall assure that all permits and/or approvals are received and copies are submitted to the Contracting Officer. The Contractor shall be responsible for any contract delays resulting from failure to obtain environmental permits, notices, reviews and/or approvals when required.

1.8 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing performance activities or delivery of materials to the site, submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during performance. Issues of concern must be defined within the Environmental Protection Plan as outlined in this section. Address each topic at a level of detail commensurate with the environmental issue and required performance task(s). Topics or issues which are not identified in this section, but are considered necessary, must be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan must be current and maintained onsite by the Contractor.

1.8.1 Compliance

No requirement in this Section will relieve the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During performance, the Contractor will be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.8.2 Contents

Include in the environmental protection plan, but not limit it to, the following:

- a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.
- 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.
- e. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan must include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.
- f. 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.

- g. Traffic control plans including measures to reduce erosion of temporary roadbeds by performance traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.
- h. 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.
- i. Drawing showing the location of borrow areas.
- j. Include in the Spill Control plan 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. Include in this plan, 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 will immediately notify the Contracting Officer and the local Fire Department 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. Include in the plan 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 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.
- k. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris and schedules for disposal.
 - (1) Identify any subcontractors responsible for the transportation and disposal of solid waste. Submit licenses or permits for solid waste disposal sites that are not a commercial operating facility.
 - (2) Evidence of the disposal facility's acceptance of the solid waste

must be attached to this plan during the . Attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. Submit the report for the previous quarter on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted (e.g. the first working day of January, April, July, and October).

- (3) Indicate in the report the total amount of waste generated and total amount of waste diverted in cubic yards or tons along with the percent that was diverted.
 - (4) A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. Detail in the plan 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.
- l. 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.
 - m. 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 Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be onsite at any given time must be included in the contaminant prevention plan. Update the plan as new hazardous materials are brought onsite or removed from the site.
 - n. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from performance 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, include a copy of the permit and associated documents 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.
 - o. 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 performance. Include in the plan methods to assure the protection of known or discovered resources, identifying lines of communication between

Contractor personnel and the Contracting Officer.

1.8.3 Appendix

Attach to the Environmental Protection Plan, as an appendix, copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents.

1.9 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite performance activities, the Contractor and the Contracting Officer will make a joint condition survey. Immediately following the survey, the Contractor will 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 will be signed by both the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor must 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 work under the contract.

1.10 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations from the drawings, plans and specifications, requested by the Contractor and 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.

1.11 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 Environmental Protection plan. After receipt of such notice, the Contractor will 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 will be granted or equitable adjustments allowed 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 LAND RESOURCES

Confine all activities to areas defined by the drawings and specifications. Identify any land resources to be preserved within the work area prior to the beginning of any performance. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval, except in areas indicated on the drawings or specified to be cleared. Ropes, cables, or guys will not 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. Remove stone, soil, or other materials displaced into uncleared areas.

3.1.1 Work Area Limits

Mark the areas that need not be disturbed under this contract prior to commencing performance activities. Mark or fence isolated areas within the general work area which are not to be disturbed. Protect monuments and markers before performance operations commence. Where performance 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.

3.1.2 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 performance operations outside the limits of the approved work area.

3.1.3 Erosion and Sediment Controls

Providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations is the Contractor's responsibility. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of performance activities. The area of bare soil exposed at any one time by performance 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. Remove any temporary measures after the area has been stabilized.

3.1.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities will be made only when approved. Erosion and sediment controls must be provided for onsite 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.

3.2 WATER RESOURCES

Monitor all water areas affected by performance activities to prevent pollution of surface and ground waters. Do not apply toxic or hazardous chemicals to soil or vegetation unless otherwise indicated. For performance 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 State or Federally issued Clean Water Act permits.

3.2.1 Wetlands

Do not enter, disturb, destroy, or allow discharge of contaminants into any wetlands.

3.3 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with all Federal and State air emission and performance laws and standards.

3.3.1 Particulates

Dust particles; aerosols and gaseous by-products from performance 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. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with all State and local visibility regulations.

3.3.2 Odors

Odors from performance activities must be controlled at all times. The odors must be in compliance with State regulations and/or local ordinances and may not constitute a health hazard.

3.3.3 Sound Intrusions

Keep performance activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of Montana rules.

3.3.4 Burning

Burning is prohibited on the Government premises.

3.4 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes will be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.4.1 Solid Wastes

Place solid wastes (excluding clearing debris) in containers which are emptied on a regular schedule. Handling, storage, and disposal must be conducted to prevent contamination. Employ segregation measures 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 will be the minimum acceptable offsite 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.

3.4.2 Chemicals and Chemical Wastes

Dispense chemicals ensuring no spillage to the ground or water. Perform and document periodic inspections of dispensing areas to identify leakage and initiate corrective action. This documentation will be periodically reviewed by the Government. Collect chemical waste in corrosion resistant, compatible containers. Collection drums must be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes will be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.4.3 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. At a minimum, manage and store hazardous waste in compliance with 40 CFR 262 in accordance with the Project Office hazardous waste management plan. Take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. Segregate hazardous waste from other materials and wastes, protect it from the weather by placing it in a safe covered location, and take precautionary measures such as berming or other appropriate measures against accidental spillage. 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 is the Contractor's responsibility. Transport Contractor generated hazardous waste off Government property within 60 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 are the Contractor's responsibility. The disposition of Contractor generated hazardous waste and excess hazardous materials are the Contractor's responsibility.

3.4.4 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. Manage and store fuel, lubricants and oil 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 is not allowed. Fuel must be brought to the project site each day that work is performed.

3.4.5 Waste Water

Disposal of waste water will be as specified below.

- a. Waste water from performance activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. will not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the performance related waste water off-Government property in accordance with all Federal, State, Regional and Local laws and regulations.

3.5 RECYCLING AND WASTE MINIMIZATION

Participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

3.6 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

Maintain an inventory of non-hazardous solid waste diversion and disposal of performance 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. Include the following in the report:

- a. performance and Demolition (C&D) Debris Disposed = ____ in cubic yards or tons, as appropriate.
- b. performance 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

If during excavation or other performance activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources will 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. The protection of threatened and endangered animal and plant species, including their habitat, is the Contractor's responsibility in accordance with Federal, State, Regional, and local laws and regulations.

3.8.1 Endangered/Threatened Species

The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations. The following are known endangered/threatened species that could possibly be in the project area.

3.8.1.1 Interior Least Terns and/or Piping Plovers

No performance shall occur within a quarter of a mile of the areas identified as nesting habitat for the Interior Least Terns and/or Piping Plovers between the dates of April 15 and August 15 of any year.

3.8.1.2 Bald Eagles

The Contractor shall be responsible for identifying and avoiding disturbance to bald eagles which may be roosting in the project area. Bald Eagles. The Government recommends avoiding roosting bald eagles by eliminating activity within 75 meters of the roosting bald eagle. However, this is a general recommendation, and may change dependant upon location, available cover, and concealment. It is the Contractor's responsibility to accurately determine appropriate distances to avoid disturbing the Bald Eagle. The Contractor shall ensure that his employees are able to identify bald eagles and shall avoid disturbing bald eagles.

3.8.2 Migratory Bird Treaty Act

Clearing and grubbing shall be scheduled so as to avoid disturbance to any active nests of migratory birds covered by the above Act. Normally, that allows clearing only from 15 September to 31 January. However, if the CO determines that trees in the work area are free of nests, the contractor may clear such trees outside that time window. Adherence to these guidelines will help avoid any unnecessary take of migratory birds and the penalties specified in the Act and associated regulations.

3.9 PREVIOUSLY USED EQUIPMENT

Clean all previously used performance 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. Consult with the USDA jurisdictional office for additional cleaning requirements.

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 performance activities create the particular pollutant.

3.11 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel must be trained in all phases of environmental protection and pollution control. Conduct environmental protection/pollution control meetings for all personnel prior to commencing performance activities. Additional meetings must be conducted for new personnel and when site conditions change. Include in the training and meeting agenda: 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 PERFORMANCE CLEANUP

The Contractor will clean up all areas used for performance in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary performance facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of performance 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 --

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

O&M Database; G, G-AO

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors shall compile and prepare data and deliver to the Contractor prior to the training of Government personnel. Compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.2.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Commissioned items without a specified data package requirement in the individual technical sections shall use Data Package 4.

1.2.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of

submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.2.4 Review and Approval

The Contractor's Commissioning Authority (CA) shall review the commissioned systems and equipment submittals for completeness and applicability. The CA shall verify that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CA shall communicate deficiencies to the Contracting Officer. Upon a successful review of the corrections, the CA shall recommend approval and acceptance of these O&M manuals to the Contracting Officer. This work shall be in addition to the normal review procedures for O&M data.

1.2.5 O&M Database

Develop a database from the O&M manuals that contains the information required to start a preventative maintenance program.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.3.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.3.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

1.3.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.3.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.3.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations

and zones or portions of systems controlled.

1.3.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.3.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.3.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

1.3.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.3.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.3.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.3.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.3.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.3.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.3.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.3.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.3.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

1.3.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

1.3.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

1.3.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.3.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.3.5.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid.

1.3.5.7 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.3.5.8 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3.5.9 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

1.3.5.10 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service

organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.4 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Full as-built sequence of operations.
- c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.5.1 Data Package 4

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Lubrication data
- i. Preventive maintenance plan and schedule
- j. Cleaning recommendations
- k. Troubleshooting guides and diagnostic techniques
- l. Wiring diagrams and control diagrams
- m. Maintenance and repair procedures
- n. Removal and replacement instructions

- o. Spare parts and supply list
- p. Corrective maintenance man-hours
- q. Product submittal data
- r. O&M submittal data
- s. Parts identification
- t. Warranty information
- u. Personnel training requirements
- v. Testing equipment and special tool information
- w. Testing and performance data
- x. Contractor information

1.5.2 Data Package 5

- a. Safety precautions
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan and schedule
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information

q. Warranty information

r. Testing and performance data

s. Contractor information

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

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Modifications and Title Block Examples

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AS-BUILT DRAWINGS
02/22

PART 1 GENERAL

Attachments: Modifications and Title Block Examples

1.1 DEFINITIONS

The definitions listed below form a part of this specification.

1.1.1 Red-Line Drawings

Contract drawings marked-up during construction to show actual work performed to include necessary sketches, modification drawings, shop drawings and notes.

1.1.2 As-Built Drawings

Electronic CAD Files developed from the contract drawings that include all of the information from the redline drawings and suitable for half-size reproduction.

1.1.3 Black-Line Drawings

Electronic CAD files that can be used to produce high quality drawings.

1.1.4 Full-Size Drawings

22 inches x 34 inches nominal size drawings with all details visually readable so that half-size plot will fit on 11 inches x 17 inches cut sheets.

1.1.5 Modification Circle

A circle with a horizontal line through the center to identify modification changes on the drawings. The top half will contain the letter "R" with the bottom half containing the Modification number, unless directed otherwise. The lettering standard will be 1/8-inch Arial.ttf.

1.1.6 Electronic CAD Files

Electronic CAD files in Bentley (.dgn) in accordance with appropriate CAD standard. The CAD standard will include level on/off status, special characters, line weights, font, and size requirements.

1.2 REFERENCES

U.S. ARMY CORPS OF ENGINEERS (USACE)

ERDC/ITL TR-19-7

(2019) A/E/C CAD Standard - Release 6.1

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

50 Percent Preliminary As-Built Drawings; G-DO

100 Percent Preliminary As-Built Drawings; G-DO

SD-11 Closeout Submittals

Final As-Built Drawings; G-DO

1.4 GENERAL REQUIREMENTS

1.4.1 As-built Drawings

Upon award of this contract, the Government will provide the Contractor PDFs of the Contract drawings. Once the Contractor makes hardcopy distribution of these drawings in accordance with Section 01 30 00.24 OTHER ADMINISTRATIVE AND SPECIAL REQUIREMENTS, the Government will provide the Contractor with Government-furnished electronic CAD Files.

Maintain electronic CAD files and Red-Line Drawings showing As-Built conditions. Use the ERDC/ITL TR-19-7 USACE A/E/C CAD Standard for the As-Built drawings. Obtain the A/E/C Standards in effect at time of Contract Award. The A/E/C Standards are available at:

<https://cadbimcenter.erdcdren.mil/>

(New users will be required to register. See "New User Registration" at the website indicated above.)

Obtain the required CAD software for Contractor use. **Do not convert electronic drawing files from one software language to another.** Show the transmittal requirements for the As-built Drawings as activities on the Contractor-prepared project schedule.

Show all changes from the contract drawings on the as-builts. Accurately and neatly record all changes on the As-built drawings using the same symbols, terminology, and general quality as the original set of contract drawings. Show all changes on all drawings that are affected by the change. Changes include: actual work performed, deviations resulting from Government responses to Requests for Information or Serial letters, surveys, shop drawings, descriptive changes, sketch changes, and modifications to the contract. Show all systems designed or enhanced by the Contractor such as HVAC control system, fire alarm system fire sprinkler system, and irrigation sprinkler system, on the As-built drawings. Where contract drawings or specifications allow for options, only show the option selected and actually constructed on the As-Built Drawings.

1.4.2 Red-Line Drawings

Update Red-Line Drawings throughout the construction phase of the contract showing all changes that will be shown on the final as-builts. Place all as-built conditions on the Red-Line Drawings **within two (2) days** after completing the work activity or it shall be entered on the deficiency tracking system (see Section 01 45 00.00 10, QUALITY CONTROL). The Government will consider the Contractor to not be making satisfactory progress and will withhold funds from progress payments if the Contractor does not completely and accurately update the as-built drawings.

Provide red-line drawings in an electronic format.

1.4.2.1 Electronic Red-Lines

Make electronic red-line drawings available to the COR at all times through a Local Area Network (LAN) or Internet connection. The connection shall have a download transfer rate not less than 10 Megabit/second (~1.250 Megabytes/second) and an upload transfer rate of not less than 1 Megabit/second (~124 kilobytes/second) in order to facilitate the timely access of drawing files. Make backups of all the electronic drawings at the close of business on the final day of work each week on a durable digital media such as removable hard-drive, tape drive, or optical disk. Preserve each weekly file system backup over the course of the project and do not overwrite; label the file folders or individual media with the date of backup. Store the weekly backup media in a fireproof and waterproof safe in a locked room of the Contractor's trailer. Electronically provide the COR with updated PDF drawings on a monthly basis. Show all changes to the electronic drawings with clouding and in accordance with ERDC/ITL TR-19-7.

1.5 PAYMENT

In accordance with the clause "Payment Under Fixed - Price Construction Contracts", \$35,000 or 1 percent of the present contract value, which ever is greater, up to \$200,000. This amount will be withheld from payment for the creation of As-Built Drawings until Final As-Built Drawings are delivered to and accepted by the COR.

1.6 CONTRACTOR PERFORMANCE RATING

The Government will evaluate the Contractor's performance in CPARS (Contractor Performance Assessment Reporting System) at intervals of no more than 365 days during the period of performance and complete the final evaluation within 120 days of completion of the project. The timeliness and quality of As-Built drawings submittals, Final As-built Drawings, Red-line drawings will be an important factor in determining the assigned rating for the Schedule evaluation area. If the Contractor fails to submit complete and accurate Final As-Built Drawings within sixty (60) calendar days of turning the completed project over to the Using Service, this failure will be noted in the comments under the Schedule evaluation area and may result in a lower rating for this area. Repeated failure to submit correct and accurate As-Built drawings submittals, Final As-built Drawings, Red-line drawings may also result in lower ratings for the Quality and Management evaluation areas.

1.7 TRANSMITTAL OF AS-BUILT DRAWINGS

1.7.1 Optional As-built Drawings Sample

Optionally submit a sample of preliminary as-built drawings to the Omaha District Office that will be reviewed for formatting purposes. Include five distinct sheets from the project drawings in this submittal. Send this optional submittal on approved digital media to the Omaha District Office (ATTN: Patricia Lambert, CENWO-CDS-C) and include the following:

- a. Electronic CAD/BIM/CIM Files
- b. Individual PDF Drawings
- c. One (1) Combined Set of full-size PDF Drawings with bookmarks for each sheet

1.7.2 50 Percent Preliminary As-Built Drawings

Submit the 50 Percent Preliminary As-Built Drawings within ten (10) days after 50% physical completion unless otherwise directed by the COR. The Government will review these drawings for technical content and formatting requirements. Include all changes up to the time of submission with "clouding" around the changes on the electronic CAD Files. Submit all drawings contained in the complete project set of drawings plus any additional drawings with the 50 Percent Preliminary As-Built Drawings. Include the following on the approved digital media for the 50 Percent Preliminary As-Built Drawings (ATTN: Patricia Lambert, CENWO-CDS-C):

- a. Electronic CAD Files.
- b. Individual PDF's of Drawings.
- c. Combined Set of PDF Drawings with bookmarks for each sheet.
- d. Current electronic red-lines for reviewing purposes.

If a resubmittal is required, resubmit within fifteen days after receiving comments back from the Government. Failure to submit the 50 Percent Preliminary As-Built Drawings by the specified time will result in the Government not considering the Contractor to be making satisfactory progress on the project and withholding funds from the progress payments.

1.7.3 100 Percent Preliminary As-Built Drawings

The 100 Percent Preliminary As-Built Drawings include all changes to the drawings as specified. The 100 Percent Preliminary As-Built Drawings will be reviewed for technical content and formatting requirements. Within thirty (30) days after the final inspection, submit 100 Percent Preliminary As-Built Drawings indicating all as-built changes with "clouding" on all of the project drawings. Submit all drawings contained in the complete project set of drawings plus any additional drawings with the 100 Percent Preliminary As-Built Drawings. The COR may grant the Contractor additional time if the Contractor is making reasonable progress on the as-builts, in the sole judgment of the COR. Do not submit the Final As-Built Drawings until the 100 Percent Preliminary As-Built Drawings are approved. Include the following on the approved digital media for the 100 Percent Preliminary As-Built Drawings (ATTN: Patricia Lambert, CENWO-CDS-C):

- a. Electronic CAD Files.
- b. Individual PDF's of Drawings.
- c. Combined Set of PDF Drawings with bookmarks for each sheet.
- d. Current electronic red-lines for reviewing purposes.

1.7.4 Final As-Built Drawings

Produce Final As-Built Drawings without "clouding". Include all changes shown on the 100 Percent Preliminary As-Built Drawings plus any additional required changes on the Final As-Built Drawings. Submit all drawings contained in the complete project set of drawings plus any additional drawings with the Final As-Built Drawings. Submit the Final Drawings no later than ten days after the 100 Percent Preliminary As-Built Drawing submittal is approved. The COR may grant additional time if the Contractor is making reasonable progress on the as-builts. Send the following to the COR:

Three approved digital media containing the following:

- a. Electronic CAD Files.
- b. Individual PDF's of Drawings.
- c. Combined Set of PDF Drawings with bookmarks for each sheet.
- d. Current electronic red-lines for reviewing purposes.

Send one copy of the digital media only to the Omaha District Office (ATTN: Patricia Lambert, CENWO-CDS-C).

1.8 AS-BUILT DRAWINGS FORMAT REQUIREMENTS

1.8.1 General Formatting

Prepare As-built Drawings in accordance with ERDC/ITL TR-19-7 requirements and/or match the detail shown on the contract drawings. Include all of the requirements below on the drawings:

- a. Update the drawing index when drawings are added.
- b. When opened, ensure the view is zoomed to fit the border.
- c. Reference a border supplied by the CAD/BIM Technology Center (<https://cadbimcenter.erdcdren.mil/>) placed in the layout/sheet model at a scale of 1 at the location (0,0) in all files.
- d. Delete all unnecessary information outside the border.
- e. Purge/compress all files.
- f. Include all reference files and ensure they are 'Bound' (AutoCAD) or 'Attached' (Microstation) to the CAD files in which the files are referenced.
- g. Use the Arial.ttf font for all text.
- h. Provide an ASCII text file with the following information: the name and phone number of the person we need to contact if we have problems, and the version of the CAD software used to create and/or work on the drawings.
- i. (CAD only) Supply pen tables for plotting.
- j. (CAD only) Provide each sheet/design with its own file and file name with only one layout/sheet per design file.
- k. (CAD only) Accomplish half toning by using the color 8 and setting the pen table to plot color 8 to half tone.
- l. The file name is the project code followed by the sheet identification number. Include the file name in the border on every sheet and match the name of the file on the Digital Media. The project code is Fp79.
- m. Include the File number in the border on every sheet. The file number is: (the Contract number, to be provided at award).
- n. Change the cover sheet from "Contract Award Set" to "As-Built

Record Set" with month & year completed.

- o. Show drawing changes by "clouding" the affected area in layer "G-ANNO-REVS" (CAD only) in the drawing file of all preliminary as-builts and redlines. For BIM, accomplish clouding commensurate with the available tools.
- p. Place all submitted Electronic CAD Files and PDF drawings under a folder labeled "As-Built" on the submitted Digital Media.
- q. Include the name of the project, location, project code, solicitation number, contract number, and words detailing which submittal it is on both the Digital Media case and Digital Media. Title the Final As-builts Drawings "As-Built Record Set".
- r. Do not use zipped or compressed folders on any of the As-built submittals.
- s. On the cover sheet add or revise text to read "This folio includes all reissued and descriptive amendments, RFIs, and modifications."
- t. Place the Electronic CAD native design files and PDF drawings in separate folders on the Digital Media.

1.8.2 Title Block

Fill in and correct all information in the title block. Include all the requirements below in the title block.

- a. Add "RECORD DRAWING" text below the title block on the right side of the drawing on all sheets.
- b. Add the date in the revision box for modifications from Block 3 of Form SF-30.
- c. State "REVISED TO SHOW AS-BUILT CONDITIONS" and date the top line of the revision box. Use a "-" for the "Mark".
- d. Enter the month and year as-builts were completed in the date box.
- e. Show the contract number and the solicitation number (if available) on all sheets.
- f. Properly identify additional word abbreviations, not found on the abbreviation sheet but necessary to describe the work, and incorporate with the other standard word abbreviations.
- g. Properly note modifications in the title block in accordance with paragraph "Modification Changes" below.

1.8.3 Modification Changes

Include all modification changes on the as-built drawings. At a minimum, include all revised and reissued sheets, descriptive changes, sketches, etc. Change other sheets as appropriate with any modification change that also affects other sheets other than the one referenced with the modification. Typically, modification changes can be done by following the descriptive change included with the modification, but may require additional effort depending on the change and level of detail of the modification change. Post modifications in accordance with the following:

- a. Follow directions in the modification for posting all changes.
- b. Post all modifications to the contract in chronological order.
- c. Show the last modification number completed on the sheet with the modification circle in the top right corner of the "Project Title" and "Project Location" box.
- d. Place a modification number in the revision box over column entitled "Mark" for all modifications to plans, sections, or details. Use the statement "GENERAL REVISIONS" when applicable.
- e. Make the Modification Circle size 1/2-inch diameter unless the area where the circle is located is crowded. Use a smaller size circle for

crowded areas.

- f. Place a Modification Circle at the location of each deletion.
- g. For all new details or sections that are added to a drawing, place a Modification Circle by the detail or section title.
- h. For changes to a drawing, place a Modification Circle by the title of the affected plan, section or detail titles (each location).
- i. For changes to schedules on drawings, place a Modification Circle either by the schedule heading or by the change in the schedule.

1.8.4 Legends

Do not use symbols which conflict with those on the original contract legend sheet. Properly identify and add to the legend sheet or supplemental legend additional symbols necessary to depict any additional work items. Those projects that do not have legend sheets may use supplemental legends on each sheet where symbol is shown.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

Make revisions to and maintain the red-line and as-built drawings to the same level of detail as shown on the original contract drawings. Provide any additional drawings as required to display all details.

3.2 SITE WORK

3.2.1 Utilities

Show all utilities whether active or abandoned on the as-built drawings and include all those shown on the original contract drawings or found on-site. Show the type of utility, location, general direction, size, material make-up and depth. Show the location and description of any utility line or other installations of any kind known to exist within the construction area. Include dimensions to permanent features as part of the location. Locate during installation all new underground utility lines (including electrical power and communications, gas, water, sanitary sewer, storm drains, roof drains and culverts). Survey pipe invert of gas, water, sanitary sewer, storm drains, roof drains and culverts and top of duct bank of electrical power and communications lines and associated fixtures (valves, manholes, test points, meters, cathodic protection points, tanks, ground points, and all point features along the new utility lines). Survey storm drains and sanitary sewer lines where pipes enter manholes and inlets and at 100-foot maximum intervals along the line. Survey the inverts of all cleanouts and tees. Survey inverts at each end of culverts. Survey electrical power, communications, gas and water lines at all manholes, tees, valves, corners, changes in direction and at intervals along the line to accurately depict the location of the line in both horizontal and vertical directions (50-foot maximum interval). Make the horizontal and vertical accuracy such that 100% of the points are + 0.25' of their absolute position. Show new underground utility lines as 3-dimensional elements in a Bentley.dgn file.

3.2.2 Structures

Show structures above and below ground. Show the size, material make-up, location, height, and/or depth. Show rim elevation and invert elevations

as applicable at manholes. Show electrical equipment, guy wires, and voltage rating on power poles.

3.2.3 Grades

Correct grade or alignment of roads, structures, or utilities if any changes were made from the contract drawings. Correct elevations if changes were made in site grading. If any grades were finalized outside of the respective grades tolerances, show that new grade on the as-builts.

3.3 STRUCTURAL

3.3.1 Steel/Concrete

Incorporate shop drawings that deviate from the contract drawings in the As-Built Drawings.

3.4 MECHANICAL

3.4.1 Ductwork

Show ductwork to reflect actual installation and duct size. Show ductwork routing changes.

3.4.2 Plumbing

Show piping and fixtures to reflect the type of material, size and the route or location.

3.5 ELECTRICAL

3.5.1 PANELS

Revise all contract drawing panel schedules to show as-built conditions. Ensure home-run circuit designation on electrical drawings accurately correspond to the as-built panel schedules.

3.5.2 Controls

Revise all control diagrams in contract drawings to reflect as-built conditions and setpoints.

3.6 CONTRACTOR SHOP DRAWINGS

Incorporate contractor shop drawings, which supersede data on the contract plans and/or additional drawings, prepared by the Contractor, into the As-Built Drawings. Include the designer's name on the As-Built Drawings for any design plans prepared by the Contractor.


-- End of Section --

RECORD DRAWING

DEFINITIONS OF REVISIONS:

- 1. LAST ENTRY IN DESCRIPTION BOX SHALL APPLY TO AS-BUILT CONDITIONS
- 2. REVISIONS BY MODIFICATION. (AFTER AWARD OF CONSTRUCTION CONTRACT).
- 3. METHOD OF ADDING NEW DRAWING BY MODIFICATION.
- 4. REVISIONS BY AMENDMENT WHEN WRITTEN "WORD DESCRIPTIVE" AMENDMENT IS ISSUED AND DRAWINGS ARE POSTED FROM WRITTEN DESCRIPTIONS AFTER THE ISSUE DATE.
- 5. REVISIONS BY AMENDMENT WHEN DRAWING IS TO BE RE-ISSUED.
- 6. METHOD OF ADDING NEW DRAWING BY AMENDMENT.
NOTE: DELTA NUMBER MATCHES AM. NUMBER

INSTRUCTIONS FOR NOTING REVISIONS:





- 1. ADD THE REVISION DESCRIPTION (EITHER CHANGE ORDER, AMENDMENT OR MODIFICATION DESCRIPTION AS APPLICABLE).
- 2. ADD THE PROPER REVISION SYMBOL TO THE LEFT OF THE REVISION NOTATION.
- 3. ADD THE PROPER AMENDMENT OR MOD. SYMBOL NEAR EACH REVISED ITEM IN THE BODY OF THE DRAWING.
- 4. ADD ARCHITECT-ENGINEERS INITIALS IN APPROVED BLOCK WHEN A-E IS RESPONSIBLE FOR AMENDMENT OR MODIFICATION.
- 5. WHEN ADDING A NEW DRAWING TO SHOW SUPPLEMENTAL DATA, USE SAME DRAWING NUMBERS AS DRAWING WITH SIMILAR SUBJECT MATTER AND ADD AN ALPHABETICAL SUFFIX TO THE SHEET NO. THIS DRAWING SHOULD BE ADDED TO THE INDEX OF DRAWINGS IN ITS PROPER PLACE ACCORDING TO THE SHEET NUMBER.
- 6. FOR MODIFICATION ONLY:
ADD A 1/2 INCH ENCIRCLED  INSIDE OF TITLE BLOCK SHOWING THE LAST MOD NUMBER COMPLETED. ALSO USE THIS NEAR EACH REVISED ITEM IN THE BODY OF THE DRAWING.

REVISION DESCRIPTIONS - FOR AMEDMENTS AND/OR MODIFICATIONS:

- CHANGE ORDER #000X (DRESCRIPTION & REASON FOR CHANGE ARE THE SAME AS AMENDMENTS LISTED BELOW)
- AM. #000X REISSUED FOR CLARITY (DRAWING IS HARD TO READ - BLURRY)
- AM. #000X GENERAL REVISIONS (THIS WOULD BE FOR ANY RE-ISSUED DRAWINGS, TYPICAL CHANGES OR CORRECTIONS)
- AM. #000X REVISED AND REDRAWN (MAJOR OVERHAUL OF THE DRAWING, TOO MANY CHANGES TO INDICATE INDIVIDUALLY)
- AM. #000X NEW DRAWING ADDED (DRAWING THAT WAS NOT ORIGINALLY INCLUDED IN THE ADVERTISED SET)
- REVISED IN ACCORDANCE WITH AM. #000X (THIS IS FOR DESCRIPTIVE CHANGES THAT WENT OUT IN THE AMENDMENT - DRAWING IS NOT RE-ISSUED - AND THE CHANGES ARE THEN LATER POSTED TO THE DRAWINGS AS IT BECOMES A CONTRACT SET)
- (DASH) REVISED TO SHOW AS-BUILT CONDITIONS

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| SHEET IDENTIFICATION NUMBER | PROJECT TITLE PROJECT LOCATION Y Y | U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS | DESIGNED BY: | DATE: | <div><div>REVISIONS</div><div><div>REVISOR</div><div>DATE</div><div>APPROVED</div><div>MARK</div></div></div> | REVISOR | | | | | DATE | | | | | APPROVED | | | | | |
| | | | DWN BY: | CKD BY: | | SOLICITATION NO.: | REVISOR | | | | | DATE | | | | | APPROVED | | | | |
| | | | SUBMITTED BY: | | | CONTRACT NO.: | REVISOR | | | | | DATE | | | | | APPROVED | | | | |
| | | | FILE NAME: | | | FILE NUMBER: | REVISOR | | | | | DATE | | | | | APPROVED | | | | |
| SIZE: | | PLOT SCALE: | | PLOT DATE: | | REVISOR | | | | | DATE | | | | | APPROVED | | | | | |

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|---|---|--|--|
| DESIGNED BY: INITIALS OF DESIGNER | | DATE: CURRENT DATE: MONTH AND YEAR EXAMPLE: JUNE 2012 | |
| DWN BY: INITIALS OF CAD TECH. OR DESIGNER | CKD BY: INITIALS OF REVIEWER | SOLICITATION NO.: THIS NUMBER IS ASSIGNED BY CONTRACTING AND ADDED TO TITLE BLOCK AT THE TIME OF PLOTTING ADVERTISEMENT DRAWINGS | |
| SUBMITTED BY: INITIALS OF REVIEWER/DESCIPLINE SECTION CHIEF | | CONTRACT NO.: THIS NUMBER IS ASSIGNED BY CONTRACTING AND ADDED TO TITLE BLOCK AT THE TIME OF PLOTTING CONTRACT AWARD DRAWINGS | |
| FILE NAME:* NAME OF CADD FILE: FILE NAMES SHOULD BEGIN WITH THE PROJECT CODE ASSIGNED BY THE CAD MANAGER. SEE A/E/C CADD STANDARDS FOR SHEET FILE NAMING CONVENTION | | FILE NUMBER:** THIS NUMBER IS ASSIGNED BY PROJECT COORDINATOR AND ADDED TO TITLE BLOCK AT THE BEGINNING OF THE PROJECT | |
| SIZE: AUTO GENERATED INFO. DO NOT EDIT | PLOT SCALE: AUTO GENERATED INFORMATION DO NOT EDIT | PLOT DATE: AUTO GENERATED INFORMATION DO NOT EDIT | |

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|---|---|------------|--------|
| - | REVISED TO SHOW AS-BUILT CONDITIONS | 08-14-2012 | |
| R-5 | REVISED AND REDRAWN | 07-03-2012 | |
| R-4 | GENERAL REVISIONS | 06-17-2012 | |
| R-1 | NEW DRAWING ADDED | 03-27-2012 | |
|  | REVISED IN ACCORDANCE WITH AM. NO. 0007 | 03-17-2012 | |
|  | AM. #0003 GENERAL REVISIONS | 02-27-2012 | |
|  | AM. #0001 NEW DRAWING ADDED | 02-17-2012 | |
|  | CHG. ORDER #0001 GENERAL REVISIONS | 02-12-2012 | R.W.S. |
| MARK | DESCRIPTION | DATE | APPR. |

**REVISION SYMBOL AND/OR NUMBER:
SEE EXAMPLE ABOVE AND/OR
AMENDMENT/MOD EXAMPLE DRAWING FOR CLEARIFICATION**

**INDICATES REVISION TYPE AND DESCRIPTION:
SEE EXAMPLE ABOVE AND/OR
AMENDMENT/MOD EXAMPLE DRAWING FOR CLARIFICATION**

— **DATE OF REVISION**

INITIALS (IF REQUIRED) BY REVIEWER/DISCIPLINE SECTION CHIEF

— SHEET IDENTIFICATION NUMBER:

— DISCIPLINE DESIGNATOR
w/ Level 2 Designator
(see A/E/C CADD STANDARD
for Level 2 Designator)

— SHEET TYPE DESIGNATOR

M-201

— SHEET SEQUENCE NUMBER

A/E NAME AND LOCATION INFORMATION

**ADDITIONAL PROJECT INFORMATION
IF NEEDED**

DRAWING TITLE

* PROJECT CODE:
FOR A/E DESIGN PROJECTS
THIS DESIGNATION IS FOUND
IN THE SCOPE OF WORK

**** FILE NUMBER:**
FOR A/E DESIGN PROJECTS THIS NUMBER IS FOUND
IN THE SCOPE OF WORK

* PROJECT CODE:
FOR DESIGN BUILD PROJECTS
THIS DESIGNATION IS FOUND IN THE R.F.P.

**** FILE NUMBER:**
FOR DESIGN BUILD PROJECTS THIS NUMBER IS
FOUND IN THE R.F.P.

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

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| DESIGNED BY: | | X |
| DWN BY: | X | C |
| SUBMITTED BY: | | X |
| FILE NAME: | | X |
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US ARMY CORPS
OF ENGINEERS

RECORD DRAWING

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DIVISION 02 - EXISTING CONDITIONS

SECTION 02 82 00

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-- End of Section Table of Contents --

SECTION 02 82 00

ASBESTOS REMEDIATION

PART 1 GENERAL

Asbestos-containing materials in the form of electrical wiring insulation or other panel components are anticipated to be present in the work areas for this project. It is expected that the asbestos materials identified above are in good condition. It is not anticipated that the removal of the asbestos-insulated wiring required for the project will cause the asbestos materials to become friable, disrupt the matrix of the asbestos-containing material, or generate the release of asbestos fibers; however a negative exposure assessment for this work is not available. Comply with paragraph Air Sampling of this specification section. If the Contractor wishes to use a negative exposure assessment meeting the requirements of 29 CFR 1926.1101(f)(2)(iii)(B), provide the documentation as required. The electrical wiring will be removed as intact as possible with minimum disturbance of the insulation and disposed of properly.

OPTIONAL WORK: In addition to the electrical wiring insulation, there is optional penstock paint repair work for the project. The transitions of the penstocks where they enter into the concrete encasement are wrapped in two layers of asbestos packing extending 2 feet from the face of the concrete. If the optional penstock work is awarded and it requires disturbance of this asbestos material, follow the requirements of this specification section for removal and disposal of asbestos-containing material as required to complete the project work.

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 Z9.2 (2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM D4397 (2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7 (2014) Compressed Air for Human Respiration; 6th Edition

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1 (2020) Occupational and Educational Personal Eye and Face Protection Devices

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH NMAM (2016; 5th Ed) NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018 (1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147 The Control of Hazardous Energy (Lock Out/Tag Out)

29 CFR 1926.59 Hazard Communication

29 CFR 1926.103 Respiratory Protection

29 CFR 1926.200 Accident Prevention Signs and Tags

29 CFR 1926.1101 Asbestos

40 CFR 61-SUBPART A General Provisions

40 CFR 61-SUBPART M National Emission Standard for Asbestos

40 CFR 763 Asbestos

42 CFR 84 Approval of Respiratory Protective Devices

49 CFR 107 Hazardous Materials Program Procedures

49 CFR 171 General Information, Regulations, and Definitions

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173 Shippers - General Requirements for Shipments and Packagings

UNDERWRITERS LABORATORIES (UL)

UL 586 (2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 ACM

Asbestos Containing Materials.

1.2.2 Amended Water

Water containing a wetting agent or surfactant with a maximum surface tension of 0.00042 psi.

1.2.3 Area Sampling

Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.2.4 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content of the material is determined to be at least one percent.

1.2.5 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

1.2.6 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.2.7 Asbestos Permissible Exposure Limit

0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.

1.2.8 Authorized Person

Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

1.2.9 Background

The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

1.2.10 Competent Person (CP)

A person meeting the requirements for competent person as specified in

29 CFR 1926.1101 including a person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, and is specifically trained in a training course which meet the criteria of EPA's Model Accreditation Plan (40 CFR 763) for project designer or supervisor, or its equivalent. The competent person must have a current State of Montana asbestos contractors or supervisors license.

1.2.11 Contractor

The Contractor is that individual, or entity under contract to perform the herein listed work.

1.2.12 Disposal Bag

A 6 mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101, used for transporting asbestos waste from containment to disposal site.

1.2.13 Disturbance

Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in one standard sized glovebag or waste bag, not larger than 60 inches in length and width in order to access a building component.

1.2.14 Friable Asbestos Material

A term defined in 40 CFR 61-SUBPART M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

1.2.15 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters must retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

1.2.16 Model Accreditation Plan (MAP)

USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763.

1.2.17 Negative Pressure Enclosure (NPE)

That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.

1.2.18 NESHAP

National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61-SUBPART M.

1.2.19 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, removal, or mishap.

1.2.20 Permissible Exposure Limits (PELs)

1.2.20.1 PEL-Time Weighted Average (TWA)

Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8-hour time weighted average (TWA).

1.2.20.2 PEL-Excursion Limit

An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

1.2.21 Personal Sampling

Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

1.2.22 Private Qualified Person (PQP)

That qualified person hired by the Contractor to perform the herein listed tasks.

1.2.23 Qualified Person (QP)

A Certified Industrial Hygienist, consultant or other qualified person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan as described in 40 CFR 763 as a Building Inspector, or Contractor/Supervisor Abatement Worker; and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The QP must be qualified to perform visual inspections. The QP must be appropriately licensed/certified in the State of Montana.

1.2.24 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

1.2.25 Wetting Agent

A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 0.00042 psi.

1.2.26 Worker

Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required

by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation, if required by the OSHA Class of work to be performed or by the state where the work is to be performed. The worker must be appropriately licensed/certified in the State of Montana.

1.3 REQUIREMENTS

1.3.1 Description of Work

The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures must be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification. The asbestos work includes the removal of electrical wiring with asbestos insulation, and as optional work, removal of asbestos packing associated with the penstocks. Under normal conditions non-friable or chemically bound materials containing asbestos would not be considered hazardous; however, this material may release airborne asbestos fibers during removal and therefore must be handled in accordance with the removal and disposal procedures as specified herein. Provide control techniques as outlined in this specification. A competent person must supervise asbestos removal work as specified herein.

1.3.2 Unexpected Discovery of Asbestos

Notify the Contracting Officer if any previously untested building components suspected to contain asbestos are impacted by the work.

1.3.3 Medical Requirements

Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.

1.3.3.1 Medical Examinations

Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract.

1.3.3.2 Medical Records

Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 50 years after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.

1.3.4 Employee Training

Submit certificates, prior to the start of work, indicating that the employee has received training in the proper handling of materials and

wastes that contain asbestos; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as indicated in 29 CFR 1926.1101 on an initial and annual basis. Workers who will handle and remove asbestos materials shall be provided training that contains the following information at a minimum: locations of ACM for this project; recognition of ACM damage and deterioration; prohibition of work practices such as grinding, abrading or pulverizing; instruction on actions to take if dust is present (cleaning with a HEPA-equipped vacuum or wet wiping); and methods for handling, packaging and disposal of the removed asbestos-containing materials. Train personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. Electricians who will be involved in disconnecting or removing asbestos-containing wiring or panel components shall have appropriate asbestos training. Document the training by providing: dates of training, training entity, and names of instructors. Furnish each employee with respirator training and fit testing administered by the Contractor as required by 29 CFR 1926.1101 and 29 CFR 1926.103. Asbestos workers must have a current State of Montana asbestos worker's license/certificate.

1.3.5 Notifications

Prior to the start of work, furnish notification of asbestos-related actions required by Federal, State, regional, and local authorities. Notify the State's environmental protection agency and the Contracting Officer in writing 10 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M and State regulations.

1.3.6 Environment, Safety and Health Compliance

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of EM 385-1-1, 29 CFR 1926.1101, 40 CFR 61-SUBPART A, and 40 CFR 61-SUBPART M. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Government apply. The following rules and regulations regarding asbestos materials apply:

MCA 75-2-501 et seq.

Administrative Rules of Montana 17.74.301-405

1.3.7 Respiratory Protection Program

Establish and implement a respirator program as required by 29 CFR 1926.1101, and 29 CFR 1926.103. Submit a written description of the program to the Contracting Officer.

1.3.7.1 Respirator Program Records

Submit records of the respirator program as required by 29 CFR 1926.103, and 29 CFR 1926.1101.

1.3.7.2 Respirator Fit Testing

The Contractor must conduct a qualitative or quantitative fit test conforming to 29 CFR 1926.103 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test must be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test must be performed. Functional fit checks must be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.3.7.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by 29 CFR 1926.1101 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators must be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter must be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type must be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered.

1.3.8 Asbestos Hazard Control Supervisor

The Contractor must be represented on site by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

1.3.9 Hazard Communication

Adhere to all parts of 29 CFR 1926.59 and provide the Contracting Officer with a copy of the Safety Data Sheets (SDS) for all materials brought to the site.

1.3.10 Asbestos Hazard Abatement Plan

Submit a plan describing the safety precautions such as lockout, tagout, tryout, and work procedures to be used in the removal of materials containing asbestos. The plan, not to be combined with other plans, must be prepared and signed by the Contractor. The plan must include but not be limited to the precise personal protective equipment to be used, the location of asbestos control areas, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, locations of any local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan must also include (both fire and medical emergency) response plans and an Activity Hazard Analyses (AHAs) in accordance with EM 385-1-1. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work. The Contractor, Asbestos Hazard Control Supervisor, CP and PQP must meet with the Contracting Officer prior to beginning work, to discuss in

detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan must be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to starting work.

1.3.11 Testing Laboratory

Submit the name, address, and telephone number of each testing laboratory selected for the analysis, and reporting of airborne concentrations of asbestos fibers along with certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis. The testing laboratory firm must be independent of the asbestos contractor and must have no employee or employer relationship which could constitute a conflict of interest.

1.3.12 Landfill Approval

Submit written evidence that the landfill is approved for asbestos disposal by the state regulatory agencies. Within three working days after delivery, submit detailed delivery tickets, prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the waste shipment records within three days of the shipment leaving the project site.

1.3.13 Transporter Certification

Submit written evidence that the transporter is approved to transport asbestos waste in accordance with the DOT requirements of 49 CFR 171, 49 CFR 172 and 49 CFR 173 as well as registration requirements of 49 CFR 107 and all other State and local regulatory agency requirements.

1.3.14 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification 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

Safety Data Sheets (SDS) for All Materials; G, PO

Respirators; G, PO

Local Exhaust Equipment; G, PO

Vacuums; G, PO

SD-06 Test Reports

Air Sampling Results; G, PO

Clearance Sampling; G, PO

SD-07 Certificates

Employee Training; G, PO

Notifications; G, PO

Respiratory Protection Program; G, PO

Asbestos Hazard Abatement Plan; G, PO

Testing Laboratory; G, PO

Landfill Approval; G, PO

Delivery Tickets; G, PO

Waste Shipment Records; G, PO

Medical Certification; G, PO

Private Qualified Person Documentation; G, PO

Designated Competent Person; G, PO

Worker's License; G, PO

Contractor's License; G, PO

Vacuums; G, PO

SD-11 Closeout Submittals

Respirator Program Records; G, PO

1.5 QUALITY ASSURANCE

1.5.1 Private Qualified Person Documentation

Submit the name, address, and telephone number of the Private Qualified Person (PQP) selected to direct air monitoring, and documented evidence that the PQP has successfully completed training in and is accredited and where required is certified as, a Building Inspector, or Contractor/Supervisor as described by 40 CFR 763 and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent.

The PQP and the asbestos contractor must not have an employee/employer relationship or financial relationship which could constitute a conflict of interest. The PQP must be a first tier subcontractor.

1.5.2 Competent Person Documentation

The Competent Person must be experienced in the administration and supervision of asbestos abatement projects including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, and notification of other employees onsite. The Designated Competent Person must be on-site at all times when asbestos activities are underway. Submit training certification and a current State of Montana Asbestos Contractor's and Supervisor's License. Submit evidence that the Designated Competent Person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA designated competent person requirements.

1.5.3 Worker's License

Submit documentation that workers meet the requirements of 29 CFR 1926.1101, 40 CFR 61-SUBPART M and have a current State of Montana Asbestos Workers License/Certificate.

1.5.4 Contractor's License

Submit a copy of the asbestos contractor's license issued by the State of Montana. Submit the following certification along with the license: "I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61-SUBPART MEM 385-1-1, and the Federal, State and local requirements for those asbestos abatement activities that they will be involved in." This certification statement must be signed by the Company's President or Chief Executive.

1.5.5 Air Sampling Results

Complete fiber counting and provide results to the PQP for review within

16 hours of the "time off" of the sample pump. Notify the Contracting Officer immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Contracting Officer and the affected Contractor employees where required by law within three working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the PQP.

1.5.6 Preconstruction Conference

Conduct a safety preconstruction conference to discuss the details of the Asbestos Hazard Abatement Plan, and Accident Prevention Plan (APP) including the AHAs required in specification Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. The safety preconstruction conference must include the Contractor and their Competent Person, Project Supervisor and the Contracting Officer. Deficiencies in the APP will be discussed. Onsite work must not begin until the APP has been accepted.

1.6 SECURITY

Barriers to prevent unauthorized entry must be provided for each asbestos control area. A log book must be kept documenting entry into and out of the asbestos control area. Entry into asbestos control areas must only be by personnel authorized by the Contractor and the Contracting Officer. Personnel authorized to enter asbestos control areas must be trained, medically evaluated, and wear the required personal protective equipment.

PART 2 PRODUCTS

2.1 DUCT TAPE

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container.

2.2 DISPOSAL CONTAINERS

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers must be provided for ACM wastes as required by 29 CFR 1926.1101. Disposal containers can be in the form of:

- a. Disposal Bags
- b. Fiberboard Drums
- c. Cardboard Boxes

2.3 SHEET PLASTIC

Sheet plastic must be polyethylene of 6 mil minimum thickness and must be provided in the largest sheet size necessary to minimize seams. Film must conform to ASTM D4397, except as specified below

2.4 WETTING AGENTS

Removal encapsulant (a penetrating encapsulant) must be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant must be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water.

PART 3 EXECUTION

3.1 EQUIPMENT

Provide the Contracting Officer or the Contracting Officer's Representative, with at least two complete sets of personal protective equipment as required for entry to and inspection of the asbestos control area. Provide equivalent training to the Contracting Officer or a designated representative as provided to Contractor employees in the use of the required personal protective equipment.

3.1.1 Air Monitoring Equipment

The Contractor's PQP must approve air monitoring equipment. The equipment must include, but must not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute.
- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps must also be equipped with an automatic flow control unit which must maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.
- c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.
- d. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

3.1.2 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

3.1.2.1 Respirators for Handling Asbestos

Provide personnel engaged in removal of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101 and 29 CFR 1926.103.

3.1.3 Exterior Whole Body Protection

3.1.3.1 Outer Protective Clothing

Provide personnel exposed to asbestos with disposable "non-breathable," whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort,

but must not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape.

3.1.3.2 Eye Protection

Provide eye protection that complies with ANSI/ISEA Z87.1 when operations present a potential eye injury hazard. Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.

3.1.4 Regulated Areas

All Class I, II, and III asbestos work must be conducted within regulated areas. The regulated area must be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

3.1.5 Load-out Unit

As needed, provide a temporary load-out unit that is adjacent and connected to the regulated area and access tunnel. Attach the load-out unit in a leak-tight manner to each regulated area.

3.1.6 Warning Signs and Labels

Provide warning signs at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to the requirements are acceptable

3.1.6.1 Warning Sign

Provide vertical format conforming to 29 CFR 1926.200, and 29 CFR 1926.1101 minimum 20 by 14 inches displaying the following legend in the lower panel:

| <u>Legend</u> | <u>Notation</u> |
|------------------------|-------------------------------------|
| DANGER | one inch Sans Serif Gothic or Block |
| ASBESTOS | one inch Sans Serif Gothic or Block |
| MAY CAUSE CANCER | one inch Sans Serif Gothic or Block |
| CAUSES DAMAGE TO LUNGS | 1/4 inch Sans Serif Gothic or Block |

| <u>Legend</u> | <u>Notation</u> |
|--|-------------------------------------|
| AUTHORIZED PERSONNEL ONLY | 1/4 inch Sans Serif Gothic or Block |
| [WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA] | 1/4 inch Sans Serif Gothic or Block |

Spacing between lines must be at least equal to the height of the upper of any two lines.

3.1.6.2 Warning Labels

Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

| |
|---|
| DANGER |
| CONTAINS ASBESTOS FIBERS |
| MAY CAUSE CANCER |
| CAUSES DAMAGE TO LUNGS |
| DO NOT BREATHE DUST AVOID CREATING DUST |

3.1.7 Local Exhaust System

If appropriate, provide a local exhaust system in the asbestos control area in accordance with ASSP Z9.2 and 29 CFR 1926.1101 that will provide at least four air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the asbestos control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the control area of minus 0.02 inch of water column relative to adjacent, unsealed areas. The building ventilation system must not be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment must conform to ASSP Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

3.1.8 Tools

Vacuums must be leak proof to the filter and equipped with HEPA filters. Filters on vacuums must conform to ASSP Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse. Reusable tools must be thoroughly decontaminated prior to being removed from the regulated areas.

3.1.9 Rental Equipment

If rental equipment is to be used, furnish written notification to the

rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

3.1.10 Single Stage Decontamination Area

A decontamination area (equipment room/area) must be provided for Class I work involving less than 25 feet or 10 square feet of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment. The equipment room or area must be adjacent to the regulated area for the decontamination of employees, material, and their equipment which could be contaminated with asbestos. The area must be covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area.

3.1.11 Decontamination Area Exit Procedures

Ensure that the exit procedures identified in the approved Asbestos Hazard Abatement Plan are followed.

- a. Before leaving the regulated area, remove all gross contamination and debris from work clothing using a HEPA vacuum.

3.2 WORK PROCEDURE

Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, and as specified herein. Use wet removal procedures and control techniques as described in the approved Asbestos Hazard Abatement Plan. Wear and utilize protective clothing and equipment as specified herein. No eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics is permitted in the asbestos work or control areas. Personnel of other trades not engaged in the removal of asbestos containing material must not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection and training provisions of this specification are complied with by the trade personnel. Power to the regulated area must be locked-out and tagged in accordance with 29 CFR 1910.147. Disconnect electrical service when wet removal is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection prior to the use of any water. All electrical work must be performed by a licensed electrician. If an asbestos fiber release or spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the Contracting Officer including clearance sampling, prior to resumption of work.

3.2.1 Building Ventilation System and Critical Barriers

Building ventilation system supply and return air ducts in a regulated area must be isolated by airtight seals to prevent the spread of contamination throughout the system. The airtight seals must consist of a minimum of 2 layers of polyethylene. Edges to wall, ceiling and floor surfaces must be sealed with industrial grade duct tape.

- a. A Competent Person must supervise the work.

- b. For indoor work, critical barriers must be placed over all openings to the regulated area.
- c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

3.2.2 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it must be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the PQP work may proceed at the discretion of the Contracting Officer.

3.2.3 Asbestos Control Area Requirements

3.2.3.1 Regulated Area for Class II Removal

Establish designated limits for the asbestos regulated work area with the use of red barrier tape; install critical barriers, splash guards and signs, and maintain all other requirements for asbestos control area except local exhaust. Place impermeable dropcloths on surfaces beneath removal activity extending out 3 feet in all directions. A detached decontamination system may be used. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.4 Removal Procedures

Wet asbestos material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 6 mil plastic disposal bags or other appropriate disposal containers as described in the approved Asbestos Hazard Abatement Plan. Remove asbestos containing material in a gradual manner, with continuous application of the amended water or wetting agent in such a manner that no asbestos material is disturbed prior to being adequately wetted. Containerize asbestos containing material while wet. Do not allow asbestos material to accumulate or become dry. Lower and otherwise handle asbestos containing material as indicated in 40 CFR 61-SUBPART M.

3.2.5 Methods of Compliance

3.2.5.1 Mandated Practices

The specific work and removal techniques and items identified must be detailed in the Contractor's AHAP. Use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

- a. Vacuum cleaners equipped with HEPA filters.

- b. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.
- c. Prompt clean-up and disposal.
- d. Inspection and repair of polyethylene.
- e. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

3.2.5.2 Control Methods

Use the following control methods:

- a. Local exhaust ventilation equipped with HEPA filter;
- b. Enclosure or isolation of processes producing asbestos dust;
- c. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, use them to reduce employee exposure to the lowest levels attainable and must supplement them by the use of respiratory protection.

3.2.5.3 Unacceptable Practices

The following work practices must not be used:

- a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- b. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- c. Dry sweeping, shoveling, or other dry clean up.
- d. Employee rotation as a means of reducing employee exposure to asbestos.

3.2.6 Class II Work Procedures

In addition to the requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

- a. A Competent Person must supervise the work.
- b. For indoor work, critical barriers must be placed over all openings to the regulated area.
- c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

3.2.7 Air Sampling

Perform sampling of airborne concentrations of asbestos fibers in accordance with 29 CFR 1926.1101, the Contractor's air monitoring plan and as specified herein. Sampling performed in accordance with

29 CFR 1926.1101 must be performed by or under the direction of the PQP. Sampling performed for environmental and quality control reasons must be performed by the PQP. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate. Results of breathing zone samples must be posted at the job site and made available to the Contracting Officer. Submit all documentation regarding initial exposure assessments, negative exposure assessments, and air-monitoring results.

3.2.7.1 Sampling During Asbestos Work

The PQP must provide personal and area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Breathing zone samples must be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Air sample fiber counting must be completed and results provided within 24-hours (breathing zone samples), and 48 hours (environmental/clearance monitoring) after completion of a sampling period. The written results must be signed by testing laboratory analyst, testing laboratory principal and the Contractor's PQP. The air sampling results must be documented on a Contractor's daily air monitoring log.

3.2.7.2 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH NMAM Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, must be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) must be confirmed from that same filter using NIOSH NMAM Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning must be repeated at the Contractor's expense. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria must be done at the Contractor's expense.

3.2.7.3 Sampling After Final Clean-Up (Clearance Sampling)

Provide area sampling of asbestos fibers and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean-up but before removal of the enclosure or the asbestos work control area. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the PQP must perform a visual inspection to ensure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris and document the results. The asbestos fiber counts from these samples must be less than 0.01 fibers per cubic centimeter or be not greater than the background, whichever is greater. Should any of the final samples indicate a higher value take appropriate actions to re-clean the area and repeat the sampling and analysis at the Contractor's expense.

3.2.7.4 Air Clearance Failure

If clearance sampling results fail to meet the final clearance

requirements, pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

3.2.8 Site Inspection

While performing asbestos engineering control work, the Contractor must be subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation must be at the Contractor's expense.

3.3 CLEAN-UP AND DISPOSAL

3.3.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will attest that the area is safe before the signs can be removed. The Contracting Officer will visually inspect all surfaces within the work area for residual material or accumulated dust or debris. The Contractor must re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer must agree that the area is safe in writing before unrestricted entry will be permitted. The Government must have the option to perform monitoring to determine if the areas are safe before entry is permitted.

3.3.2 Responsibility for Materials

All waste materials, except as specified otherwise, become the responsibility of the Contractor and must be disposed of as specified in applicable local, State, and Federal regulations and herein.

3.3.3 Disposal of Asbestos

3.3.3.1 Procedure for Disposal

Coordinate all waste disposal manifests/waste shipment records with the Contracting Officer and Project Environmental Compliance Coordinator. The Contractor shall prepare the disposal documents and such documents will be signed by the Project Environmental Compliance Coordinator. Collect asbestos waste, contaminated waste water filters, asbestos contaminated water, scrap, debris, bags, containers, equipment, and any asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 6 mils thick bags with the approved warnings and DOT labeling

preprinted on the bag. Clearly indicate on the outside of each container the name of the waste generator and the location at which the waste was generated. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be assigned by the Contracting Officer or his authorized representative. Comply with 40 CFR 61-SUBPART M, State, regional, and local standards for hauling and disposal. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags must remain in the drum and the entire contaminated drum must be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums must wear appropriate personal protective equipment when handling asbestos materials at the disposal site.

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SECTION 02 83 00

LEAD IN CONSTRUCTION

PART 1 GENERAL

Painted surfaces in the work area where mechanical equipment and associated systems will be refurbished, removed, and/or replaced are anticipated to be coated with lead-based paint and/or lead-containing paint. Where project activities will disturb or remove paint, follow appropriate procedures identified in this section. Ensure that workers are protected from any exposure to airborne lead particulate and that no loose paint contaminates the environment. Collect any lead-based paint waste generated when paint is disturbed, or painted items that are identified for proper disposal in accordance with this section and applicable regulations. Any painted metal items identified for disposal can be disposed at a recycler authorized to recycle scrap metal, with notification to the recycler of the presence of lead paint.

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)

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

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

| | |
|----------------|--|
| 29 CFR 1926.21 | Safety Training and Education |
| 29 CFR 1926.59 | Hazard Communication |
| 29 CFR 1926.62 | Lead |
| 40 CFR 260 | Hazardous Waste Management System: General |
| 40 CFR 261 | Identification and Listing of Hazardous Waste |
| 40 CFR 262 | Standards Applicable to Generators of Hazardous Waste |
| 40 CFR 263 | Standards Applicable to Transporters of Hazardous Waste |
| 40 CFR 264 | Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities |
| 40 CFR 265 | Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities |

| | |
|------------|--|
| 40 CFR 268 | Land Disposal Restrictions |
| 49 CFR 172 | Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements |
| 49 CFR 178 | Specifications for Packagings |

1.2 DEFINITIONS

1.2.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period.

1.2.2 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of leadhazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard.

1.2.3 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead to which an employee is exposed, averaged over an 8-hour workday as indicated in 29 CFR 1926.62.

1.2.4 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.5 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

1.2.6 Lead-Based Paint (LBP)

Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.

1.2.7 Lead Control Area

A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel.

1.2.8 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

PEL (micrograms/cubic meter of air) = 400/No. hrs worked per day

1.2.9 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

1.2.10 Personal Sampling

Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples must be representative of the employees' work tasks. Breathing zone must be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

1.2.11 Physical Boundary

Area physically roped or partitioned off around leadcontrol area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

Construction activities impacting PWL or material containing lead which are covered by this specification include the removal and disposal of lead paint coated items and/or paint waste resulting from disturbance of painted surfaces. If existing paint is disturbed, flaking or deteriorated, ensure the collection and proper disposal of loose paint and associated debris. The work covered by this section includes work tasks and the precautions specified in this section for the protection of area occupants and the environment during and after the performance of the removal and disposal activities.

1.3.1 Protection of Existing Areas To Remain

Project work including, but not limited to, lead hazard work, storage, transportation, and disposal must be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, restore work and areas to the original condition.

1.3.2 Coordination with Other Work

Coordinate with work being performed in adjacent areas to ensure there are no exposure issues. Explain coordination procedures in the Lead Compliance Plan and describe how the Contractor will prevent lead exposure to other contractors and Government personnel performing work unrelated to lead activities.

1.3.3 Sampling and Analysis

If air sampling is performed, submit a log of the analytical results from sampling conducted during the abatement. Keep the log of results current with project activities and brief the results to the Contracting Officer as analytical results are reported.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification 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

Competent Person Qualifications; G, PO

Lead Waste Management Plan; G, PO

Lead Compliance Plan; G, PO

Written Evidence of TSD Approval; G, PO

SD-06 Test Reports

Sampling and Analysis; G, PO

Sampling Results; G, PO

SD-11 Closeout Submittals

Hazardous Waste Manifest; G, PO

Turn-In Documents or Weight Tickets; G, PO

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph COMPETENT PERSON (CP) RESPONSIBILITIES. Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead and exposure reduction methods to protect employee health. Demonstrate a minimum of 2 years experience implementing OSHA's Lead in Construction standard (29 CFR 1926.62). Submit proper documentation that the CP is trained in accordance with federal

regulations.

1.5.1.2 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform any air analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis must be OSHA approved.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.
- c. Continuously inspect LBP/PWL or MCL work for conformance with the approved plan.
- d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.
- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

1.5.2.2 Lead Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of lead, LBP/PWL or MCL. Include in the plan a the location, size, and details of lead control areas, and physical boundaries. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of leadrelated work, collected waste water and dust containing lead and debris, air sampling, personal protective equipment, and a detailed description of the method of control of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, and cleanup procedures. Include any occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform

affected employees and to clarify responsibilities to control exposures.

1.5.2.3 Training

Train each employee performing work that disturbs lead who performs LBP/MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, and 29 CFR 1926.62

1.5.2.4 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

1.5.2.5 Lead Waste Management

The Lead Waste Management Plan must comply with applicable requirements of federal, State, and local hazardous waste regulations and address:

- a. Identification and classification of wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact.
- d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented.
- g. Work plan and schedule for waste removal and disposal. Clean up wastes daily.

1.5.2.6 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead. Comply with the applicable requirements of the current issue of 29 CFR 1926.62, and EM 385-1-1. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirements apply. 1.5.3 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

1.6 PROJECT/SITE CONDITIONS

1.6.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

- a. Notify the Contracting Officer 20 days prior to the start of any lead work.

3.1.1.2 LeadControl Area

- a. Physical Boundary - Provide physical boundaries around the lead, cadmium, chromium control area by roping off the area designated in the work plan to ensure that lead will not escape outside of the lead control area. Prohibit the general public from accessing the lead control areas.
- b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs must comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Personnel Protection

Personnel must wear and use protective clothing and equipment as specified in the Lead Compliance Plan. Eating, smoking, or drinking or application of cosmetics is not permitted in the leadcontrol area. No one will be permitted in the leadcontrol area unless they have been appropriately trained and provided with protective equipment.

3.2 APPLICATION

3.2.1 Lead Work

Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62 and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

3.3.1.1 Air Sampling

If required by the approved Lead Compliance Plan, conduct sampling for lead in accordance with 29 CFR 1926.62. Air and wipe sampling must be directed or performed by the CP.

- a. If personal air samples are required, collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP.
- b. Submit results of air samples, signed by the CP, within 72-hours after the air samples are taken.

3.3.1.2 Testing of Material Containing Lead Residue

Test any residue in accordance with 40 CFR 261 for hazardous waste.

3.4 CLEANING AND DISPOSAL

3.4.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area.

3.4.2 Disposal

- a. Dispose of material, whether hazardous or non-hazardous in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
- b. Contractor is responsible for segregation of waste. Collect lead contaminated waste, scrap, debris, bags, containers, equipment, and any lead, cadmium, chromium contaminated clothing that may produce airborne concentrations of lead particles. For any hazardous waste such as loose paint, label the containers in accordance with 29 CFR 1926.62, and 40 CFR 261, 40 CFR 262 and corresponding state regulations.
- c. Dispose of lead contaminated material classified as hazardous waste at an EPA or State approved hazardous waste treatment, storage, or disposal facility off Government property.
- d. Accumulate loose paint and debris waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums or appropriately sized container for smaller volumes. Properly label each drum to identify the type of hazardous material (49 CFR 172). For hazardous waste, the collection container requires marking/labeling in accordance with 40 CFR 262 and corresponding state regulations during the accumulation/collection timeframe. The

Contracting Officer or an authorized representative will assign an area for accumulation of waste containers.

- e. Handle, store, transport, and dispose lead or lead contaminated waste that is considered to be hazardous in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- f. All lead waste generation, management, and disposal will be coordinated with the project environmental POC.

3.4.2.1 Disposal Documentation

Coordinate all disposal or off-site shipments of lead waste with the project environmental POC. Submit written evidence of TSD approval to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Provide a certificate that the waste was accepted by the disposal facility.

Provide turn-in documents or weight tickets for non-hazardous waste disposal.

-- End of Section --

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SECTION 03 60 00.01 26

CONCRETE DEMOLITION AND MINOR REPAIR OF CONCRETE SURFACES

PART 1 GENERAL

1.1 GENERAL INFORMATION

The work covered by this Section consists of furnishing all material, labor, and equipment, and performing all work for installation of concrete anchors and minor concrete repairs associated with the rehabilitation of the butterfly valves. The Contractor is required to provide protection from concrete dust and water damage to existing and new equipment. Take effective measures to control gas, vapor, fumes, dust, slurry and mist during concrete removal operations. Accomplish work described in this Section in accordance with and under limitations stated in these Specifications.

1.2 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

| | |
|-------------------|--|
| ASTM C1107/C1107M | (2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) |
| ASTM C882/C882M | (2013a) Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear |
| ASTM C928/C928M | (2013) Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs |
| ASTM C579 | (2001; R 2012) Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes |
| ASTM C881/C881M | (2015) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete |

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)

| | |
|-------------|--|
| 29 CFR 1910 | Occupational Safety and Health Standards |
| 29 CFR 1926 | Safety and Health Regulations for |

Construction

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

Concrete Imaging Report; G, HDC

1.4 CONCRETE REMOVAL LOCATIONS

Locations of concrete removal areas are as follows:

- a. Hammer-drilled holes for concrete anchors.

PART 2 PRODUCTS

2.1 NON-SHRINK GROUT

Provide non-shrink grout which is inorganic, non-metallic, non-gas-liberating cement-based meeting all requirements of ASTM C1107/C1107M; with a minimum 28-day compressive strength of 5,000 pounds per square inch (psi); and with no shrinkage (0.0 percent) and a maximum 2.0 percent expansion in the hardened state.

2.2 EPOXY ADHESIVE GROUT

Epoxy adhesive grout for use with post installed concrete anchors must be a high strength, two part epoxy adhesive meeting all requirements of ASTM C881/C881M Type IV, Grade 2 and 3; have a minimum compressive strength of 12,000 psi per ASTM C579; and have a seven day cure bond strength of 1,800 psi per ASTM C882/C882M.

2.3 GROUT FOR UNCONFINED CONCRETE REPAIR

Provide commercially available prepackaged grout needing only the addition of water and pea gravel (depending on the size of the repair) and consisting of a commercial formulation suitable for the application proposed and meeting the requirements for ASTM C928/C928M. The use of metallic iron in the grout will not be acceptable.

PART 3 EXECUTION

3.1 GENERAL SAFETY

3.1.1 General

Accomplish all site work in compliance with EM 385-1-1, 29 CFR 1910 and 29 CFR 1926, as applicable.

3.1.2 Electrical Hazards

The work areas may be in proximity of energized electrical equipment.

Formally train and document safety training for all workers required to work in this area. Spray over onto live equipment is hazardous to workers and equipment and is not permitted. Provide Contracting Officer (CO) with signed safety training sheets documenting worker safety training prior to starting work.

3.2 GAS, VAPOR, FUME, DUST, SLURRY AND MIST CONTROL IN POWERHOUSE

Take all necessary measures to effect maximum control of all gases, vapors, fumes, dust, slurry and mists created by Contractor operations under this contract. To the maximum extent possible, remove all dust and dirt by vacuum cleaning and mopping, unless otherwise directed by the CO. The required dust and debris control measures include but are not limited to the following:

- a. Provision of exhaust ducts which discharge outside the powerhouse structure where mechanical ventilation is used. Comply with requirements of 29 CFR 1910.94 and 29 CFR 1926.57 for ventilation systems.
- b. Controlled operation of power-driven tools.
- c. Providing and removal of approved dust preventatives in areas that cannot be properly rendered free from excessive dusting by vacuum cleaning and mopping or other methods.
- d. Vacuum cleaning and mopping (or other acceptable method) of spaces within the powerhouse where dust accumulates.
- e. Only air, electrical, propane, or battery-driven equipment may be used inside the powerhouse.
- f. Keep all doors closed when not in use.
- g. Do not block doors for extended periods unless agreed upon in writing by the CO.
- h. Methods to prevent exposure of employees to inhalation, ingestion, skin absorption, or contact with any material or substance at concentrations above those specified in 29 CFR 1910.1000, 29 CFR 1926.55 and 29 CFR 1926.58.

3.3 TEMPORARY BARRIER

Construct temporary barriers for the control of dust and debris as required by the CO.

3.4 REMOVAL METHOD

No concrete demolition work is anticipated on this project, excluding concrete anchor installation.

3.4.1 Research of Embedded Items and Concrete Imaging

Prior to drilling into any concrete, such as for installation of concrete anchors, scan the concrete in the affected area using Ground Penetrating Radar (GPR). Mark the locations of embedded items identified on the surface of the concrete in the affected vicinity in a non-permanent method. Adjust the drill locations to avoid any embedded items, such as

reinforcing steel, ground wires, conduit, etc.

Submit a Concrete Imaging Report for approval prior to the start of work. At a minimum, include the following in the report:

- a. Description of the findings.
- b. Proposed penetration location and purpose of penetration.
- c. Show the proposed concrete to be removed on a dimensioned concrete outline drawing of the area.
- d. Photo or sketch showing:
 - (1) Embedded Items.
 - (2) Proposed penetration location.
 - (3) Dimensions.

3.4.2 Disposal Of Waste Water And Concrete Debris

Use a method in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces that does not stain, discolor, or affect exposed surfaces of the structure and does not allow waste water to enter the river or reservoir. As some Project drains lead to the river, do not dispose of waste water in Government drains. Dispose of waste water in accordance with all applicable local, state, and federal requirements. Do not allow debris to enter the river or reservoir.

3.4.3 Repair Of Concrete Surfaces

Repair and restore concrete surfaces using a Government approved method. Repair any anchor holes made in concrete which are to be abandoned following completion of work with non-shrink grout.

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ULTRASONIC INSPECTION

PART 1 GENERAL

1.1 GENERAL INFORMATION

This section contains the requirements for measuring and recording the thicknesses of the pipes at the locations shown on Contract Drawing S-101 .

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 SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

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

Personnel Qualification; G, HDC

Inspection Plan; G, HDC

SD-03 Product Data

Ultrasonic Equipment; G, HDC

Couplant; G, HDC

SD-06 Test Reports

Equipment Qualifications; G, HDC

Inspection Report; G, HDC

1.4 QUALITY ASSURANCE

1.4.1 Personnel Qualification

Personnel performing NDT are to be qualified in accordance with ANSI/ASNT CP-189 and be a current level II or III. If a Level III will be performing the inspection, a Level II Practical Examination (conducted within the last three years) is required in addition to the Level III certification. Submit level II qualification/certification documentation in a format similar to Appendix C: Sample Certification Form ANSI/ASNT CP-189. Submit qualifying level III certification as provided by ASNT.

1.4.2 Equipment Qualifications

Using reference standards to calibrate the inspection equipment, test its operating condition, and record the sensitivity or response of the equipment during the inspection. Provide the standard reference block or primary standard consisting of the IIW block in AWS D1.1/D1.1M.

1.5 INSPECTION PLAN

Submit an inspection plan a minimum of 60 days prior to performing the work. The inspection plan must describe all aspects of the inspection such as access, execution, and reporting. Measure and record the pipe thickness and location at each point as shown on the Contract Drawings. Include the following, at a minimum, in the inspection plan:

- a. Ultrasonic equipment and transducer make, model, and serial number.
- b. Ultrasonic equipment calibration certificate; calibrated within one year of the date equipment will be used onsite.
- c. Means of access around the full perimeter of the penstocks.
- d. Inspection Procedure, to include means and methods used to verify location from within the penstocks.
- e. Template(s) for reporting field measurements.

1.6 INSPECTION REPORT

Submit the inspection report within 14 days following the completion of the inspection. Compare the measured thickness against the nominal thickness shown on the reference drawings. Explicitly identify locations where the measured thickness deviates +/- 10 percent from the nominal thickness. The inspection report is to include, at a minimum, the following items:

- a. A brief narrative describing the inspection and procedures used. Identify any deviations from the approved Inspection Plan.
- b. Field measurements using the approved reporting templates.
- c. Pertinent inspection photos.
- d. Drawings, sketches, or other supplementary information.

PART 2 PRODUCTS

2.1 ULTRASONIC EQUIPMENT

Provide ultrasonic equipment that is the pulse-echo straight beam type. The transducer is to be 1 to 1-1/8 inch in diameter or 1 inch square. A nominal test frequency of 2-1/4 MHz is recommended. The ultrasonic test instruments must be able to generate, receive, and to present pulses in the frequency range from 1 to 10 megahertz (MHz). Conduct the examination using a frequency and instrument adjustment that will produce a minimum 50 to a maximum 75 percent of full scale reference back reflection from the opposite side of a sound area of the plate.

2.1.1 Couplant

Use a suitable couplant such as water, soluble oil, or glycerin.

PART 3 EXECUTION

3.1 PREPARATION OF MATERIALS FOR INSPECTION

Surfaces to be scanned must be clean and smooth. Remove all loose scale, rust, dirt, and other foreign material from the coupling surface that might disrupt the signal. Do not remove the existing paint coating system.

3.2 EQUIPMENT CALIBRATION

Calibrate equipment in accordance with Part 1.4.2 Equipment Qualifications at the start of each shift.

3.3 INSPECTION PROCEDURE

Perform the inspection in accordance with the approved Inspection Plan. Any deviations must be approved by the Contracting Officer.

-- End of Section --

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-- End of Section Table of Contents --

SECTION 05 05 23.17 26

WELDING (STEEL), FABRICATION, AND MACHINE WORK

PART 1 GENERAL

This Section covers general workmanship requirements, applicable to the fabrication and inspection of various items of metalwork and machine work, which includes but is not limited to the butterfly valve operator (actuator) housing, hydraulic power unit (HPU) skid, mounting brackets, structural supports, structural members where power piping does not apply and is not explicitly called out to follow ASME Boiler Pressure Vessel Code, and miscellaneous steel structures such as ladders, platforms, guardrails, and hatch modifications. This Section also covers the Unit 4 and Unit 5 penstock butterfly valve weld inspections and repairs. These requirements are in addition to those contained in the specification Sections covering the specific items of work or as shown.

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

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A3.0M/A3.0 (2020) Standard Welding Terms and Definitions

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B4.1 (1967; R 1994; R 2004; R 2009; R 2020) Preferred Limits and Fits for Cylindrical Parts

ASME B46.1 (2020) Surface Texture, Surface Roughness, Waviness and Lay

ASTM INTERNATIONAL (ASTM)

| | |
|-------------------|---|
| ASTM A123/A123M | (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A780/A780M | (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| ASTM E165/E165M | (2018) Standard Practice for Liquid Penetrant Examination for General Industry |
| ASTM E709 | (2015) Standard Guide for Magnetic Particle Examination |
| ASTM F2329 | (2013) Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners |
| ASTM F3125/F3125M | (2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength |

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

| | |
|-----------|--|
| RCSC S348 | (2014; Errata 2015) RCSC Specification for Structural Joints Using High-strength Bolts |
|-----------|--|

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

Fabricator's Welding Quality Control Plan; G, EC, HDC

Witness Points; G, EC, HDC

Welding Procedure Specifications (WPS); G, EC, HDC

Procedure Qualification Records (PQR); G, EC, HDC

Welder Performance Qualification Records (WPQR); G, EC, HDC

Butterfly Valve Weld Repair Plan; G, HDC

SD-03 Product Data

Nonconformance Reports; G, EC, HDC

Pre-Qualified Welding Procedures; G, EC, HDC

Welding Electrodes and Rods; G

Shielding Gas; G

SD-06 Test Reports

Test and Inspection Report; G, EC, HDC

NDT Equipment Calibration Records

SD-07 Certificates

Inspector Qualifications; G, EC

1.3 DEFINITIONS AND SYMBOLS

Use symbols in accordance with AWS A2.4 terms and definitions in accordance with AWS A3.0M/A3.0, unless otherwise indicated.

1.4 QUALITY ASSURANCE

1.4.1 Fabricator's Welding Quality Control Plan

Before the start of work, submit a Fabricator's Welding Quality Control Plan for approval. Ensure the plan describes the methods, equipment, and procedures utilized to ensure quality control including but not limited to material tracking, weld tracking, NDT equipment calibration, non-conformance reports, weld repair, and inspection witness points.

1.4.1.1 NDT Equipment Calibration Records

Submit NDT Equipment Calibration Records for all NDT equipment used by both the fabricator and any subcontractors performing NDT.

1.4.1.2 Inspection Witness Points

Establish Witness Points for the necessary QA Inspections and prepare a detailed schedule showing the progression of work and completion of components with the Witness Points identified. The extent of completion and details and the date of the QA Inspections will be determined at the Prefabrication Conference by the Government after discussion with the Contractor. Update the inspection witness point schedule weekly and provided by e-mail to the CO. Give the CO two weeks minimum notice prior to the predetermined date for the Initial QA Inspection, including adjustments for changes in schedule.

1.4.2 Welding Procedure Specifications

a. Submit Welding Procedure Specifications (WPS), with supporting Procedure Qualification Records (PQR) and all supporting test documentation on forms similar or equivalent to the sample forms found in AWS D1.1/D1.1M, Annex M for each weld even if the procedure is considered prequalified. Welding Procedure Specifications must be approved by the Government prior to the start of any fabrication and must be individually identified and referenced on the shop drawings.

If a welding procedure is to be qualified by testing, a representative of the Government will witness the test plate welding and the mechanical testing.

b. Approval of any procedure, does not relieve the Contractor of the responsibility for producing a finished weldment meeting all requirements of these specifications. A current Certified Welding Inspector (CWI) must approve all WPS's and PQR's. Keep approved WPS's posted at all work stations where welding is occurring so that the welder, QC staff, and Government QA staff have access to the WPS's. In case of conflict between this specification and applicable requirements in AWS D1.1/D1.1M, this specification governs.

c. Welding procedures for butterfly valve disc and body weld repairs must be qualified to meet minimum Charpy V-Notch Toughness (CVN) requirements in accordance with AWS D1.1/D1.1M. The minimum CVN toughness requirements is 25 ft-lbs at 40 degrees F. Include the passing CVN test report in the submitted PQR clearly detailing the test procedure in conformance with AWS D1.1/D1.1M as well as meeting the minimum required toughness.

1.4.2.1 Previous WPS Qualifications

Welding procedure specifications previously qualified by testing may be accepted for this contract without re-qualification, upon receipt of the test results, if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tack welder qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.4.2.2 Pre-qualified Welding Procedures

Submit Pre-qualified Welding Procedures which comply with AWS D1.1/D1.1M for approval. Submit for approval a listing or an annotated drawing which clearly identifies any joints for which pre-qualified weld procedures will be used.

1.4.2.3 Retests

If welding procedure fails to meet the requirements of AWS D1.1/D1.1M, revise and re-qualify the procedure specification, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1/D1.1M. If the welding procedure is qualified through retesting, submit all test results, including those of test welds that failed to meet the requirements, with the welding procedure.

1.4.3 Welder, Welding Operator, and Tack Welder Qualification

a. Submit Welder Performance Qualification Records (WPQR) for each welder, welding operator, and tack welder to the Government for approval prior to the start of any fabrication. Submit WPQR's on forms

similar or equivalent to the sample forms found in AWS D1.1/D1.1M, Annex M with all pertinent data filled out.

b. Welders, welding operators, and tack welders must be approved by the Government prior to working on this project. Each welder, welding operator, and tack welder assigned to work on this contract must be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M and as specified in this section. Welders, welding operators, and tack welders who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

c. Before assigning any welder, welding operator, or tack welder to work under this contract, submit the names of the welders, welding operators, and tack welders to be employed, and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tack welder is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests.

1.4.3.1 Previous Welding Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tack welders qualified by test within the previous 6 months may be accepted for this contract without re-qualification if all the following conditions are met:

- a. Copies of the Welder Qualification Records are submitted and approved in accordance with the specified requirements.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- d. The welder, welding operator, and tack welder qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.4.3.2 Renewal of Welding Personnel Qualification

Re-qualification of a welder or welding operator is required under any of the following conditions:

- a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.
- b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract.
- d. A tack welder who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and

with the processes for which he/she is qualified, unless there is some specific reason to question the tack welder's ability. In such a case, the tack welder is required to pass the prescribed tack welding test.

e. The Government determines the welder, welding operator, or tack welder's performance is not in conformance with the applicable welding code and/or the contract specifications.

1.4.4 Inspector Qualifications

Submit Inspector Qualifications for approval. Quality control personnel can be assigned to more than one task, provided they are qualified and able to fully perform the duties of each position. Individual(s) responsible for quality assurance/quality control may not serve as or report to production management. If the ability of QC is in doubt, the Government reserves the right to have QC personnel removed from the project.

a. All inspectors, performing weld inspection in accordance with these specifications, must be currently qualified and certified in conformance with AWS QC1. The Contractor must provide an AWS Certified Welding Inspector (CWI) as the primary point of contact for quality control of welding. When several CWI and NDT technicians are working, one primary individual must be designated as having primary responsibility for all quality control in accordance with AWS D1.1/D1.1M and this specification. Non-certified inspectors and certified associate weld inspectors (CAWI) must not be used for inspection under these specifications.

b. All personnel performing Non-Destructive Testing (NDT) must be qualified in accordance with ANSI/ASNT CP-189 and be a current level II or III for each applicable method. In the event that a level III will be performing NDT, a level II practical examination (conducted within the last three years) will be required in addition to the level III qualifications. Submit level II qualification/certification documentation in a format similar to Appendix C: Sample Certification Form ANSI/ASNT CP-189. Submit qualifying level III certification as provided by ASNT.

c. The nondestructive testing of welds and the evaluation of tests as to the acceptability of the welds must be performed by a 3rd party testing agency adequately equipped and competent to perform such services. In either case written approval of the examination procedures is required. Notify the government prior to any testing. The evaluation of examination tests shall be subject to the approval of, and all records shall become the property of, the Government.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all materials and material documentation as per SECTION 05 50 04.00 26, METALS: STRUCTURAL SHOP FABRICATED ITEMS, Section 22 00 00.00 26, BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING, and Section 35 05 40.14 26, HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES

2.2 WELDING EQUIPMENT AND MATERIALS

Provide all welding equipment, welding electrodes and rods, welding wire, shielding gas, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. Provide welding equipment and materials that comply with the applicable requirements of AWS D1.1/D1.1M. Use only filler metals and electrodes with a maximum average diffusible hydrogen rate of 8 ml/100 g of deposited metal (designation H8 or better). Submit product data on welding electrodes and rods and shielding gas.

PART 3 EXECUTION

3.1 FABRICATION

3.1.1 Structural Fabrication

a. Material must be straight before being laid off or worked. If necessary, straighten by methods that will not impair the metal. Sharp kinks or bends are cause for rejection of the material. Make bends by approved dies, press brakes or bending rolls. Finished members must be free of twists, bends, and open joints.

b. Do not commence welding until shop drawings, welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and approved. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved.

c. Where heating is required, take precautions to avoid overheating the metal and allow to slowly cool in still air in a manner that will not adversely impair the original properties of the metal.

d. Cut structural steel to meet the dimensions as required on the approved shop drawings and to obtain an accurate profile with a surface that is smooth and free from cracks and notches. Limit flame cutting to low carbon, non-heat treated steels used for structural applications with the exception of structural bolt hole installation. Approve all other flame cutting prior to use and clearly indicate locations on shop drawings. Shearing must be accurate and all portions of the work neatly finished. Corners must be square and true unless otherwise shown. Fillet re-entrant cuts with a minimum radius of 3/4 inch, unless otherwise approved. Cut steel and fabricate steel plates and splice plates for major structural components so the primary direction of rolling is parallel to the direction of the main tensile or compressive stresses.

e. Break all cut edges and corners with 1/16-inch radius to eliminate sharp edges. Bolts, nuts, and screws must be tight.

3.1.2 Dimensional Tolerances and Alignment for Structural Fabrication

Measure dimensions by an approved measuring system. Submit the measuring system for approval with the work plan. The overall dimensions of an assembled structural unit are required to be within the tolerances indicated on the drawings or as specified for the item of work. Where tolerances are not specified in other Sections of these specifications or shown on drawings, a variation of 1/32 inch is permissible in the overall length of component members with both ends milled and component members

without milled ends are not permitted deviate from the dimensions shown by more than 1/16 inch for members 30 feet or less in length and more than 1/8 inch for members over 30 feet in length based on a structure temperature of 70 degrees F. In all cases, completed members must be free of twists (except as allowed by ASTM standards), bends and open joints. Sharp kinks or sharp bends will be cause for rejection.

For straight structural members other than compression members, the variation in straightness is not permitted to exceed that specified for structural shapes in the applicable ASTM standards.

For straight compression members, the variation in straightness must be equal to or less than 1/1000 of the axial length between points that are to be laterally supported.

For beams that are detailed without specified camber, fabricate the member so that, after erection, any incidental camber due to rolling or shop fabrication is upward.

The accumulation of the mill tolerances and fabrication tolerances must not cause the erection tolerances to be exceeded.

3.1.3 Erection Tolerances

Structures must be erected in such a manner as to be straight and plumb, including individual pieces between splices, unless a member is specifically designed, as shown in design documents, to be other than straight or plumb.

Erection tolerances are defined relative to member working points and working lines, which are defined as follows:

- a. For members other than horizontal members, the member work point is defined as the actual center of the member at each end of the shipping piece.
- b. For horizontal members, the working point is defined as the actual centerline of the top flange or top surface at each end.
- c. The member working line is defined as the straight line that connects the member working points.

For an individual column shipping piece, the angular variation of the working line from a plumb line must be equal to or less than 1/500 of the distance between working points.

For a member that consists of an individual, straight shipping piece and that is a segment of a field assembled unit containing field splices between points of support, the plumbness, elevation and alignment will be acceptable if the angular variation, vertically and horizontally, of the working line from a straight line between points of support is equal to or less than 1/500 of the distance between working points.

3.1.4 WELDING OPERATIONS

3.1.4.1 Welded Connections

Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Do not begin welding

until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and approved.

3.1.4.2 Welding Equipment

Provide all welding equipment, electrodes, welding wire, fluxes, preparatory tools and equipment, and any other accessories required to perform the work. Adhere to electrode storage requirements and exposure limits in accordance with AWS D1.1/D1.1M.

3.1.4.3 Welding Process

Conform workmanship and techniques for welded construction to the requirements of AWS D1.1/D1.1M. Welding of Structural steel must be by an electric arc welding process using a method which excludes the atmosphere from the molten metal and must conform to the applicable provisions of AWS D1.1/D1.1M for all welds. Welding must be such as to minimize residual stresses, distortion and shrinkage.

3.1.4.4 Preparation of Base Metal

Prior to welding, inspect surfaces to be welded to assure compliance with the applicable Clauses of AWS D1.1/D1.1M.

3.1.4.5 Tack and Temporary Welds

Make tack and temporary welds required for fabrication and erection in accordance with AWS D1.1/D1.1M under the controlled conditions prescribed herein for permanent work. Tack welds that are to be incorporated into the permanent work are subject to the same quality requirements as the permanent welds. In making temporary welds, do not strike arcs outside weld locations. Remove each temporary weld as required by AWS D1.1/D1.1M.

3.1.4.6 Weld Backing Removal

Unless otherwise indicated, remove all steel weld backing material from welded joints prior to testing. Identify all weld backing material that cannot be removed on the shop drawings for approval.

3.1.4.7 Weld Backing

Qualify all weld backing material, other than steel, by testing and include in submitted PQR/WPS. Variation from approved weld backing material will not be permitted and will require the development and testing a new weld procedure which addresses the change in backing material.

3.1.4.8 Preheat

Preheat will be in accordance with AWS D1.1/D1.1M, and this specification. Do not weld at an ambient temperature below 32 degrees F, or when moisture is present in the area of welding. Do not weld in wind greater than 5 mph or when the surfaces are wet or exposed to precipitation. Verify the minimum temperature of the base metal in the area of welding and adjacent to welding.

3.1.4.9 Interpass Temperature

In a multi-pass weld, ensure the temperature of the weld metal is within

acceptable interpass temperatures per AWS D1.1/D1.1M before the next pass is started.

3.1.4.10 Postweld Heat Treatment

Postweld heat treatment of weldments is prohibited unless noted in the applicable Welding Procedure Specifications (WPS).

3.2 BOLTED CONNECTIONS

3.2.1 General

Provide bolts, nuts, and washers of the type specified or indicated on the drawings. Equip all bolt heads and nuts with washers except for high-strength bolts. Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Ribbed bolts will not be acceptable.

3.2.2 Bolt Holes

3.2.2.1 Regular Bolts

Drill or sub-drill and ream holes for regular bolts. Holes must be accurately located, smooth, perpendicular to the member, cylindrical and not more than 1/16-inch larger than the diameter of the bolt, unless shown or noted otherwise.

3.2.2.2 Fitted Bolts

Holes for fitted bolts must be match-reamed or drilled. Holes must be smooth, perpendicular to the member and cylindrical. Remove burrs resulting from reaming. The threads of the bolt must be entirely outside of the holes. Tolerances for the body diameter of the bolt conform to recommendations in ASME B4.1 for the class to fit specified. Fitted bolts must be fitted in reamed holes by selective assembly to provide an LC 7 or closer tolerance fit.

3.2.2.3 High-Strength Bolts

Holes for high-strength bolts must be accurately spaced, cylindrical and perpendicular to the member. The diameter of the hole must be not more than 1/16-inch larger than the bolt diameter. If the thickness of the material is not greater than the diameter of the bolt, the holes may be punched. If the thickness of the material is greater than the diameter of the bolt, the holes must be either drilled full size or must be sub-punched or sub-drilled at least 1/8-inch smaller than the diameter of the bolt and then reamed to full size. Poor matching of holes will be cause for rejection. Drifting done during assembly must not distort the metal or enlarge the holes. For slight mismatching, reaming to a larger diameter for the next standard size bolt will be allowed.

3.2.3 Bolt Installation

a. Follow installation procedures outlined in RCSC S348 and AISC 325.

b. Tighten all high strength connections for structural frame members carrying primary loads to a tension not less than that given below for ASTM F3125/F3125M Grade A325 bolts, unless specified otherwise. Perform bolt tightening by turn-of-nut, direct tension indicator,

calibrated wrench, or alternative design bolt methods as approved by the Government. Install all bolts in a connection to a snug tight condition prior to pretensioning. Perform pretensioning in the same order as snug-tightening.

| | |
|------------|----------|
| 5/8 inch | 19 kips |
| 3/4 inch | 28 kips |
| 7/8 inch | 39 kips |
| 1 inch | 51 kips |
| 1-1/8 inch | 56 kips |
| 1-1/4 inch | 71 kips |
| 1-3/8 inch | 85 kips |
| 1-1/2 inch | 103 kips |

c. Tighten all other connections to the snug-tight condition or as required by the designer. Perform snugging in a systematic manner starting at the most rigid part of the joint and working to the outside of the connection or the free edges.

d. Additional bolt installation requirements may be found in Section 05 05 23.18 26, BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION, Section 22 00 00.00 26, BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING, and Section 35 05 40.14 26, HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES.

3.2.3.1 Rotational-Capacity (RC) Tests

Rotational-capacity (RC) tests are required and must be performed on all black or galvanized bolt, nut, and washer assemblies by the manufacturer or distributor prior to shipping. The Contractor is responsible for assuring the RC testing is performed by either the manufacturer or distributor prior to shipping. In addition, perform the RC test after assembly.

a. Except as modified herein, perform the RC test in accordance with ASTM F3125/F3125M. All lots, whether coated or plain, are subjected to RC testing.

b. Test each combination of bolt production lot, nut lot, and washer lot as an assembly. Do not include washers in the lot identification, where washers are not required by the installation procedures.

c. Assign a RC lot number to each combination of lots tested.

d. Assemble the bolt, nut, and washer assembly in a Skidmore-Wilhelm Calibrator or in an approved equivalent device for RC testing. Test bolts that are too short to be tested in the Skidmore-Wilhelm Calibrator in a steel joint as described in ASTM F3125/F3125M.

e. The minimum frequency of testing is three assemblies per RC lot.

f. Three bolts of the same grade, size, and condition as those under inspection are placed individually in a device calibrated to measure bolt tension. Perform this calibration operation at least once each inspection day. Provide a washer under the part turned in torquing each bolt. In the calibrated device, tighten each bolt by any convenient means to the specified tension. Apply the inspecting wrench to the tensioned bolt to determine the torque required to turn the nut or head five degrees in the tightening direction. Use the average

torque required for all three bolts as the job inspection torque.

g. Select at random ten percent, but at minimum two, of the tensioned bolts on the structure represented by the test bolts in each connection. Apply the job inspection torque to each bolt with the inspecting wrench turned in the tightening direction. If no bolt head or nut turns with this torque, the bolts in the connection will be considered to be properly tensioned. However, if the torque turns one or more bolt heads or nuts, apply the inspection torque to all bolts in the connection. Retorque and reinspect any bolt in which the head or nut turned. The Contractor may, however, retension all the bolts in the connection and resubmit it for inspection, so long as bolts are not over tensioned or damaged by this action.

3.3 MACHINE WORK

3.3.1 General

a. For tolerances, allowances and gages for metal fits between plain, non-threaded, cylindrical parts, conform to ASME B4.1 for the class of fit shown or to the dimensions shown. Where fits are not shown comply with good industrial practice for the intended application and obtain approval prior to beginning work. Provide tolerances for machine-finished surfaces designated by non-decimal dimensions within 1/64-inch unless otherwise specified. Provide tolerances for machine-finished surfaces designated by decimal dimensions as follows, unless otherwise specified or shown on the contract or reference drawings. Note that these tolerances are for general machine work for non-critical components.

One (1) place..... +/- 0.030

Two (2) places..... +/- 0.010

Three (3) places..... +/- 0.001

b. Allow for sufficient excess material stock on surfaces requiring machining to ensure true surfaces of solid material while maintaining the specified minimum or finished plate thickness. Finished contact or bearing surfaces must be true and exact to secure full contact. Finish all surfaces in accordance with the contract drawings to ensure proper operation when assembled. Accurately machine parts and make all like parts interchangeable. Accurately locate all drilled bolt holes to ensure interchangeability.

3.3.2 Finished Surfaces

Provide surface finishes as indicated on drawings, or specified in accordance with ASME B46.1. Values of required roughness heights are arithmetical average deviations expressed in micro inches. These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements is determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of ASME B46.1. Values of roughness width and waviness height must be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified, provide a surface finish that is most suitable for the particular surface, provides the class of fit required and indicate the finish on the shop drawings by a symbol which conforms to ASME B46.1

when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks, or checks which will make the part unsuitable for the intended use will be cause for rejection.

3.3.3 Unfinished Surfaces

Lay out all work to secure proper matching of adjoining unfinished surfaces unless otherwise directed. Where there is a discrepancy between adjoining unfinished surfaces, grind the discrepancy smooth or machine to secure proper alignment. Unfinished surfaces must be true to the lines and dimensions shown. Grind free all projections and rough spots. Fill in depressions or holes not affecting the strength or usefulness of the parts using an approved method.

3.3.4 Pin Holes

Bore pin holes in accordance with the dimensions and tolerances shown or noted. Pin holes are to be smooth, straight, and at right angles to the axis of the member

3.3.5 Shafting

Provide fillets where changes in section occur. Cold-finished shafting may be used where keyseating or grinding are the only machine work required.

3.3.6 SET SCREWS

Set screws must be of the socket type, with sockets of the hexagonal or multi-splined shape. Set screws must not be used for transmitting torsion. Set screws must be installed using Loctite.

3.4 GALVANIZING

Apply zinc coatings in a manner and of a thickness and quality conforming to ASTM A123/A123M for structural steel members and for ASTM F2329 for threaded parts, as applicable. Unless specified elsewhere, galvanize after fabrication where practicable. Where zinc coatings are destroyed by cutting, welding, or other causes, regalvanize the affected areas. Repair coatings less than 2 ounces in accordance with ASTM A780/A780M. Clean galvanized and the holes for cotter pins following galvanizing to remove material build-up interfering with fit and function.

3.5 INSPECTION/NONDESTRUCTIVE TESTING (NDT)

3.5.1 Inspection

- a. Maintain an approved inspection system and perform required inspections. Submit Test and Inspection Report(s) for each weld examination. Document nonconformances in writing and submit a Nonconformance Reports documenting any deviation from the QCP, approved shop drawings, code, Work Plan and/or specifications.
- b. Perform fabrication/erection inspection to ensure that materials and workmanship meet the minimum requirements of the Contract documents.
- c. Final acceptance of all welded joints will be by the CO.
- d. When doubt exists as to the soundness of any material part; such

part may be subjected to any form of nondestructive testing that will thoroughly investigate the part in question as determined by the CO. Any defects may be cause for rejection and rejected parts are required to be replaced and retested at the Contractor's expense.

e. After weld joints have been satisfactorily completed by the Contractor and accepted by the CO, clean the joint area to a bright, unpitted, and unscarred surface and protect in accordance with the applicable Contract documents.

3.5.2 Methods of Non-Destructive Testing (NDT)

Perform NDT inspection of structural steel weldments as required below. Comply with STANDARDS OF ACCEPTANCE for all welds. Identify the acceptance criteria on the shop drawings.

3.5.2.1 Visual Inspection (VT)

Perform 100 percent visual examination of all completed welds by an approved CWI. Clean and carefully examine welds for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity or reinforcement, and other surface defects to ensure compliance with the requirements of AWS D1.1/D1.1M. Enhance Visual Inspection (VT) for cracks and other discontinuities with a magnifying lens of 5X power wherever required to discern indications or defects otherwise not clear. Measure size and contour of welds with suitable gages.

3.5.2.2 Magnetic Particle Inspection (MT) and Liquid Penetrant Inspection (PT)

a. Perform MT or PT for 25 percent of partial penetration and fillet welds. Randomly select welds and joints in addition to any welds indicated on the drawings to determine conformance with paragraph STANDARDS OF ACCEPTANCE, AWS D1.1/D1.1M, and with ASTM E709 or ASTM E165/E165M as applicable.

b. On butterfly valves and lifting beams, perform MT or PT for 100 percent of partial penetration and fillet welds in conformance with paragraph STANDARDS OF ACCEPTANCE, AWS D1.1/D1.1M, and with ASTM E709 or ASTM E165/E165M as applicable.

3.5.2.3 Radiographic Inspection (RT)

Perform RT for any welds or joints indicated or on critical welds designated for RT at the direction of the Contracting Officer based on review of the Contractor's design documentation to determine conformance with paragraph STANDARDS OF ACCEPTANCE and AWS D1.1/D1.1M.

3.5.2.4 Ultrasonic Inspection (UT)

Perform UT for 100 percent of complete joint penetration welds to determine conformance with paragraph STANDARDS OF ACCEPTANCE and AWS D1.1/D1.1M.a.

3.6 SHOP INSPECTION

Inspect each structural unit prior to assembly to determine the correctness of the fabrication and machining of the component parts. Do not exceed tolerances shown. Closely check each unit inspected to ensure

that dimensions and tolerances are met. Maintain an inspection record for review by the Government for each item inspected.

3.7 PROTECTION OF MACHINED SURFACES

For machined surfaces, thoroughly clean of foreign matter and protect by suitable means. For un-assembled pins and bolts, oil and wrap with moisture-resistant paper or protect by other approved means.

3.8 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of AWS D1.1/D1.1M and the approved shop drawings. NDT acceptance criteria for welds are to be in accordance with AWS D1.1/D1.1M. Acceptance criteria for welds on butterfly valve body and disc are to be in accordance with those for cyclically loaded connections in tension.

3.9 GOVERNMENT INSPECTION AND TESTING

When the soundness of any weld is suspected of being deficient due to faulty welding or stresses that might occur during shipment or erection, the Government reserves the right to perform nondestructive supplemental examinations before final acceptance to the extent determined by the CO. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing.

3.10 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Defects caused by shipping and handling or due to latent defects that were not caught at shop inspection must be corrected at the Contractor's expense inclusive any shipping costs. Make corrections in accordance with the requirements of AWS D1.1/D1.1M, the approved repair procedures, and the specifications. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Weld inspector must be present during excavation in order to determine that the defect is fully removed before repairs are made. Repaired welds must meet the inspection requirements for the original welds.

3.10.1 Butterfly Valve Weld Repairs

The existing butterfly valve disc and body welds are to be inspected by visual and NDT methods as specified in Section 22 00 00.00 26, BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING. If weld repair is required, as determined by the Government, the Contracting Officer will provide direction to the Contractor on which welds must be repaired. All costs associated with the repairs are to be included with the Optional bid item, including development of the Butterfly Valve Weld Repair Plan. Assemble and submit a Butterfly Valve Weld Repair Plan in accordance with this Section and requirements of AWS D1.1/D1.1M, Part 7.25 Repairs.

- a. Removal of weld metal and/or portions of base metal must be done in such a manner that does not nick or gouge the adjacent weld metal or base metal.
- b. Only the unacceptable portions of the weld are to be removed without substantial removal of the base metal. If a suspected crack is being repaired, the extent of the crack must be ascertained by use of acid etching, MT, PT, or other equally positive means, and the crack plus two inches of sound metal beyond each end of the crack must be removed before rewelding.
- c. The total length of weld repair to be performed must be documented and written approval given by the Contracting Officer before any repairs commence.
- d. All repaired welds must be inspected by the same NDT methods that were used in locating the indications originally, and repaired welds must meet the inspection requirements for the original welds.

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BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION

PART 1 GENERAL

This Section covers general workmanship requirements, applicable to the fabrication and inspection of pressurized piping and equipment, which includes but is not limited to the hydraulic power unit (HPU), all power piping, butterfly valve bypass piping, tunnel drain piping, and inspection of butterfly valve welds. These requirements are in addition to those contained in the specification Sections covering the specific items of work or as shown.

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

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A3.0M/A3.0 (2020) Standard Welding Terms and Definitions

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B4.1 (1967; R 1994; R 2004; R 2009; R 2020) Preferred Limits and Fits for Cylindrical Parts

ASME B31.1 (2018; R 2020) Power Piping

ASME B46.1 (2020) Surface Texture, Surface Roughness, Waviness and Lay

ASME BPVC SEC II-C (2017) BPVC Section II-Materials Part C-Specifications for Welding Rods Electrodes and Filler Metals

ASME BPVC SEC IX (2021) BPVC Section IX-Qualification

Standard for Welding, Brazing, and Fuzing
Procedures; Welders; Brazers; and Welding
Brazing, and Fusing Operators

ASTM INTERNATIONAL (ASTM)

| | |
|-------------------|---|
| ASTM A123/A123M | (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A780/A780M | (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| ASTM E165/E165M | (2018) Standard Practice for Liquid Penetrant Examination for General Industry |
| ASTM E709 | (2015) Standard Guide for Magnetic Particle Examination |
| ASTM F2329 | (2013) Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners |
| ASTM F3125/F3125M | (2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength |

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

| | |
|-----------|---|
| RCSC S348 | (2014; Errata 2015) RCSC Specification for Structural Joints Using High-strength Bolts |
|-----------|---|

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

Fabricator's Welding Quality Control Plan; G, EC, HDC

Witness Points; G, EC, HDC

Welding Procedure Specifications (WPS); G, EC, HDC

Procedure Qualification Records (PQR); G, EC, HDC

Welder Performance Qualification Records (WPQR); G, EC, HDC

Weld Tracking; G, EC, HDC

SD-03 Product Data

Nonconformance Reports; G, EC, HDC

Welding Electrodes and Rods; G, EC, HDC

Shielding Gas; ; G, EC, HDC

SD-06 Test Reports

Test and Inspection Report; G, EC, HDC

NDT Equipment Calibration Records; G, EC, HDC

SD-07 Certificates

Inspector Qualifications; G, EC, HDC

1.3 DEFINITIONS AND SYMBOLS

Use symbols in accordance with AWS A2.4 terms and definitions in accordance with AWS A3.0M/A3.0, unless otherwise indicated.

1.4 GENERAL

Perform fabrication and welding in accordance with ASME B31.1. All mandatory appendices will be considered part of ASME B31.1 and therefore apply. The non-mandatory appendices and commentary will be used as guides and supplementary information unless otherwise specified for the interpretation and application of ASME B31.1. Unless otherwise specified, the choice of welding process is the responsibility of the Contractor. Partial penetration welds are not permissible.

1.5 QUALITY ASSURANCE

1.5.1 Fabricator's Welding Quality Control Plan

Before the start of work, submit a Fabricator's Welding Quality Control Plan for approval. Ensure the plan describes the methods, equipment, and procedures utilized to ensure quality control (QC) including but not limited to material tracking, weld tracking, nondestructive testing (NDT) equipment calibration, non-conformance reports, weld repair, and inspection witness points.

1.5.1.1 NDT Equipment Calibration Records

Submit NDT Equipment Calibration Records for all NDT equipment used by both the fabricator and any subcontractors performing NDT.

1.5.1.2 Inspection Witness Points

Establish Witness Points for the necessary quality assurance (QA) inspections and prepare a detailed schedule showing the progression of work and completion of components with the Witness Points identified. The extent of completion and details and the date of the QA inspections will be determined at the Prefabrication Conference by the Government after discussion with the Contractor. Update the inspection witness point schedule weekly and provided by e-mail to the Contracting Officer. Give

the Contracting Officer two (2) weeks minimum notice prior to the predetermined date for the Initial QA Inspection, including adjustments for changes in schedule.

1.5.2 Welding Procedure Specifications

a. Submit Welding Procedure Specifications (WPS), with supporting Procedure Qualification Records (PQR) and all supporting test documentation on forms similar or equivalent to the sample forms found in ASME BPVC SEC IX. WPS's must be approved by the Government prior to the start of any fabrication and must be individually identified and referenced on the shop drawings. A representative of the Government will witness the welding of the test plate and the mechanical testing portion.

b. Approval of any procedure, does not relieve the Contractor of the responsibility for producing a finished weldment meeting all requirements of these specifications. A current Certified Welding Inspector (CWI) must approve all WPS's and PQR's. Keep approved WPS's posted at all work stations where welding is occurring so that the welder, QC staff, and Government QA staff have access to the WPS's. In case of conflict between this specification and applicable requirements in ASME BPVC SEC IX, this specification governs.

1.5.2.1 Previous WPS Qualifications

WPS's previously qualified by testing may be accepted for this Contract without re-qualification, upon receipt of the test results, if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved QC organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this Contract.

c. The welder, welding operator, and tack welder qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this Contract.

1.5.2.2 Retests

If welding procedure fails to meet the requirements of ASME BPVC SEC IX, revise and re-qualify the procedure specification, or at the Contractor's option, welding procedure may be retested in accordance with ASME BPVC SEC IX. If the welding procedure is qualified through retesting, submit all test results, including those of test welds that failed to meet the requirements, with the welding procedure.

1.5.3 Welder, Welding Operator, and Tack Welder Qualification

a. Submit Welder Performance Qualification Records (WPQR) for each welder, welding operator, and tack welder to the Government for approval prior to the start of any fabrication. Submit WPQR's on forms similar or equivalent to the sample WPQ or WOPQ forms found in ASME BPVC SEC IX with all pertinent data filled out.

b. Welders, welding operators, and tack welders must be approved by

the Government prior to working on this project. Each welder, welding operator, and tack welder assigned to work on this Contract must be qualified in accordance with the applicable requirements of ASME BPVC SEC IX and as specified in this Section. Welders, welding operators, and tack welders who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

c. Before assigning any welder, welding operator, or tack welder to work under this Contract, submit the names of the welders, welding operators, and tack welders to be employed, and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tack welder is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests.

1.5.3.1 Previous Welding Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tack welders qualified by test within the previous six (6) months may be accepted for this Contract without re-qualification if all the following conditions are met:

- a. Copies of the WPQR's are submitted and approved in accordance with the specified requirements.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved QC organization.
- c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this Contract.
- d. The welder, welding operator, and tack welder qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this Contract.

1.5.3.2 Renewal of Welding Personnel Qualification

Re-qualification of a welder or welding operator is required under any of the following conditions:

- a. It has been more than six (6) months since the welder or welding operator has used the specific welding process for which they are qualified.
- b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this Contract.
- d. A tack welder who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which they are qualified, unless there is some specific reason to question the tack welder's ability. In such a case, the tack welder is required to pass the prescribed tack welding

test.

e. The Government determines the welder, welding operator, or tack welder's performance is not in conformance with the applicable welding code and/or the Contract specifications.

1.5.4 Inspector Qualifications

Submit Inspector Qualifications for approval. QC personnel can be assigned to more than one (1) task, provided they are qualified and able to fully perform the duties of each position. Individual(s) responsible for QA/QC may not serve as or report to production management. If the ability of QC is in doubt, the Government reserves the right to have QC personnel removed from the project.

a. All inspectors, performing weld inspection in accordance with these specifications, must be currently qualified and certified in conformance with AWS QC1. The Contractor must provide an AWS compliant CWI as the primary point of contact for QC of welding. When several CWI and NDT technicians are working, one (1) primary individual must be designated as having primary responsibility for all QC in accordance with ASME B31.1 and this specification. Non-certified inspectors and certified associate weld inspectors (CAWI) must not be used for inspection under these specifications.

b. All personnel performing NDT must be qualified in accordance with ANSI/ASNT CP-189 and be a current level II or III for each applicable method. In the event that a level III will be performing NDT, a level II practical examination (conducted within the last three years) will be required in addition to the level III qualifications. Submit level II qualification/certification documentation in a format similar to Appendix C: Sample Certification Form ANSI/ASNT CP-189. Submit qualifying level III certification as provided by ASNT.

c. The NDT of welds and the evaluation of examination tests as to the acceptability of the welds must be performed by a third party testing agency adequately equipped and competent to perform such services. In either case, written approval of the examination procedures is required. Notify the Government prior to any testing. The evaluations of examination tests are subject to the approval of, and all records become the property of, the Government.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all materials and material documentation as per Section 05 50 04.00 26 METALS: MISCELLANEOUS, STANDARD ARTICLES, SHOP FABRICATED ITEMS, Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING, and Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES.

2.2 WELDING EQUIPMENT AND MATERIALS

Provide all welding equipment, welding electrodes and rods, welding wire, shielding gas, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. Provide welding equipment and materials that comply with the applicable requirements of ASME B31.1. Provide filler metals

which comply with ASME BPVC SEC II-C. Use only low-hydrogen electrodes for shielded metal-arc welding. Submit product data on Welding Electrodes and Rods and Shielding Gas.

PART 3 EXECUTION

3.1 FABRICATION

3.1.1 General

a. Material must be straight before being laid off or worked. If necessary, straighten by methods that will not impair the metal. Sharp kinks or bends are cause for rejection of the material. Make bends by approved dies, press brakes or bending rolls. Finished members must be free of twists, bends, and open joints.

b. Do not commence welding until shop drawings, welding procedures, inspectors, NDT personnel, welders, welding operators, and tackers have been qualified and approved. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved.

c. Where heating is required, take precautions to avoid overheating the metal and allow to slowly cool in still air in a manner that will not adversely impair the original properties of the metal.

d. Cut steel to meet the dimensions as required on the approved shop drawing and to obtain an accurate profile with a surface that is smooth and free from cracks and notches. Limit flame cutting to low carbon. Approve all flame cutting prior to use and clearly indicate locations on shop drawings. Shearing must be accurate and all portions of the work neatly finished. Corners must be square and true unless otherwise shown. Fillet re-entrant cuts with a minimum radius of 3/4 inch, unless otherwise approved. Cut steel and fabricate steel plates and splice plates for major components so the primary direction of rolling is parallel to the direction of the main tensile or compressive stresses.

e. Break all cut edges and corners with 1/16 inch radius to eliminate sharp edges. Bolts, nuts, and screws must be tight.

3.1.2 Dimensional Tolerances

Measure dimensions by an approved measuring system. Submit the measuring system for approval with the work plan. The overall dimensions of an assembled unit are required to be within the tolerances indicated on the drawings or as specified for the item of work. Where tolerances are not specified in other sections of these specifications or shown on drawings, a variation of 1/32 inch is permissible in the overall length of component members with both ends milled and component members without milled ends are not permitted deviate from the dimensions shown by more than 1/16 inch based on a temperature of 70 degrees F.

3.2 WELDING OPERATIONS

3.2.1 Welded Connections

Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Do not begin welding

until welding procedures, inspectors, NDT personnel, welders, welding operators, and tackers have been qualified and approved. Each welder or welding operator must apply his mark adjacent to his weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal.

3.2.1.1 Weld Tracking

A Weld-Tracking Log must be developed and maintained by the Contractor as described herein. Provide a log capable of individually identifying and tracking every weld on the project. Submit an example for approval. Follow the numbering scheme shown on the shop drawings for member identification. At a minimum, include the following in the log: the member to be welded, type of weld including temporary and tack welds which are meant to be consumed, welding position, applicable WPS reference, joint preparation designation, name or stamping designation of welder, welding operator or tacker, date and time of completion of welding and/or tacking (weld time required to designate required hold time prior to NDT), name and date of CWI visual examination prior to welding, name and date of Final CWI visual examination, NDT performed, including the type of inspection, date(s) of inspection, inspector name, and the acceptance criteria used, description of defects found and reason for non-compliance, corrective action taken, or whether the weld is acceptable. Match weld identification on the shop drawing with the weld tracking log identification. Immediately following completion of the fabrication for each weldment, submit two (2) copies of a completed log, bound together, to the Contracting Officer. Furnish draft copies of NDT reports to the Contracting Officer. NDT test reports are required to be available on the shop floor during any inspection.

3.2.2 Welding Equipment

Provide all welding equipment, electrodes, welding wire, fluxes, preparatory tools and equipment, and any other accessories required to perform the work. Deliver filler metals, electrodes, fluxes and other welding materials to the site in the manufacturer's original packaging and store in a dry, low hydrogen, space until used. Label and design packages properly to give maximum protection from moisture and to assure safe handling.

3.2.3 Welding Process

Conform workmanship and techniques for welded construction to the requirements of ASME BPVC SEC IX. Welding of steel must be by an electric arc welding process using a method which excludes the atmosphere from the molten metal and must conform to the applicable provisions of ASME BPVC SEC IX for all welds. Welding must be such as to minimize residual stresses, distortion and shrinkage.

3.2.4 Preparation of Base Metal

Prior to welding, inspect surfaces to be welded to assure compliance with the applicable Clauses of ASME B31.1.

3.2.5 Tack and Temporary Welds

Make tack and temporary welds required for fabrication and erection in accordance with ASME B31.1 under the controlled conditions prescribed herein for permanent work. Tack welds that are to be incorporated into

the permanent work are subject to the same quality requirements as the permanent welds. In making temporary welds, do not strike arcs outside weld locations. Remove each temporary weld as required by ASME BPVC SEC IX.

3.2.6 Weld Backing Removal

Unless otherwise indicated, remove all steel weld backing material from welded joints prior to testing. Identify all weld backing material that cannot be removed on the shop drawings for approval.

3.2.7 Weld Backing

Qualify all weld backing material, other than steel, by testing and include in submitted PQR/WPS. Variation from approved weld backing material is not be permitted and requires the development and testing of a new weld procedure which addresses the change in backing material.

3.2.8 Preheat

Preheat will be in accordance with ASME B31.1, and this specification. Do not weld at an ambient temperature below 32 degrees F, or when moisture is present in the area of welding. Do not weld in wind greater than 5 mph or when the surfaces are wet or exposed to precipitation. Verify the minimum temperature of the base metal in the area of welding and adjacent to welding.

3.2.9 Interpass Temperature

In a multi-pass weld, ensure the temperature of the weld metal is within acceptable interpass temperatures per ASME B31.1 before the next pass is started.

3.2.10 Postweld Heat Treatment

Complete postweld heat treatment of weldments only as per the applicable WPS. Do not allow spot overheating or heating longer than the requirements in the WPS.

3.3 BOLTED CONNECTIONS

3.3.1 General

Provide bolts, nuts, and washers of the type specified in the Contract specifications or indicated on the Contract drawings. Equip all bolt heads and nuts with washers except for high-strength bolts. Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Ribbed bolts will not be acceptable. Where there are deviations between this specification Section and Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING or Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES, information from the aforementioned sections govern.

3.3.2 Bolt Holes

3.3.2.1 Regular Bolts

Drill or sub-drill and ream holes for regular bolts. Holes must be accurately located, smooth, perpendicular to the member, cylindrical and not more than 1/16 inch larger than the diameter of the bolt, unless shown

or noted otherwise.

3.3.2.2 Fitted Bolts

Holes for fitted bolts must be match-reamed or drilled. Holes must be smooth, perpendicular to the member and cylindrical. Remove burrs resulting from reaming. The threads of the bolt must be entirely outside of the holes. Tolerances for the body diameter of the bolt conform to recommendations in ASME B4.1 for the class to fit specified. Fitted bolts must be fitted in reamed holes by selective assembly to provide an LC 7 or closer tolerance fit.

3.3.2.3 High-Strength Bolts

Holes for high-strength bolts must be accurately spaced, cylindrical and perpendicular to the member. The diameter of the hole must be not more than 1/16 inch larger than the bolt diameter. If the thickness of the material is not greater than the diameter of the bolt, the holes may be punched. If the thickness of the material is greater than the diameter of the bolt, the holes must be either drilled full size or must be sub-punched or sub-drilled at least 1/8 inch smaller than the diameter of the bolt and then reamed to full size. Poor matching of holes will be cause for rejection. Drifting done during assembly must not distort the metal or enlarge the holes. For slight mismatching, reaming to a larger diameter for the next standard size bolt will be allowed.

3.3.3 Bolt Installation

a. Follow installation procedures outlined in RCSC S348 and AISC 325.

b. Tighten all high strength connections for frame members carrying primary loads to a tension not less than that given below for ASTM F3125/F3125M Grade A325 bolts, unless specified otherwise. Perform bolt tightening by turn-of-nut, direct tension indicator, calibrated wrench, or alternative design bolt methods as approved by the Government. Install all bolts in a connection to a snug tight condition prior to pretensioning. Perform pretensioning in the same order as snug-tightening.

| | |
|------------|----------|
| 5/8 inch | 19 kips |
| 3/4 inch | 28 kips |
| 7/8 inch | 39 kips |
| 1 inch | 51 kips |
| 1-1/8 inch | 64 kips |
| 1-1/4 inch | 81 kips |
| 1-3/8 inch | 97 kips |
| 1-1/2 inch | 118 kips |

c. Tighten all other connections to the snug-tight condition or as required by the designer. Perform snugging in a systematic manner starting at the most rigid part of the joint and working to the outside of the connection or the free edges.

d. Additional bolt installation requirements may be found in Section 05 05 23.17 26 WELDING (STEEL), FABRICATION AND MACHINE WORK, Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING, and Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES.

3.3.3.1 Rotational-Capacity Tests

Rotational-capacity (RC) tests are required. The Contractor is responsible for assuring the RC testing is to be performed on all black or galvanized bolt, nut, and washer assemblies by the manufacturer or distributor prior to shipping. In addition, perform the RC test after assembly.

- a. Except as modified herein, perform the RC test in accordance with ASTM F3125/F3125M. All lots, whether coated or plain, are subjected to RC testing.
- b. Test each combination of bolt production lot, nut lot, and washer lot as an assembly. Do not include washers in the lot identification, where washers are not required by the installation procedures.
- c. Assign a RC lot number to each combination of lots tested.
- d. Assemble the bolt, nut, and washer assembly in a Skidmore-Wilhelm Calibrator or in an approved equivalent device for RC testing. Test bolts that are too short to be tested in the Skidmore-Wilhelm Calibrator in a steel joint as described in ASTM F3125/F3125M.
- e. The minimum frequency of testing is three (3) assemblies per RC lot.
- f. Three (3) bolts of the same grade, size, and condition as those under inspection are placed individually in a device calibrated to measure bolt tension. Perform this calibration operation at least once each inspection day. Provide a washer under the part turned in torquing each bolt. In the calibrated device, tighten each bolt by any convenient means to the specified tension. Apply the inspecting wrench to the tensioned bolt to determine the torque required to turn the nut or head five (5) degrees in the tightening direction. Use the average torque required for all three (3) bolts as the job inspection torque.
- g. Select at random, ten percent, but a minimum two (2), of the tensioned bolts represented by the test bolts in each connection. Apply the job inspection torque to each bolt with the inspecting wrench turned in the tightening direction. If no bolt head or nut turns with this torque, the bolts in the connection will be considered to be properly tensioned. However, if the torque turns one (1) or more bolt heads or nuts, apply the inspection torque to all bolts in the connection. Retorque and reinspect any bolt in which the head or nut turned. The Contractor may, however, retension all the bolts in the connection and resubmit it for inspection, so long as bolts are not over tensioned or damaged by this action.

3.4 MACHINE WORK

3.4.1 General

- a. For tolerances, allowances and gauges for metal fits between plain, non-threaded, cylindrical parts, conform to ASME B4.1 for the class of fit shown or to the dimensions shown. Where fits are not shown comply with good industrial practice for the intended application and obtain approval prior to beginning work. Provide tolerances for machine-finished surfaces designated by non-decimal dimensions within 1/64 inch unless otherwise specified. Provide tolerances for

machine-finished surfaces designated by decimal dimensions as follows, unless otherwise specified or shown on the Contract or reference drawings. Note that these tolerances are for general machine work for non-critical components.

One (1) place..... +/- 0.030

Two (2) places..... +/- 0.010

Three (3) places..... +/- 0.001

b. Allow for sufficient excess material stock on surfaces requiring machining to ensure true surfaces of solid material while maintaining the specified minimum or finished plate thickness. Finished contact or bearing surfaces must be true and exact to secure full contact. Finish all surfaces in accordance with the Contract drawings to ensure proper operation when assembled. Accurately machine parts and make all like parts interchangeable. Accurately locate all drilled bolt holes to ensure interchangeability.

3.4.2 Finished Surfaces

Provide surface finishes as indicated on drawings, or specified in accordance with ASME B46.1. Values of required roughness heights are arithmetical average deviations expressed in micro inches. These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements is determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of ASME B46.1. Values of roughness width and waviness height must be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified, provide a surface finish that is most suitable for the particular surface, provides the class of fit required and indicate the finish on the shop drawings by a symbol which conforms to ASME B46.1 when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks, or checks which will make the part unsuitable for the intended use will be cause for rejection.

3.4.3 Unfinished Surfaces

Lay out all work to secure proper matching of adjoining unfinished surfaces unless otherwise directed. Where there is a discrepancy between adjoining unfinished surfaces, grind the discrepancy smooth or machine to secure proper alignment. Unfinished surfaces must be true to the lines and dimensions shown. Grind free all projections and rough spots. Fill in depressions or holes not affecting the strength or usefulness of the parts using an approved method.

3.4.4 Pin Holes

Bore pin holes in accordance with the dimensions and tolerances shown or noted. Pin holes are to be smooth, straight, and at right angles to the axis of the member.

3.4.5 Shafting

Provide fillets where changes in section occur. Cold-finished shafting may be used where keyseating or grinding are the only machine work required.

3.4.6 Set Screws

Set screws must be of the socket type, with sockets of the hexagonal or multi-splined shape. Set screws must not be used for transmitting torsion. Set screws must be installed using an anaerobic thread locker with a means of preventing the screws from loosening.

3.5 GALVANIZING

Apply zinc coatings in a manner and of a thickness and quality conforming to ASTM A123/A123M for steel members and for ASTM F2329 for threaded parts, as applicable. Unless specified elsewhere, galvanize after fabrication where practicable. Where zinc coatings are destroyed by cutting, welding, or other causes, regalvanize the affected areas. Repair coatings less than 2 ounces in accordance with ASTM A780/A780M. Clean galvanized and the holes for cotter pins following galvanizing to remove material build-up interfering with fit and function.

3.6 INSPECTION/NONDESTRUCTIVE TESTING

3.6.1 Inspection

- a. Maintain an approved inspection system and perform required inspections. Submit Inspection Plans and Inspection Reports for each inspection method performed as required below; reference Section 05 05 23.17 26, AWS WELDING AND FABRICATION, Subpart 3.6 INSPECTION/NONDESTRUCTIVE TESTING for additional Inspection Plans and Inspection Report requirements. Test and Inspection Report(s) for each weld inspection inclusive of all inspection records from each inspection method performed. Document nonconformances in writing and submit a Nonconformance Reports documenting any deviation from the QCP, approved shop drawings, code, Work Plan and/or specifications.
- b. Perform fabrication/erection inspection to ensure that materials and workmanship meet the minimum requirements of the Contract documents.
- c. Final acceptance of all welded joints will be by the Contracting Officer.
- d. When doubt exists as to the soundness of any material part; such part may be subjected to any form of NDT that will thoroughly investigate the part in question as determined by the Contracting Officer. Any defects may be cause for rejection and rejected parts are required to be replaced and retested at the Contractor's expense.
- e. After weld joints have been satisfactorily completed by the Contractor and accepted by the Contracting Officer, clean the joint area to a bright, unpitted, and unscarred surface and protect in accordance with the applicable Contract documents.

3.6.2 Methods of Non-Destructive Testing

Perform NDT of steel weldments as required below. Comply with STANDARDS OF ACCEPTANCE for all welds. Identify the acceptance criteria on the shop drawings. Cloud any deviations on the shop drawing for Government approval.

3.6.2.1 Visual Inspection

Perform 100 percent visual inspection (VT) of all completed welds by an approved CWI. Clean and carefully examine welds for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity or reinforcement, and other surface defects to ensure compliance with the requirements of ASME B31.1. Enhance VT for cracks and other discontinuities with a magnifying lens of 5X power wherever required to discern indications or defects otherwise not clear. Measure size and contour of welds with suitable gauges.

3.6.2.2 Magnetic Particle and Liquid Penetrant Inspection

a. For all welds to any component of the butterfly valve, perform MT or PT for 100 percent of partial penetration and fillet welds in conformance with ASME B31.1, and with ASTM E709 or ASTM E165/E165M as applicable.

b. At a minimum, perform MT or PT on all pressure pipings as required and outlined in ASME B31.1 section 136.4 Examination Methods of Welds. Inspection acceptance criteria are to be in conformance with the aforementioned section of ASME B31.1 in addition to ASTM E709 or ASTM E165/E165M as applicable.

3.6.2.3 Radiographic Inspection

Perform radiographic inspection (RT) for any welds or joints indicated or on critical welds designated for RT at the direction of the Contracting Officer based on review of the Contractor's design documentation to determine conformance with section 136.4.5, Radiography, as outlined ASME B31.1.

3.6.2.4 Ultrasonic Inspection

Perform ultrasonic inspection (UT) for 100 percent of complete joint penetration welds to determine conformance with part 136.4.6, Ultrasonic Examination, of ASME B31.1. Where differing inspection requirements are specified in the Contract drawings or other specification Sections, the more stringent requirement governs.

3.7 SHOP INSPECTION

Inspect each component/system prior to assembly to determine the correctness of the fabrication and machining of the component parts. Do not exceed tolerances shown. Closely check each inspected component/system to ensure that dimensions and tolerances are met. Maintain an inspection record for review by the Government for each item inspected.

3.8 PROTECTION OF MACHINED SURFACES

For machined surfaces, thoroughly clean of foreign matter and protect by suitable means. For un-assembled pins and bolts, oil and wrap with moisture-resistant paper or protect by other approved means.

3.9 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of ASME B31.1 and

the approved shop drawings. Welds on all pressurized members and any welds connecting any ancillary item to a primary load member in accordance with ASME B31.1.

3.10 GOVERNMENT INSPECTION AND TESTING

When the soundness of any weld is suspected of being deficient due to faulty welding or stresses that might occur during shipment or erection, the Government reserves the right to perform nondestructive supplemental examinations before final acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate Contract for inspection and testing.

3.11 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Defects caused by shipping and handling or due to latent defects that were not caught at shop inspection must be corrected at the Contractor's expense inclusive any shipping costs. Make corrections in accordance with the requirements of ASME B31.1, the approved repair procedures, and the specifications. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds must meet the inspection requirements for the original welds.

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SECTION 05 50 04.00 26

METALS: MISCELLANEOUS, STANDARD ARTICLES, SHOP FABRICATED ITEMS

PART 1 GENERAL

1.1 GENERAL INFORMATION

This Section covers the fabrication requirements, workmanship provisions, and miscellaneous metals, standard articles and shop fabricated items. For fabrication requirements and workmanship provisions for items specified in this Section also conform to the requirements of SECTION 05 05 23.17 26 WELDING (STEEL), FABRICATION, AND MACHINE WORK.

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 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 355.2 | (2007) Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary |
| ACI 355.4 | (2011) Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4) and Commentary |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- | | |
|--------------|--|
| ASME B1.1 | (2003; R 2018) Unified Inch Screw Threads (UN and UNR Thread Form) |
| ASME B18.2.1 | (2018; R 2020; Errata 2013) Square and Hex Bolts and Screws (Inch Series) |
| ASME B18.2.2 | (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) |
| ASME B18.3 | (2012) Socket Cap, Shoulder, Set Screws, and Hex Keys (Inch Series) |
| ASME B18.6.2 | (2020) Square Head Set Screws and Slotted Headless Set Screws (Inch Series) |
| ASME B18.6.3 | (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series) |

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

ASME B18.22.1 (1965; R 2008) Plain Washers

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M (2020) Standard Specification for Steel
Castings, Carbon, for General Application

ASTM A36/A36M (2019) 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 2016) Standard Specification for
Gray Iron Castings

ASTM A53/A53M (2020) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM A108 (2013) Standard Specification for Steel
Bar, Carbon and Alloy, Cold-Finished

ASTM A123/A123M (2017) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A148/A148M (2020; E 2020) Standard Specification for
Steel Castings, High Strength, for
Structural Purposes

ASTM A153/A153M (2016a) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A193/A193M (2020) Standard Specification for
Alloy-Steel and Stainless Steel Bolting
Materials for High-Temperature Service and
Other Special Purpose Applications

ASTM A307 (2014; E 2017) Standard Specification for
Carbon Steel Bolts, Studs, and Threaded
Rod 60 000 PSI Tensile Strength

ASTM A500/A500M (2021) Standard Specification for
Cold-Formed Welded and Seamless Carbon
Steel Structural Tubing in Rounds and
Shapes

ASTM A563 (2015) Standard Specification for Carbon
and Alloy Steel Nuts

ASTM A572/A572M (2018) Standard Specification for
High-Strength Low-Alloy Columbium-Vanadium

Structural Steel

| | |
|-------------------|---|
| ASTM A576 | (2017) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality |
| ASTM A615/A615M | (2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| ASTM A653/A653M | (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A668/A668M | (2020a) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use |
| ASTM A780/A780M | (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| ASTM A786/A786M | (2015a) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates |
| ASTM A924/A924M | (2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process |
| ASTM A992/A992M | (2020) Standard Specification for Structural Steel Shapes |
| ASTM F1554 | (2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength |
| ASTM F3125/F3125M | (2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength |
| ASTM E488/E488M | (2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements |
| ASTM F436/F436M | (2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions |

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

Inspector Qualifications; G, HDC

SD-03 Product Data

Mechanical Anchors; G, HDC

Adhesive Anchors; G, HDC

SD-05 Design Data

SD-06 Test Reports

Post-Installed Anchor Inspection Reports

Materials; G, HDC

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions; G, HDC

PART 2 PRODUCTS

2.1 MATERIALS

Supply the certified manufacturer's mill test reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the products described below.

2.1.1 Steel Castings

2.1.1.1 General

Provide steel castings conforming to ASTM A27/A27M or ASTM A148/A148M grade as required, except that repairs to castings must not be made without the knowledge and prior approval of the Contracting Officer. Minor surface imperfections not affecting the strength of castings may be welded in the "green" if approved by the Contracting Officer. Surface imperfections will be considered minor when the depth of the cavity prepared for welding is not greater than 20 percent of the actual wall thickness, but in no case greater than one inch. Defects other than minor surface imperfections may be welded only when specifically authorized in accordance with the following requirements:

a. The defects have been entirely removed and are judged not to affect the strength, use, or machinability of the castings, when properly welded and stress relieved.

b. The proposed welding procedure, stress relieving and method of examination of the repair work have been submitted and approved.

2.1.1.2 Castings Requiring Stress Relief

Castings for parts carrying calculated stresses, parts subject to shock and other principal parts, including machine frame castings, gears, and heavy-duty bearing stands must be stress-relief annealed before being machined.

2.1.2 Iron Castings

Provide iron castings conforming to ASTM A48/A48M, class as required.

2.1.3 Structural Steel

Provide structural steel conforming to ASTM A36/A36M, ASTM A992/A992M, or ASTM A572/A572M Grade 50.

2.1.4 Steel Forgings

Provide steel forgings conforming to ASTM A668/A668M, class as required.

2.1.5 Structural Steel Tubing

Provide Structural Steel Tubing complying with ASTM A500/A500M Grade B.

2.1.6 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.6.1 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.1.7 Shaft Steel

Provide steel for shafting conforming to ASTM A108, ASTM A576 or applicable specifications of the Society of Automotive Engineers, Inc.

2.1.8 Bolts, Screws, And Washers

2.1.8.1 General

Provide material for fitted bolts conforming to the applicable requirements of ASTM A307 or ASME B18.2.1, SAE grade 5 or higher. Provide washers conforming to the applicable requirements in paragraph MACHINE BOLTS, STUDS, SCREWS, AND WASHERS.

2.1.8.2 Machine Bolts, Studs, Screws, and Washers

Provide machine bolts, studs, screws and washers furnished as an integral part of a catalog item, conforming to the manufacturer's standard practice. Except where otherwise specified, provide machine bolts, studs, screws and washers conforming to the applicable requirements of the following specifications:

a. Threads. Provide all bolts, studs, machine screws, nuts, and tapped holes threaded in accordance with ASME B1.1.

b. Bolts. Provide finished hex bolts conforming to ASME B18.2.1, SAE grade 2 or higher.

c. Nuts. Provide hex nuts conforming to ASME B18.2.2.

d. Cap and Set Screws. Provide cap and set screws conforming to the requirements of ASME B18.3 or ASME B18.6.2.

e. Machine Screws and Nuts. Provide machine screws and nuts conforming to the requirements of ASME B18.6.3.

f. Washers

(1) Plain Washers. Provide plain washers conforming to ASME B18.22.1, Type B.

(2) Lock Washers. Provide lock washers conforming to ASME B18.21.1.

(3) Beveled Washers. Provide beveled washers conforming to ASTM F436/F436M.

2.1.8.3 Structural Bolts

Provide structural bolts conforming to the requirements of ASTM F3125/F3125M Grade A325. Nuts are to be in conformance with ASTM A563, and washers in conformance with ASTM F436/F436M.

2.1.9 Floor Plates

Provide floor plates conforming to the requirements of ASTM A786/A786M, diamond pattern.

2.1.10 Mechanical Anchors

Mechanical anchors must have been tested and qualified for performance in cracked and uncracked concrete in accordance with ACI 355.2.

2.1.10.1 Expansive Anchors

Provide stainless steel, Alloy 304 or 316, expansive anchors. Expansive anchors must have a minimum diameter of 1/2-inch and a minimum 4-inch nominal embedment.

2.1.10.2 Undercut Anchors

Provide undercut anchors suitable for cracked and uncracked concrete and seismic loading. Undercut anchors must have a minimum diameter of 1/2-inch. Provide galvanized (or sheradized) or stainless steel alloy 316 anchors.

2.1.11 Adhesive Anchors

a. Use an adhesive to bond steel anchors to concrete. The adhesive must be a moisture insensitive, structural adhesive. Anchors must have been tested and qualified for performance in cracked and uncracked concrete, horizontal and overhead applications, and long term creep in accordance with ACI 355.4.

b. Threaded rod anchors must meet the requirements of ASTM F1554, ASTM A36/A36M, or ASTM A193/A193M Grade B7. Carbon steel threaded rods must be galvanized in accordance with ASTM A153/A153M. Reinforcing bars must meet the requirements of ASTM A615/A615M.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

2.2.2 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

PART 3 EXECUTION

3.1 CONCRETE ANCHORS

3.1.1 General Requirements for Fasteners to Concrete

a. Provide anchors at least 1/2 inch in diameter unless otherwise indicated in the plans or this specification section. Provide chemically bonded adhesive anchors with an embedded depth equal to at least 12 times nominal diameter of the bolt. Provide expansive or undercut anchors with a minimum embedded depth of at least 4 inches. Compute anchor capacity as per Chapter 17 of ACI 318 and reduce the anchor capacity to account for the effect of spacing between anchor bolts and the distance between anchor bolt and the nearest concrete edge. Provide anchor test data in accordance with ICC ES Evaluation Services Reports (ESR) for each type and class of concrete anchor verifying the suitability of an anchor for the intended application.

b. Embedment is only considered to occur in structural concrete and embedment solely in architectural floating slabs and house-keeping foundation pads not integrally connected to the reinforced concrete structure will not be accepted. For anchors installed in an environment subject to water intrusion and freeze thaw cycles, provide epoxy adhesive anchors or alternately use undercut anchors and seal with a flexible sealant recommended by the anchor manufacturer and as indicated on the drawings and approved by the CO.

3.1.2 Tests and Inspections

Anchors must be inspected during installation to verify anchor type, dimensions, base material, hole cleaning procedures, effective embedment, tightening torque, adherence to manufacturer's installation instructions, and any additional items recommended in the Evaluation Report. Inspections are to be performed by a third party inspector with at least 3 years experience inspecting post-installed concrete anchors. Submit inspector qualifications for review. Perform testing on the first three anchors of each type and size, for each installer, and a minimum of 10 percent of randomly selected anchors. Anchors for testing will be selected by the Contracting Officer.

3.1.2.1 Mechanical Anchors

- a. For mechanical anchors, periodic special inspections are required. Inspectinos must be inaccordance with ICC IBC and the Evaluation Report.
- b. For mechanical anchors whose strength is dependent on a minimum installation torque, the anchors are to be torque tested with a calibrated torque wrench.
- c. For mechanical anchors whose strength is not dependent on a minimum installation torque, the inspector must tested by proof loading. Perform confined tension proof load testing in accordance with ASTM E488/E488M. Use incremental loading for tensile test. Maintain proof load for a minimum of 10 seconds. Consider anchors to have failed if displacement exceeds 0.1 inch, $D/10$, where D is the nominal anchor diameter, or if any of the failure modes listed in ASTM E488/E488M occur.

3.1.2.2 Adhesive Anchors

- a. Periodic inspections are required except for where adhesive anchors are used to resist sustained tension in horizontal or upwardly inclined orientations, or where the findings of the Evaluation Report for the adhesive anchor product require it, continuous inspection is required. Inspections must be in accordance with ICC IBC and the Evaluation Report.
- b. Perform confined tension proof load testing in accordance with ASTM E488/E488M. Use incremental loading for tensile test. Maintain proof load for a minimum of 10 seconds. Consider anchors failed if displacement exceeds 0.1 inch, $D/10$, where D is the nominal anchor diameter, or if any of the failure modes listed in ASTM E488/E488M occur. Torque testing of adehsive anchors is not acceptable.

3.1.2.3 Post-Installed Anchor Inspection Reports

Report the results of all anchor inspections. Submit report as an electronic PDF file to the Contracting Officer for review. The report must include the following:

- (1) Exact locations of the inspected and tested work.
- (2) Inspector's name.
- (3) Date of inspection.
- (4) Summary of work completed during the inspection period.
- (5) Test results.
- (6) Statement by the Inspector that clearly identifies the tested anchors as being acceptable or rejected.
- (7) Statement by the Inspector confirming that the materials and installation procedures conform with the approved Contract Documents and the manufacturer's published installation instructins.

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SECTION 05 51 33.00 26

MISCELLANEOUS STEEL STRUCTURES

PART 1 GENERAL

This section covers the requirements for the design, fabrication, and installation of the maintenance platforms, ladders, guardrails, and maintenance access hatch modifications.

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

AMERICAN LADDER INSTITUTE (ALI)

ALI A14.3 (2008; R 2018) Ladders - Fixed - Safety Requirements

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A1264.1 (2017) Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrail/Handrail Systems

ASSP Z359.16 (2016) Safety Requirements for Climbing Ladder Fall Arrest Systems

ASTM INTERNATIONAL (ASTM)

ASTM A563 (2015) Standard Specification for Carbon and Alloy Steel Nuts

ASTM D1187/D1187M (1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (2016) Primer, Alkyd, Anti-Corrosive for Metal

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

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)

29 CFR 1910.29 (Nov 2016) Fall Protection System and Falling Object Protection - Criteria and Practices

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

Shop Drawings; G, HDC

SD-03 Product Data

Ladders

Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

SD-05 Design Data

Design Package; G, HDC

1.3 DESIGN REQUIREMENTS

1.3.1 General

The Contractor is responsible for designing the structures and/or components listed below and identified on the Contract Drawings. The designs are to be performed, stamped and certified by a registered professional engineer.

a. Maintenance Platforms

b. Access Hatch Modifications

c. Access Ladders

d. Butterfly Valve Access Hatch Guardrails

1.3.2 Design Package

Submit a design package for each design item listed above at least 90 days

prior to the start of any of the related work. Items may be combined or submitted individually. Each design package must include, at a minimum, a stamped letter of certification from a registered professional engineer, design calculations, design drawings, product data sheets, and any finite element model outputs (if used). Clearly state all assumptions, references, and standards used. After the design package has been approved, submit shop drawings for fabrication.

1.3.3 Design Loading and Criteria

Develop loads and load combinations in accordance with ASCE 7-16, except as noted in this specification. Use the Load and Resistance Factor Design (LRFD) methodology in all places possible. The maximum floor deflections are not to exceed $L/480$ for live loads only, and $L/240$ for dead plus live loads. Structural steel design is to be in accordance with AISC 325.

a. Dead Loads. Dead loads include the self-weight of the structure and any permanently attached components and/or equipment.

b. Maintenance Platform Live Loads. Design maintenance platforms to support a distributed live load of 100 pounds per square foot or a concentrated live load of 300 pounds, whichever produces the greater load effects. Reduction of the live load is not permitted.

c. Hatch Cover Live Loads. Design the hatch covers to support a distributed live load of 150 pounds per square foot or a concentrated live load of 500 pounds, whichever produces the greater load effects. Reduction of the live load is not permitted.

d. Guardrail Systems. Design guardrail systems to resist a concentrated load of 200 pounds or a distributed load of 50 pounds per lineal foot applied to the top rail in any direction, whichever produces the greater load effects.

e. Ladders. Design each ladder rung for a single concentrated live load of 250 pounds. The minimum design live load is two 250 pound concentrated loads between any two consecutive ladder attachment points. Include any impact loads from ladder climbing devices, if applicable.

PART 2 PRODUCTS

2.1 MATERIALS

Materials are to be in accordance with those listed in Part 2 of Section 05 50 04.00 26 METALS: MISCELLANEOUS, STANDARD ARTICLES, SHOP FABRICATED ITEMS, unless noted otherwise herein.

2.2 MAINTENANCE PLATFORMS

Provide maintenance platforms as shown and as approved in accordance with the provisions in EM 385-1-1 and ASSP A1264.1. Design new platforms using the design loading and criteria specified herein. Unless shown otherwise on the Contract Drawings, provide a minimum clear width of 30 inches. All decking to be heavy-duty steel grating unless otherwise shown or specified. Provide guardrails, toe boards, and safety gates around the platforms as required with welded joints.

2.2.1 Floor Grating

Bar type grating must be designed in accordance with NAAMM MBG 531 or NAAMM MBG 532, and must be carbon steel, hot-dip galvanized. Metal plank grating must meet non-slip requirement, steel ASTM A563, G90. Floor grating must exceed both wet and dry static coefficient of friction of 0.60, or must be listed by Underwriter Laboratories as "slip-resistant".

2.3 LADDERS

Provide ladders as shown and as approved in accordance with the provisions in EM 385-1-1 and ALI A14.3. For ladders greater than 20-feet in length, provide each ladder with a ladder climbing device (LCD) meeting EM 385-1-1 as required. Ladder cages are not permitted in place of a ladder climbing device. Design ladders using the design loading and criteria specified herein. Provide ladders not less than 16-inches wide, measured inside the rails, and rungs not less than 7/8-inch in diameter, equally spaced on approximately 12-inch centers. Provide ladder rungs with non-slip surfaces. Unless shown otherwise in the drawings or otherwise specified, design ladders with the following clearances:

- a. Outwards - 30 inches, measured from the center of the rungs
- b. Inwards - 7 inches, measured from the center of the rungs
- c. Side - 15 inches, measured from the centerline of the ladder
- d. Floor-to-first rung - 12 inches, measured from the floor surface to center of the rung

2.3.1 Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

Conform to 29 CFR 1910.29, Section 7 of ALI A14.3 and ASSP Z359.16. Install ladder safety devices on ladders over 20 feet long or more. The ladder safety systems must meet the design requirement of the ladders which they serve. The ladder safety system must be capable of sustaining a minimum static load of 1,000 pounds. The applied loads transferred to the climbing ladder mounting locations as a result of a fall shall be specified by the manufacturer of the climbing ladder fall arrest system. Each ladder safety system must allow the worker to climb up and down using both hands and does not require the employee continuously, hold, push, or pull any part of the system while climbing. The connection between the carrier or lifeline and the point of attachment to the body harness does not exceed 9 inches. The ladder safety system consists of a rigid or flexible carrier. Mountings for the rigid carriers are attached at each end of the carrier, with intermediate mountings spaced as necessary, along the entire length of the carrier. Mountings for flexible carrier are attached at each end of the carrier and cable guides for flexible carriers are installed at least 25 feet apart but not more than 40 feet apart along the entire length of the carrier. The design and installation of mountings and cable guides does not reduce the design strength of the ladder.

2.4 ACCESS HATCH MODIFICATIONS

Modify the existing hatch covers to enlarge the maintenance access hatch, as shown on contract drawings. The new maintenance access hatch opening must be 30 inches by 30 inches. The modified hatch cover must be able to support the loading and meet the criteria specified herein, and

constructed of steel. Provide hinged hatch cover, designed to support the loading specified herein, and constructed of steel; and provide recessed handle and positive mechanical locking latch for securing the hatch in the open position. Provide railing, toe boards, and safety gates around the opening as required with welded joints. Railing and gates must conform to design loads as specified herein.

2.5 BUTTERFLY VALVE ACCESS HATCH GUARDRAIL

Provide guardrails to provide fall protection, including toeboards, around the the butterfly valve access hatches as shown on Contract Drawing MD101 and MD102. One set of guardrails will fully surround the access hatch. Provide quantities as noted on MD101. Design guardrails in accordance with EM 385-1-1 and 29 CFR 1910.29. Guardrails must be removable and utilize existing pipe pockets. Limit weight of each guardrail section not to exceed 50 pounds.

2.6 SAFETY GATES

Provide safety gates at all openings in the guardrails and as shown in the Contract Drawings. Permanently attach safety gates to the guardrails. Provide self-closing adjustable type safety gates designed for easy passage (will not require personnel to stop and lift a bar or undo chains for passing through). Provide safety gates that are adjustable using stop bolts, and include stainless steel spring for automatic gate closure. Construct the gates from structural steel and paint yellow per the manufacturer. Force test the gates up to 300 pounds and designed in accordance with ASSP A1264.1.

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. 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 will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed 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 metal items securely in place. Unless shown or specified otherwise, use expansion anchors for anchorage to concrete Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, and harmonize with the material to which fastenings are applied.

3.3 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with 05 05 23.17 26 WELDING (STEEL), FABRICATION, AND MACHINE WORK. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.4 FINISHES

3.4.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 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.

3.4.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.5 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to 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. Ends of ladders must not rest upon floor.

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SECTION 09 97 02.00 26

PAINTS AND COATINGS

PART 1 GENERAL

1.1 GENERAL INFORMATION

The work covered by this section consists of furnishing all material, labor, and equipment, and performing all work for painting, and touch-up painting for Fort Peck Powerhouse 2 Refurbished Penstock Butterfly Valves, Penstock Paint Repairs (Optional), and associated system and component modifications.

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.

ASTM INTERNATIONAL (ASTM)

| | |
|------------|---|
| ASTM D153 | (1984; R 2014) Specific Gravity of Pigments |
| ASTM D281 | (2012; R 2016) Standard Test Method for Oil Absorption of Pigments by Spatula Rub-Out |
| ASTM D520 | (2000; R 2011) Zinc Dust Pigment |
| ASTM D561 | (1982; R 2014) Carbon Black Pigment for Paint |
| ASTM D740 | (2011) Methyl Ethyl Ketone |
| ASTM D841 | (2019) Nitration Grade Toluene |
| ASTM D1045 | (2019) Sampling and Testing Plasticizers Used in Plastics |
| ASTM D1152 | (2006; R 2012) Methanol (Methyl Alcohol) |
| ASTM D1153 | (2012) Methyl Isobutyl Ketone |
| ASTM D1200 | (2010; R 2014) Viscosity by Ford Viscosity Cup |
| ASTM D1210 | (2005; R 2014) Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage |
| ASTM D2917 | (2007; R 2013) Methyl Isoamyl Ketone |
| ASTM D3465 | (2014) Standard Test Method for Purity of Monmeric Plasticizers by Gas Chromatography |
| ASTM D3721 | (2005; R 2011) Synthetic Red Iron Oxide Pigment |

| | |
|------------|--|
| ASTM D4228 | (2005; R 2017) Standard Practice for Qualification of Coating Applicators for Application of Coatings to Steel Surfaces |
| ASTM D4417 | (2019) Field Measurement of Surface Profile of Blast Cleaned Steel |
| ASTM D7091 | (2013) Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nondestructive Coatings Applied to Non-Ferrous Metals |
| ASTM E1347 | (2006; R 2020) Color and Color Difference Measurement by Tristimulus (Filter) Colorimetry |

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

| | |
|------------------|--|
| ANSI/ISEA Z87.1 | (2020) Standard for Occupational and Educational Eye and Face Protection |
| ANSI/ISEA Z358.1 | (2014) American National Standard for Emergency Eyewash and Shower Equipment |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---------|---|
| NFPA 70 | (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code |
|---------|---|

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

| | |
|----------------|---|
| NIOSH 2003-154 | (2003; 4th Ed, Supple 3) NIOSH Manual of Analytical Methods |
|----------------|---|

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

| | |
|---------------|---|
| SSPC Paint 38 | (2006) Single-Component Moisture-Cure Weatherable Aliphatic Polyurethane Topcoat, Performance-Based |
| SSPC Paint 40 | (2019) Zinc-Rich Moisture-Cure Polyurethane Primer, Performance-Based |
| SSPC Paint 41 | (2008) Moisture-Cured Polyurethane Primer or Intermediate Coat, Micaceous Iron Oxide Reinforced, Performance-Based |
| SSPC QP 1 | (2019) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures) |
| SSPC QP 2 | (2009; E 2013) Standard for Evaluating Painting Contractors (Removal of Hazardous Coatings from Industrial/Marine Structures) |

| | |
|----------------------|--|
| SSPC QP 3 | (2010) Standard Procedure for Evaluating Qualifications of Shop Painting Applicators |
| SSPC SP 1 | (2015) Solvent Cleaning |
| SSPC SP 3 | (2018) Power Tool Cleaning |
| SSPC 7/NACE No. 4 | (2007) Brush-Off Blast Cleaning |
| SSPC SP 5/NACE No. 1 | (2007) White Metal Blast Cleaning |
| SSPC SP 6/NACE No. 3 | (2007) Commercial Blast Cleaning |

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

| | |
|------------------|--|
| SAE AMS-STD-595A | (2017) Colors used in Government Procurement |
|------------------|--|

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

U.S. DEPARTMENT OF DEFENSE (DOD)

| | |
|---------------|---|
| MIL-DTL-24441 | (2009; Rev D) Paint, Epoxy-Polyamide, General Specification For |
|---------------|---|

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

| | |
|-----------------|---|
| 29 CFR 1910 | Occupational Safety and Health Standards |
| 29 CFR 1910.20 | Access to Employee Exposure and Medical Records |
| 29 CFR 1910.94 | Ventilation |
| 29 CFR 1910.134 | Respiratory Protection |
| 29 CFR 1910.146 | Permit-required Confined Spaces |
| 29 CFR 1926.62 | Lead |
| 40 CFR 261 | Identification and Listing of Hazardous Waste |
| 40 CFR 262 | Standards Applicable to Generators of Hazardous Waste |
| 40 CFR 262.22 | Number of Copies |
| 40 CFR 263 | Standards Applicable to Transporters of Hazardous Waste |
| 49 CFR 171 | General Information, Regulations, and Definitions |

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

Interpretation of Safety, Health, and Environmental Requirements; G

This submittal requests Government clarification of safety, health, and environmental requirements. If no clarifications are sought, then state as such in the submittal.

Accident Prevention Plan; G

Ventilation Assessment Plan; G

Confined Spaces Plan; G

Respiratory Protection Plan; G

A comprehensive written respiratory protection program in accordance with 29 CFR 1910.134, 29 CFR 1926.62, and section 05.E of EM 385-1-1.

Medical Surveillance Plan; G

Airborne Sampling Plan; G

Waste Classification, Handling, and Disposal Plan; G AKCT

Waste Manifest; G

SD-03 Product Data

Manufacturer's Product Data Sheet; G

SD-04 Samples

Product Samples; G CERL

Special Paint Formulas; G CERL

Solvent and Thinners; G CERL

SD-06 Test Reports

Air Monitoring Test Plan; G

Air Monitoring Test Report; G

Medical Status Report; G

Change in Medical Status Report; G

Inspection Reports; G

SD-07 Certificates

Certified EHS Professional; G

SSPC QP 2 Certificate; G, HDC

Qualified Paint Applicator; G

Coating Thickness Gage Qualification; G

Certified Coating Inspector; G

Qualified Painting Contractor; G

1.4 SAFETY, HEALTH, AND ENVIRONMENTAL REQUIREMENTS

Perform work in accordance with all applicable health, safety, and environmental requirements as well as EM 385-1-1. Submit matters of Interpretation of Safety, Health, and Environmental Requirements to the Contracting Officer for resolution before starting work. Where the regulations conflict, the most stringent requirements apply. This paragraph supplements the health, safety, and environmental requirements of EM 385-1-1.

1.4.1 Safety

Submit a Accident Prevention Plan in accordance with the requirements of Section 01 of EM 385-1-1, including, but not limited to, each of the topic areas listed in Appendix A therein and the specified requirements. Develop each topic in a concise manner to include management and operational aspects. Submit a Ventilation Assessment Plan complying with all applicable safety standards.

1.4.1.1 Abrasive Blasting

For abrasive blasting comply with the requirements in section 06.H of EM 385-1-1. In addition to the requirements in section 20 of EM 385-1-1, use hoses and hose connections of a type to prevent shock from static electricity. Join hose lengths together by approved couplings of a material and type designed to prevent erosion and weakening of the couplings. The couplings and nozzle attachments must fit on the outside of the hose and designed to prevent accidental disengagement.

1.4.1.2 Workers Other Than Blasters

Protect workers, other than blasting operators working in close proximity to abrasive blasting operations. Use MSHA/NIOSH-approved half-face or full-face air purifying respirators equipped with high-efficiency particulate air (HEPA) filters, eye protection meeting or exceeding ANSI/ISEA Z87.1 and hearing protectors (ear plugs and/or ear muffs) providing a noise reduction rating of at least 20 dBA or as needed to provide adequate protection. Provide personal protective equipment where required by 29 CFR 1910.146 and in accordance with 29 CFR 1910, Subpart I.

1.4.1.3 Cleaning Before and After Abrasive Blasting

Cleaning with compressed air must be in accordance with Section 20.B.5 of EM 385-1-1 and personnel protected as specified in 29 CFR 1910.134. When

cleaning with solvents, provide ventilation where required by 29 CFR 1910.146 or where the concentration of solvent vapors exceeds 10 percent of the Lower Explosive Limit (LEL). Ventilation must be in accordance with 29 CFR 1910.94, paragraph (c)(5).

1.4.1.4 Pretreatment of Metals and Concrete with Acids

Personnel must be protected in accordance with 29 CFR 1910, Subpart I. In addition to the requirements of Section 05 of EM 385-1-1, provide an eyewash in accordance with ANSI/ISEA Z358.1, paragraph (6).

1.4.1.5 Paint Mixing

Provide local exhaust ventilation in the area where coatings are mixed. Size the ventilation system such that it is capable of providing at least 100 linear fpm of capture velocity in the mixing zone. Avoid exposure of skin and eyes by wearing appropriate chemically resistant gloves, safety goggles, and face shields meeting the requirements of ANSI/ISEA Z87.1. Provide a personal eyewash unit within close proximity to the mixing operation in accordance with ANSI/ISEA Z358.1, paragraph (9). All powered mixing equipment must be either pneumatic or double insulated (intrinsically safe), in order to guard against fire or explosion. Individuals who have a history of, or develop a sensitivity to epoxy or polyurethane resin systems, must not conduct work tasks or otherwise be exposed to such chemicals.

1.4.1.6 Confined Spaces

When using solvent-based paint in confined spaces, prepare a Confined Spaces Plan. Provide ventilation to exchange air in the space at a minimum rate of 5,000 cubic feet per minute per spray gun in operation. It may be necessary to install both a mechanical supply and exhaust ventilation system to effect adequate air changes within the confined space. Locate and affix all air-moving devices to an opening of the confined space in a manner assuring that the airflow is not restricted or short circuited and is supplied in the proper direction. All ventilation must be vented outside of the powerhouse in a location away from the HVAC intake system of the structure. A suitable means of egress must be maintained at all times. Continue ventilation after completion of painting and through the drying phase of the operation. If the ventilation system fails or the concentration of volatiles exceeds 10 percent of the LEL (except in the zone immediately adjacent to the spray nozzle), stop painting and evacuate spaces until adequate ventilation is provided. Provide an audible alarm that signals system failure as an integral part of the ventilation system. Check the effectiveness of the ventilation by using ventilation smoke tubes and making frequent oxygen and combustible gas readings during painting operations. Exhaust ducts must discharge clear of the working areas and away from possible sources of ignition. Detail written standard operating procedures for confined spaces in accordance with 29 CFR 1910.146 and EM 385-1-1 section 6H, Section 34. The procedures must include:

- a. Certificates of calibration for all testing and monitoring equipment. Include as part of the certificates of calibration : type of equipment, model number, date of calibration, firm conducting calibration, and signature of individual certifying calibration.
- b. Methods of inspection of personal protective equipment prior to use.

c. Work practices and other engineering controls designed to reduce airborne hazardous chemical exposures to a minimum.

d. Specification of the design and installation of ventilation systems which must provide adequate oxygen content and provide for the dilution of paint solvent vapor, lead, and other toxic particulates within the confined space. In addition, include plans to evaluate the adequacy of air flow patterns.

1.4.1.7 Paint Spraying

Submit a Respiratory Protection Plan in accordance with 29 CFR 1910.134, 29 CFR 1926.62, and EM 385-1-1, Section 05.G. During all spray painting operations, spray painters must use approved SCBA or SAR (air line) respirators, unless valid air sampling has demonstrated contaminant levels to be consistently within concentrations that are compatible with air-purifying respirator Assigned Protection Factor (APF). Persons with facial hair that interferes with the sealing surface of the facepiece to face seal or interferes with respirator valve function are not allowed to perform work requiring respiratory protection. Air-purifying chemical cartridge/canister half- or full-facepiece respirators that have a particulate prefilter and are suitable for the specific type(s) of gas/vapor and particulate contaminant(s) may be used for nonconfined space painting, mixing, and cleaning (using solvents). These respirators may be used provided the measured or anticipated concentration of the contaminant(s) in the breathing zone of the exposed worker does not exceed the APF for the respirator and the gas/vapor has good warning properties or the respirator assembly is equipped with a NIOSH-approved end of service life indicator for the gas(es)/vapor anticipated or encountered. Where paint contains toxic elements that may become airborne during painting in nonconfined spaces, air-purifying half- and full-facepiece respirators or powered air-purifying respirators equipped with appropriate gas vapor cartridges, in combination with a high-efficiency filter, or an appropriate canister incorporating a high-efficiency filter, are to be used.

1.4.1.8 Explosion Proof Equipment

Electrical wiring, lights, and other equipment located in the paint spraying area are to be of the explosion proof type designed for operation in Class I, Division 1, Group D, hazardous locations as required by the NFPA 70. Electrical wiring, motors, and other equipment, outside of but within 20 feet of any spraying area, must not spark and must conform to the provisions for Class I, Division 2, Group D, hazardous locations. Electric motors used to drive exhaust fans must not be placed inside spraying areas or ducts. Fan blades and portable air ducts must be constructed of nonferrous materials. Properly maintain and ground motors and associated control equipment. Electrically bond and ground the metallic parts of all air-moving devices, spray guns, connecting tubing, and duct work.

1.4.1.9 Further Precautions

a. Wear nonsparking safety shoes.

b. Place and ground solvent drums, taken into the spraying area, on nonferrous surfaces. Maintain metallic bonding between containers and drums when materials are being transferred.

c. Inspect insulation on all power and lighting cables to ensure that the insulation is in excellent working condition and is free of all cracks and worn spots. Further inspect cables to ensure that no connections are within 50 feet of the operation, that lines are not overloaded, and that they are suspended with sufficient slack to prevent undue stress or chafing.

1.4.1.10 Ignition Sources

Ignition sources, to include lighted cigarettes, cigars, pipes, matches, or cigarette lighters are prohibited in area of solvent cleaning, paint storage, paint mixing, or paint application.

1.4.2 Health

Prepare and submit a Medical Surveillance Plan and a statement from the examining physician indicating the name of each employee evaluated and any limitations that precludes the employee from performing the work required. Provide a statement that includes the date of the medical evaluation, the physician's name, signature, and telephone number.

1.4.2.1 Air Monitoring

Prepare and submit an Air Monitoring Test Plan. Perform air sampling and testing as needed to assure that workers are not exposed to contaminants above the permissible exposure limit. In addition, provide the Contracting Officer with a copy of the Air Monitoring Test Report from the laboratory within five (5) working days of the sampling date, including records of air monitoring plans and tests performed. Submit reports as soon as information is available. Also provide results from direct-reading instrumentation on the same day the samples are collected. Prepare and submit an Airborne Sampling Plan as specified in the Submittals paragraph. An Airborne Sampling Plan detailing the NIOSH 2003-154, Factory Mutual, or Underwriters Laboratories approved equipment, equipment calibration procedures, sampling methods, sampling to be performed, and analytical procedures to be used based on the type of work to be performed and anticipated toxic contaminants to be generated. Include the name of the accredited laboratory, listed by the American Industrial Hygiene Association (AIHA), to be used to conduct the analysis of any collected air samples.

1.4.2.2 Medical Status

Prior to the start of work, and annually thereafter, submit a Medical Status Report including records of medical tests. Medically evaluate all Contractor employees working with or around paint systems, thinners, blast media, those required to wear respiratory protective equipment, and those who will be exposed to high noise levels for the particular type of exposure they may encounter. Maintain medical records as required by 29 CFR 1910.20. Include the following in the evaluation:

- a. Audiometric testing and evaluation of employees who will work in a noise environment with a time weighted average greater than or equal to 90 dBA.
- b. Vision screening (employees who use full-facepiece respirators are not to wear contact lenses).
- c. Include, but not limited to, the following in the medical

evaluation:

- (1) Medical history including, but not limited to, alcohol use, with emphasis on liver, kidney, and pulmonary systems, and sensitivity to chemicals to be used on the job.
- (2) General physical examination with emphasis on liver, kidney, and pulmonary system.
- (3) Determination of the employee's physical and psychological ability to wear respiratory protective equipment and to perform job-related tasks.
- (4) Determination of baseline values of biological indices for later comparison to changes associated with exposure to paint systems and thinners or blast media, which include: liver function tests to include SGOT, SGPT, GGPT, alkaline phosphates, bilirubin, complete urinalysis, EKG (employees over age 40), blood urea nitrogen (bun), serum creatinine, pulmonary function test, FVC, and FEV, chest x-ray (if medically indicated), blood lead and ZPP (for individuals where it is known there will be an exposure to materials containing lead), other criteria that may be deemed necessary by the Contractor's physician, and Physician's statements for individual employees that medical status would permit specific task performance.

1.4.2.3 Change in Medical Status

Any employee whose medical status has changed negatively due to work related chemical and/or physical agent exposure while working with or around paint systems and thinners, blast media, or other chemicals are to be evaluated by a physician, and obtain a physicians statement as described in paragraph MEDICAL STATUS prior to allowing the employee to return to those work tasks. Submit a Change in Medical Status Report detailing any negative changes in employee medical status and the results of the physicians reevaluation statement.

1.4.3 Environmental Protection

In addition to the requirements of SECTION 01 57 20.00 10 ENVIRONMENTAL PROTECTION, comply with the following environmental protection criteria.

1.4.3.1 Waste Classification, Handling, and Disposal

Prepare and submit a Waste Classification, Handling, and Disposal Plan in accordance with the requirements of 40 CFR 261 and 40 CFR 262 including classification and handling. The Contractor is responsible for assuring the proper disposal of all hazardous and nonhazardous waste generated during the project. Regardless of results of 40 CFR 261 App II, Mtd 1311, all waste generated from abrasive blasting, lead-containing paints with recyclable steel or iron abrasives must be either disposed of as a hazardous waste or be stabilized with proprietary pre-blast additives. Where stabilization is preferred, employ a proprietary blast additive, that has been blended with the blast media prior to use. Place hazardous waste in properly labeled, closed containers shielded adequately to prevent dispersion of the waste by wind or water. Any evidence of improper storage is cause for immediate shutdown of the project until corrective action is taken. Store nonhazardous waste in closed containers separate from hazardous waste storage areas. Transport all hazardous

waste by a licensed transporter in accordance with 40 CFR 263 and 49 CFR 171, Subchapter C. Transport all nonhazardous waste in accordance with local regulations regarding waste transportation. In addition to the number of copies required by 40 CFR 262.22, supply one copy of each Waste Manifest to the Contracting Officer prior to transportation. Include in the waste manifest, a Waste Classification, Handling, and Disposal Plan in accordance with the requirements of 40 CFR 261 and 40 CFR 262.

1.5 QUALIFICATIONS

Ensure qualifications and experience comply with the following:

1.5.1 Quality Control Personnel

Quality control personnel must include a Certified Coating Inspector who is listed as either SSPC-PCI Level 2, or NACE CIP Level 2 for all surface preparation and painting activities. Submit a copy of the applicable SSPC or NACE certificates. Submit all renewals if they occur during the contract performance period. Renewals must be achieved prior to expirations occurring.

1.5.2 Certified Environmental, Health, and Safety Professionals

Provide a certificate for each Certified EHS Professional; submit qualifications and experience of qualified and competent persons employed to provide preconstruction and onsite environmental, safety, and health services. Obtain acceptance of this submission prior to the submission of other required environmental, safety, and health submittal items.. Utilize a qualified and competent person as defined in Section 01 of EM 385-1-1 to develop the required safety and health submittal and to provide onsite safety and health services during the contract period. Ensure the person is a Certified Industrial Hygienist (CIH), an Industrial Hygienist (IH), or a Certified Safety Professional (CSP) with a minimum of three years of demonstrated experience in similar related work. The CIH, IH, or CSP may utilize other qualified and competent persons, as defined in EM 385-1-1, to conduct on-site safety and health activities as long as these persons have a minimum of two years of demonstrated experience in similar related work and are under the direct supervision of the CIH, IH, or CSP. For lead containing jobsites, the competent and qualified person must have successfully completed an EPA or state accredited lead-based paint abatement Supervisor course specific to the work to be performed and possess current and valid state and/or local government certification, as required.

1.5.3 Qualified Painting Contractor

Provide a certified SSPC QP 1 Painting Contractor for field applications. Provide a certified SSPC QP 3 or AISC Sophisticated Paint Endorsement for shop applied coatings

1.5.4 Qualified Hazardous Paint Removal Contractor

The Paint Removal Contractor must be a certified SSPC QP 2 Painting Contractor. Provide a copy of the SSPC QP 2 Certificate. The contractor must have been certified prior to the award of this contract and must remain certified for the duration of this contract. Certifications scheduled to expire during the contract performance period must be renewed and submitted to the Contracting Officer prior to expiration.

1.5.5 Qualified Paint Applicator

Submit records of qualification tests and third party certification for each Qualified Paint Applicator. Prior to the initiation of any work, all paint applicators must be tested and certified as meeting the requirements of ASTM D4228. Certification must be administered by an authorized Government representative. Applicators failing the certification procedure will not be permitted to apply any paint on the project.

1.5.5.1 Test Plate

The test plate is to consist of a 6- by 6-foot steel plate with a 3/8 inch minimum thickness. The test plate must have at least six (6) bolts, three (3) with bolt heads exposed and three (3) with threads exposed, a 12 inch wide flange and a 6 inch diameter pipe each 18 inches long welded perpendicular to the test panel and a 6 inch deep T-beam with sealed ends welded horizontal across the test panel 1 foot up from the bottom all within the area to be painted on one (1) side. Bolts are to be 1 inch minimum diameter.

1.5.5.2 Certification Test Procedure

Conduct certification testing of coating applicators at the job site, for all paint systems specified in this Section, in coordination with the Contracting Officer. Supply the fabricated test plates to be used for the tests and provide crane service, rigging, and any other work necessary to provide accessibility for the certification testing and inspection. The test plate must be painted in accordance with the requirements of the contracted work. Perform abrasive blasting with the blast media to be used in the Contract. Coatings must be applied as specified in this Contract. The applicator being tested must mix and thin the paints to be used in the test and set up and adjust the application equipment for use. Each applicator must apply each of the types of paint comprising the specified system. The Contractor's QC inspector must be present during the procedure to monitor the actions of the applicator being tested. Paint the test plate in a near vertical position.

1.5.5.3 Certification Criteria

Evaluate the paint applicator based on the conformance of the applied paint system to the requirements of the specifications. Deficiencies in the coatings, improper mixing or improper application methods are basis for failure. The authorized Government Representative is the sole judge as to the acceptability of each coating applicator's performance.

1.5.6 Coating Thickness Gage Qualification

Submit Coating Thickness Gage Qualification documentation of manufacturer's certification for all coating thickness gages. Magnetic flux thickness gages as described in ASTM D7091 are to be used to make all coating thickness measurements on ferrous metal substrates. Eddy current thickness gages as described in ASTM D7091 are to be used to measure coating thickness on all nonferrous metal substrates. Ensure gages have an accuracy of +/- 3 percent or better. Gages to be used on the job are to be certified by the manufacturer as meeting these requirements.

1.6 AMBIENT CONDITIONS

Paint must be applied in accordance with the manufacturers written

instruction or to the special requirements contained herein. Surfaces that are less than 5 degrees F above the dew point temperature must be monitored closely to assure that they are completely free of moisture as determined by sight and touch. Paint must not be applied to surfaces upon which there is detectable frost or ice. Except as otherwise specified, paint must not be applied if the temperature of the surfaces to be painted and of air in contact therewith is less than 45 degrees F during paint application nor if the surfaces can be expected to drop to 32 degrees F or lower before the film has dried to a reasonably firm condition. During periods of inclement weather, painting may be continued by enclosing the surfaces and utilizing climate control equipment (e.g. dehumidification, heaters, etc.), provided the minimum temperatures and surface dryness requirements prescribed previously are maintained. Paint must not be applied to surfaces heated by direct sunlight or other sources to temperatures that will cause detrimental blistering, pinholing, or porosity of the film.

1.7 DELIVERY, STORAGE, AND HANDLING

Process and package paints to ensure that within a period of one year from date of manufacture, they will not gel, liver, or thicken deleteriously, or form gas in the closed container. Paints, unless otherwise specified or permitted, are to be packaged in standard containers not larger than 5-gallon, with removable friction or lug-type covers. Containers for vinyl-type paints are to be lined with a coating resistant to solvents in the formulations and capable of effectively isolating the paint from contact with the metal container. Label each container of paint or separately packaged component thereof to indicate the purchaser's order number, date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name, and formula or specification number of the paint together with special labeling instructions, when specified. Delivery paint to the job in unbroken containers. Store paints that can be harmed by exposure to cold weather in ventilated, heated shelters. Store all paints under cover from the elements, in accordance with all manufacturer's recommendations, in locations free from sparks and flames, and be in accordance with all relevant requirements of EM 385-1-1.

PART 2 PRODUCTS

Submit Product Samples of each batch of thinner, solvent, and paint to the Government for testing. Submit Manufacturer's Product Data Sheet for each type of paint used; for products that are specified to be applied in accordance with the manufacturer's recommendations, submit the paint manufacturer's product data sheet or other written instructions for those products. Submit samples of all special paint formula, Military, Master Painter Institute, and SSPC paints and samples of solvents or thinners used to reduce the viscosity of the paint. Allow at least 30 calendar days for sampling and testing of samples of paints and thinners. Sampling may be at the jobsite or source of supply. Notify the Contracting Officer when the paint and thinner are available for sampling. Sampling of each batch will be witnessed by the Contracting Officer unless otherwise specified or directed. Submit a 1-quart sample of paint and thinner for each batch proposed for use. The sample must be labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project Contract number. Testing will be performed by the Government. Costs for retesting rejected material will be deducted from payments to the Contractor at the rate of \$1000 dollars for each paint sample retested and \$200 dollars for each

thinner retested. The Contractor is responsible to ship samples to the designated laboratory. Ship samples to:

US Army Corps of Engineers ERDC-CERL
2902 Newmark Drive
Champaign, Illinois 61826-9005
Attn: Paint Laboratory

2.1 SPECIAL PAINT FORMULAS

Special paints are to have the composition as indicated in the formulas listed herein. Where so specified, certain components of a paint formulation is to be packaged in separate containers for mixing on the job. If not specified or otherwise prescribed, the color must be that naturally obtained from the required pigmentation.

2.2 PAINT FORMULATIONS

Ensure special paint formulas (System No. 5-E-Z) comply with the following:

2.2.1 Formula V-766E

This formula is for Vinyl-Type White (or Gray) Impacted Immersion Coating, the ingredients are shown below.

| INGREDIENTS | PERCENT BY MASS |
|---|-----------------|
| Vinyl Resin, Type 3 | 5.6 |
| Vinyl Resin, Type 4 | 11.6 |
| Titanium Dioxide and (for Gray) Carbon Black | 13.0 |
| Diisodecyl Phthalate | 2.9 |
| Methyl Isobutyl Ketone | 32.0 |
| Toluene | 34.7 |
| Ortho-Phosphoric Acid | 0.2 |
| Total | 100.0 |

a. The dispersion of pigment is to be accomplished by means of pebble mills or other approved methods to produce a fineness of grind (ASTM D1210) of not less than 7 on the Hegman scale. Grinding in steel-lined or steel-ball mills will not be permitted. No grinding aids, antissettling agents, or any other materials except those shown in the formula will be permitted. Measure the ortho-phosphoric acid accurately and dilute it with at least four parts of ketone to one part of acid. Add it slowly into the finished paint with constant and thorough agitation.

b. The finished paint must show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric

methods. The viscosity of the paint must be between 60 and 90 seconds using ASTM D1200 and a No. 4 Ford cup.

c. Furnish the white and gray paints in the volume ratio designated by the purchased. The gray paint must contain no pigments other than those specified. Include enough carbon black to produce a dry paint film having a reflectance of 20-24 (ASTM E1347). The resulting gray color must approximate color 26231 of SAE AMS-STD-595A.

2.2.2 Formula VZ-108d

This formula is for Vinyl-Type Zinc-Rich Impacted Immersion Coating, the ingredients are shown below.

| INGREDIENTS | PERCENT BY WEIGHT | POUNDS | GALLONS |
|----------------------------|-------------------|--------|-------------------------|
| COMPONENT A | | | |
| Vinyl Resin, Type 3 | 16.6 | 109.2 | 9.65 |
| Methyl Isobutyl Ketone | 80.6 | 528.9 | 79.30 |
| Suspending Agent E | 0.7 | 4.6 | 0.28 |
| Suspending Agent F | 0.4 | 2.7 | 0.19 |
| Methanol | 0.5 | 3.3 | 0.50 |
| Synthetic Iron Oxide (Red) | 1.2 | 7.9 | 0.19 |
| Total | 100.0 | 656.6 | 90.11 |
| COMPONENT B | | | |
| Silane B | 100.0 | 4.1 | 0.47 |
| COMPONENT C | | | |
| Zinc Dust | 100.0 | 550.0 | 9.42 |
| Total Volume | | | 100.00 (mixed paint) |

a. Disperse the iron oxide and suspending agents into the vehicle (Component A) to a fineness of grind of not less than 4 on the Hegman scale (ASTM D1210). Grinding in steel-lined containers or using steel-grinding media will not be permitted. The paint must show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric methods. The sole purpose of the iron oxide pigment is to produce a contrasting color. A red iron oxide-type 3 vinyl resin vehicle paste may be used in place of dry iron oxide provided compensating adjustment are made in the additions of Type 3 resin and methyl isobutyl ketone. The finished product with zinc dust added must produce a paint which has a red tone upon drying and a reflectance of not more than 16 (ASTM E1347).

b. Supply VZ-108d paint as a kit. Each kit must consist of 4.5 gallons (33.1 pounds) of Component A in a 5 gallon lug closure type pail, 27.5 pounds of zinc dust (Component C) packaged in a 1 gallon plastic pail, and 3 fluid ounces of silane (Component B) packaged in a glass bottle of suitable size having a polyethylene lined cap. Place the bottle of silane on the zinc dust in the 1 gallon pail. In addition to standard labeling requirements, identify each container of each component as to component type. Each container label of Component A must carry the following: MIXING AND APPLICATION INSTRUCTIONS: WARNING - THIS PAINT WILL NOT ADHERE TO STEEL SURFACES UNLESS COMPONENT B IS ADDED. Remove the 3 ounces of bottled Component B (silane) from the Component C (zinc dust) container and add to the base paint Component A) with thorough stirring. Then sift the zinc dust into the base paint while it is being vigorously agitated with a power-driven stirrer and continue the stirring until the zinc dust has been dispersed. At some point strain the mixed paint through a 30-60 mesh screen to prevent zinc dust slugs from reaching the spray gun nozzle. Stir the paint continuously during application at a rate that will prevent settling. If spraying is interrupted for longer than 15 minutes, vigorously whip the entire length of the hose to redisperse the zinc. If the spraying is to be more than 1 hour, empty the hose by blowing the paint back into the paint pot. Thinning will not normally be required when ambient temperatures are below about 80 degrees F, but when the ambient and steel temperatures are higher, methyl isoamyl ketone (MIAK) or methyl isobutyl ketone (MIBK) should be used. If paint is kept covered at all times, its pot life will be about eight days.

2.3 INGREDIENTS FOR SPECIAL PAINT FORMULAS

The following ingredient materials and thinners apply only to those special paints whose formulas are shown above in detail.

2.3.1 Pigments and Suspending Agents

2.3.1.1 Carbon Black

Carbon black must conform to ASTM D561, Type I or II.

2.3.1.2 Zinc Dust

Zinc dust pigment must conform to ASTM D520, Type II.

2.3.1.3 Iron Oxide

Iron oxide, (Dry) synthetic (red) must conform to ASTM D3721. In addition, the pigment must have a maximum oil absorption of 24 and a specific gravity of 4.90 to 5.20 when tested in accordance with ASTM D281 and ASTM D153, Method A, respectively. When the pigment is dispersed into specified vinyl paint formulation, the paint must have color approximating SAE AMS-STD-595A color 10076 (dark red paint), and show no evidence of incompatibility or reaction between pigment and other components after 6 months storage.

2.3.1.4 Titanium Dioxide

Titanium dioxide in vinyl paint Formula V-766e must be one of the following: Kronos 2160 or 2101, Kronos, Inc.; Ti-Pure R-960, E.I. DuPont DeNemours and Co., Inc.

2.3.1.5 Suspending Agent E

Suspending Agent E must be a light cream colored finely divided powder having a specific gravity of 2 to 2.3. It must be an organic derivative of magnesium aluminum silicate mineral capable of minimizing the tendency of zinc dust to settle hard without increasing the viscosity of the paint appreciably. M-P-A-14, produced by Elementis Specialties, has these properties.

2.3.1.6 Suspending Agent F

Suspending Agent F must be a light cream colored finely divided powder having a specific gravity of approximately 1.8. It must be an organic derivative of a special montmorillonite (trialkylaryl ammonium hectorite). Bentone 27, produced by Elementis Specialties, has these properties.

2.3.2 Resins, Plasticizer, and Catalyst

2.3.2.1 Plasticizer

The plasticizer must be either Di 2-propyl Heptyl Phthalate (DPHP) or Diisodecyl Phthalate (DIDP). DPHP must have an ester content of not less than 99.5 percent (ASTM D3465), must contain not more than 0.1 percent water, and must have an acid number (ASTM D1045) of not more than 0.07. DIDP must have a purity of not less than 99.0 percent, must contain not more than 0.1 percent water, and must have an acid number (ASTM D1045) of not more than 0.10.

2.3.2.2 Vinyl Resin, Type 3

Vinyl resin, Type 3, must be a vinyl chloride-acetate copolymer of medium average molecular weight produced by a solution polymerization process and must contain (by weight) 85 +/- 1.0 percent vinyl chloride and 15 +/- 1.0 percent vinyl acetate by weight. The resin must have film-forming properties and must, in specified formulations, produce results equal to Vinnol H 15/50, as manufactured by Wacker Chemie AG.

2.3.2.3 Vinyl Resin, Type 4

Vinyl resin, Type 4, must be a copolymer of the vinyl chloride-acetate type produced by a solution polymerization process, must contain 1 percent interpolymerized dicarbonic acid, 84 +/- 1.0 percent vinyl chloride, and 15 +/- 1.0 percent vinyl acetate. The resin must have film-forming properties and must, in the specified formulations, produce results equal to Vinnol H 15/45 M, as manufactured by Wacker Chemie AG.

2.3.2.4 Ortho-phosphoric Acid

Ortho-phosphoric acid must be a chemically pure 85-percent grade.

2.3.3 Solvent and Thinners

2.3.3.1 Methanol

Methanol (methyl alcohol) must conform to ASTM D1152.

2.3.3.2 Methyl Ethyl Ketone

Methyl ethyl ketone (MEK) must conform to ASTM D740.

2.3.3.3 Methyl Isobutyl Ketone

Methyl isobutyl ketone (MIBK) must conform to ASTM D1153.

2.3.3.4 Methyl Isoamyl Ketone

Methyl isoamyl ketone (MIAK) must conform to ASTM D2917.

2.3.3.5 Toluene

Toluene must conform to ASTM D841.

2.3.4 Silane B

Silane B for Formula VZ-108d must be N-beta-(aminoethyl)-gamma-aminopropyltrimethoxy silane. Silquest A-1120, produced by Momentive Performance Materials Inc., and Silane Z-6020, produced by Dow Corning Corporation, are products of this type.

2.4 TESTING

2.4.1 Chromatographic Analysis

Solvents in vinyl paints and thinners are to be subject to analysis by programmed temperature gas chromatographic methods and/or spectrophotometric methods, employing the same techniques that give reproducible results on prepared control samples known to meet the specifications. If the solvent being analyzed is of the type consisting primarily of a single chemical compound or a mixture of two or more such solvents, interpretation of the test results must take cognizance of the degree of purity of the individual solvents as commercially produced for the paint industry.

2.4.2 Vinyl Paints

Vinyl paints are to be subject to the following adhesion test. When V-766 or V-106 formulations are tested, 5 to 7 mils (dry) must be spray applied to mild steel panels. Ensure the steel panels are essentially free of oil or other contaminants that may interfere with coating adhesion. Dry blast clean the test panels to a White Metal grade in compliance with SSPC SP 5/NACE No. 1. Ensure the surface has an angular profile of 2.0 to 2.5 mils as measured by ASTM D4417, Method C. When V-102 or V-103 formulations are tested, they are to be spray applied over 1.5 to 2.5 mils (dry) of V-766 or V-106 known to pass this test. When VZ-108 is tested, the coating is to be mixed in its proper proportions and then spray applied to a dry film thickness of 1.5 to 2.5 mils above the blast profile. Top coat the VZ-108 with a V-766 known to pass this test. In all cases, the complete system must have a total dry film thickness of 5 to 7 mils above the blast profile. After being air dried for 2 hours at room temperature, dry the panel in a vertical position for 16 hours at 120 degrees F. After cooling for 1 hour, immerse the panel in tap water at 85 to 90 degrees F for 48 to 72 hours. Immediately upon removal, dry the panel with soft cloth and examined for adhesion as follows: With a pocket knife or other suitable instrument, two parallel cuts at least 1 inch long is to be made 1/4 to 3/8 inch apart through the paint film to the steel

surface. A third cut is to be made perpendicular to and passing through the end of the first two. With the tip of the knife blade, the film is to be loosened from the panel from the third cut between the parallel cuts for a distance of 1/8 to 1/4 inch. With the panel being held horizontally, the free end of the paint film is to be grasped between the thumb and forefinger and pulled vertically in an attempt to remove the film as a strip from between the first two cuts. The strip of paint film is to be removed at a rate of approximately 1/10 inch per second and is to be maintained in a vertical position during the process of removal. The adhesion is acceptable if the strip of paint breaks when pulled or if the strip elongates a minimum of 10 percent during its removal. Paints not intended to be self-priming must exhibit no delamination from the primer.

PART 3 EXECUTION

3.1 CLEANING AND PREPARATION OF SURFACES TO BE PAINTED

3.1.1 General Requirements

Clean surfaces to be painted before applying paint or surface treatments. Remove deposits of grease or oil in accordance with SSPC SP 1, prior to mechanical cleaning. For solvent cleaning, utilize 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. Protect items not to be prepared or coated from damage by the surface preparation methods. Protect machinery against entry of blast abrasive and dust into working parts. Cleaning and painting are to 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 must be suitably protected from the effects of cleaning and painting operations. Welding of, or in the vicinity of, previously painted surfaces must 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 are to be restored to original condition. Surfaces to be painted that will be inaccessible after construction, erection, or installation operations are completed are to be painted before they become inaccessible. Prior to application of coating break all sharp corners and grind flame cut edges.

3.1.2 Ferrous Surfaces Subject to Atmospheric Exposures

Ferrous surfaces that are to be continuously in exterior or interior atmospheric exposure and other surfaces as directed are to be cleaned by means of power tools or by dry blasting to the brush-off grade. Perform cleaning and priming in the shop unless otherwise directed or permitted. Perform power tool cleaning to the requirements of SSPC SP 3. Perform brush-off blast cleaning to the requirements of SSPC 7/NACE No. 4. Perform commercial blast cleaning to the requirements of SSPC SP 6/NACE No. 3. Clean welds and adjoining surfaces within a few inches (centimeters) thereof to remove weld flux, spatter, and other harmful deposits by blasting, power impact tools, power wire brush, or such combination of these and other methods as may be necessary for complete removal of each type of deposit. The combination of cleaning methods need not include blasting when preparation of the overall surfaces is carried out by the power tool method. However, brush scrubbing and rinsing with clean water, after mechanical cleaning is completed, will be required unless the latter is carried out with thoroughness to remove all soluble alkaline deposits. Limit the wetting of the surfaces during water-washing operations to the

weld area required to be treated, and ensure such areas are dry before painting. Welds and adjacent surfaces cleaned thoroughly by blasting alone will be considered adequately prepared provided that weld spatter not dislodged by the blast stream is removed with impact or grinding tools. Prime all surfaces as soon as practicable after cleaning and in all cases prior to contamination or deterioration of the prepared surfaces. Clean and prime all steel surfaces prior to lengthy outdoor storage.

3.1.2.1 Coated Ferrous Surfaces Subject to Atmospheric Exposures

Coated ferrous surfaces to be overcoated are to be power tool cleaned in accordance with SSPC SP 3. The entire surface to be overcoated does not have to be power tool cleaned provided that all surfaces are free of all loose rust and loose paint. Power tool prepared surfaces must be further cleaned by power washing using a rotating tip and pressures of 1500 to 5000 PSI. Adjust water pressure such that all chalk is removed without significantly eroding the existing coating. Spot prime all surfaces as soon as practicable after drying, and in all cases prior to contamination or deterioration of the prepared surfaces.

3.1.3 Ferrous Surfaces Subject to Severe Exposure

Ferrous surfaces subject to extended periods of immersion or as otherwise required are to be dry blast-cleaned to SSPC SP 5/NACE No. 1. The blast profile, unless otherwise specified, are to be 1.5 to 2.5 mils as measured by ASTM D4417, Method C. Existing surface profiles on the butterfly valves are unknown and may exceed 2.5 mils as measured by ASTM D4417, Method C. Contractor shall notify the Contracting Officer if profiles exceeding 2.5 mils are encountered. A larger profile should be accounted for in the price proposal and will not be considered a differing site condition by the Government. Use appropriate abrasive blast media to produce the desired surface profile and to give an angular anchor tooth pattern. If recycled blast media is used, maintain an appropriate particle size distribution so that the specified profile is consistently obtained. Do not use steel shot or other abrasives that do not produce an angular profile. Remove weld spatter not dislodged by blasting with impact or grinding tools and the areas reblasted prior to painting. Ensure the surfaces are dry at the time of blasting. Perform blast cleaning to SSPC SP 5/NACE No. 1 in the field and, unless otherwise specifically authorized, after final erection. Within 8 hours after blast cleaning, and in any case prior to the deposition of any detectable moisture, contaminants, or corrosion, all ferrous surfaces are to be cleaned of dust and abrasive particles by brush, vacuum cleaner, and/or blown down with clean, dry, compressed air, and given the first coat of paint. Upon written request by the Contractor, the Contracting Officer may authorize mill or shop cleaning of assembled or partially assembled components specified to receive one of the vinyl-type paint systems or Systems 6-A-Z and 21-A-Z employing the epoxy zinc-rich primer or Systems 23-A-Z and 23-B-Z employing SSPC Paint 40 moisture cure urethane zinc-rich primer. The surfaces, if shop blasted, are to be shop coated with the first and second coats of the specified paint system except that moisture cure urethane and epoxy zinc-rich primed surfaces must receive an extra single spray coat of the zinc primer at the time field painting is started, as specified in the paint system instructions. Maintain the shop coating in good condition by cleaning and touching up of areas damaged during the construction period. If pinpoint or general rusting appears, surfaces are to be reblasted and repainted at no added cost to the Government. Prior to the field application of subsequent coats, soiled areas of the shop

coating are to be thoroughly cleaned and all welds or other unpainted or damaged areas are to be cleaned and coated in a manner to make them equivalent to adjacent, undamaged paint surfaces.

3.1.4 Non-Ferrous Metal Surfaces

Perform abrasive blasting to non-ferrous metal surfaces to be painted to roughen the surface and promote adhesion. Before blast cleaning surfaces, visible deposits of oil, grease, and other contaminants are to be removed in accordance with SP 1. Perform abrasive blasting of the entire surface so as to produce a dense and uniform surface profile. The blasted surface is to exhibit a continuous pattern with no smooth areas. Use clean, dry compressed air for abrasive blasting. Select an abrasive size and type based on the surface to be cleaned. Ensure the abrasive is dry and free of oil, grease, and other contaminants. Only use non-metallic abrasives. Select an abrasive that minimizes particle embedment in the surface. The blast cleaned metal surface must have a minimum profile of 0.75 mils, when measured in accordance with ASTM D4417. Remove dust, dirt and loose residues from blasted surfaces by brushing; blowing off with clean, dry air; or vacuuming. Prime all surfaces as soon as practicable after cleaning and in all cases prior to contamination or deterioration of the prepared surfaces.

3.2 PAINT APPLICATION

3.2.1 General

Ensure the finished coating is free from holidays, pinholes, bubbles, runs, drops, ridges, waves, laps, excessive or unsightly brush marks, and variations in color, texture, and gloss. Do not commence application of initial or subsequent coatings until the Contracting Officer has verified that atmospheric conditions and the surfaces to be coated are satisfactory. Apply each paint coat 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 must receive special attention to ensure that they receive an adequate thickness of paint. Equip spray equipment with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, and screens or filters. Air caps, nozzles, and needles are to 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. Do not use airless-type equipment for the application of vinyl paints.

3.2.2 Mixing and Thinning

Thoroughly mix paints, 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 must, 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. Generally limit thinning to the addition of not more than 1 pint per gallon of the proper thinner; this general limitation is not to apply when more specific thinning instructions are provided. Paint that has been stored at low temperature, must 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 must 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 must not be used and be removed from the project site. Resample and resubmit paint and thinner that is more than one year old for testing to determine its suitability for application. Resample and resubmit moisture cure urethane paint for testing to determine its suitability for application whenever the paint is more than six (6) months old as indicated by the date of manufacture on the container.

3.2.3 Time Between Surface Preparation and Painting

Surfaces that have been cleaned and/or otherwise prepared for painting are to be primed as soon as practicable after such preparation has been completed but, in any event, prior to any deterioration of the prepared surface.

3.2.4 Method of Paint Application

Unless otherwise specified, apply paint by brush, roller, or spray to ferrous and nonferrous metal surfaces. Give special attention toward ensuring adequate coverage of edges, corners, crevices, pits, rivets, bolts, welds, and similar surface irregularities. Other methods of application to metal surfaces are to be subject to the specific approval of the Contracting Officer. Apply paint on plaster, concrete, or other nonmetallic surfaces by brush, roller, and/or spray. Application of zinc rich primers must not be made with a roller.

3.2.5 Coverage and Film Thickness

Film thickness or spreading rates must be as specified hereinafter. Where no spreading rate is specified, apply the paint at a rate consistent with the manufacturer's written instructions. In any event, the combined coats of a specified paint system must completely hide base surface and the finish coats must completely hide undercoats of dissimilar color.

3.2.5.1 Measurement on Ferrous Metal

Where dry film thickness requirements are specified for coatings on ferrous surfaces, make measurements with a gage qualified in accordance with paragraph Coating Thickness Gage Qualification. Calibrate and use the equipment in accordance with ASTM D7091. Prior to each use the Base Metal Reading (BMR) are to be established for the gage as specified in the test method. Verify accuracy of the gage using plastic shims as specified by the test method both prior to and following each set of measurements. Frequency of measurements are to be as recommended for field measurements by ASTM D7091, except that measurements are to be performed on all areas of the structure being coated. Report thickness measurements as the mean for each spot determination.

3.2.5.2 Measurements on Nonferrous Metal

Where dry film thickness requirements are specified for coatings on nonferrous surfaces, make measurements with a gage qualified in accordance with paragraph Coating Thickness Gage Qualification. Calibrate and use gages in accordance with ASTM D7091. Prior to each use the Base Metal Reading (BMR) is to be established for the gage as specified in the test

method. Verify the accuracy of the gage using plastic shims as specified by the test method both prior to and following each set of measurements. Frequency of measurements are to be as recommended for field measurements by ASTM D7091, except that measurements are to be performed on all areas of the structure being coated. Report thickness measurements as the mean for each spot determination.

3.2.6 Progress of Painting Work

Where field painting on any type of surface has commenced, the complete painting operation, including priming and finishing coats, on that portion of the work is to be completed as soon as practicable, without prolonged delays. Sufficient time must elapse between successive coats to permit them to dry properly for recoating, and this period is to be modified as necessary to suit adverse weather conditions. Paint must be considered dry for recoating when it feels firm, does not deform or feel sticky under moderate pressure of the finger, and the application of another coat of paint does not cause film irregularities such as lifting or loss of adhesion of the undercoat. Ensure all coats of all painted surfaces are unscarred and completely integral at the time of application of succeeding coats. At the time of application of each successive coat, clean undercoats of dust, grease, overspray, or foreign matter by means of airblast, solvent cleaning, or other suitable means. Cement and mortar deposits on painted steel surfaces, not satisfactorily removed by ordinary cleaning methods, are to be brush-off blast cleaned and completely repainted as required. Undercoats of high gloss, if necessary for establishment of good adhesion, are to be scuff sanded, solvent wiped, or otherwise treated prior to application of a succeeding coat. Field coats on metal are to be applied after erection except as otherwise specified and except for surfaces to be painted that will become inaccessible after erection.

3.2.7 Contacting Surfaces

When riveted or ordinary bolted contact is to exist between surfaces of ferrous or other metal parts of substantially similar chemical composition, such surfaces will not be required to be painted, but any resulting crevices is to be subsequently filled or sealed with paint. Do not paint contacting metal surfaces formed by high-strength bolts in friction-type connections. Where a nonmetal surface is to be in riveted or bolted contact with a metal surface, clean the contacting surfaces of the metal and give three coats of the specified primer. Unless otherwise specified, do not paint corrosion-resisting metal surfaces, including cladding therewith.

3.2.8 Drying Time Prior to Immersion

Minimum drying periods after final coat prior to immersion are to be: epoxy and moisture cure urethane systems at least five days, and vinyl-type paint systems at least three days. Minimum drying periods are to be increased twofold if the drying temperature is below 65 degrees F and/or if the immersion exposure involves considerable abrasion.

3.2.9 Protection of Painted Surfaces

Where shelter and/or heat are provided for painted surfaces during inclement weather, such protective measures must be maintained until the paint film has dried and discontinuance of the measures is authorized. Items that have been painted are not to be handled, worked on, or

otherwise disturbed until the paint coat is fully dry and hard. All metalwork coated in the shop or field prior to final erection are to be stored out of contact with the ground in a manner and location that will minimize the formation of water-holding pockets; soiling, contamination, and deterioration of the paint film, and damaged areas of paint on such metalwork are to be cleaned and touched up without delay. Apply the first field coat of paint within a reasonable period of time after the shop coat and in any event before weathering of the shop coat becomes extensive.

3.2.10 Vinyl Paints

3.2.10.1 General

Spray applied vinyl paints, except that areas inaccessible to spraying is to be brushed. All of the vinyl paints require thinning for spray application except the zinc-rich vinyl paint (Formula VZ 108d) which will normally require thinning only under certain weather conditions. Thinners for vinyl paints are to be as follows:

| APPROXIMATE AMBIENT AIR TEMPERATURE (Degrees F) | |
|---|------|
| Below 50 | MEK |
| 50 - 70 | MIBK |
| Above 70 | MIAC |

The amount of thinner must be varied to provide a wet spray and avoid deposition of particles that are semidry when they strike the surface. Do not apply vinyl paints when the temperature of the ambient air and receiving surfaces is less than 35 degrees F nor when the receiving surfaces are higher than 125 degrees F. Each spray coat of vinyl paint is to consist of a preliminary extra spray pass on edges, corners, interior angles, pits, seams, crevices, junctions of joining members, rivets, weld lines, and similar surface irregularities followed by an overall double spray coat. A double spray coat of vinyl-type paint is to consist of applying paint to a working area of not less than several hundred square feet (meters) in a single, half-lapped pass, followed after drying to at least a near tack-free condition by another spray pass applied at the same coverage rate and where practicable at right angles to the first. Rivets, bolts, and similar surface projections are to receive sprayed paint from every direction to ensure complete coverage of all faces. Pits, cracks, and crevices are to be filled with paint insofar as practicable, but in any event, all pit surfaces must be thoroughly covered and all cracks and crevices must be sealed off against the entrance of moisture. Fluid and atomization pressures are to be kept as low as practicable consistent with good spraying results. Unless otherwise specified, not more than 2.0 mils, average dry film thickness, of vinyl paint is to be applied per double spray coat. Except where otherwise indicated, an undercoat of the vinyl-type paint may receive the next coat any time after the undercoat is tack-free and firm to the touch, provided that no speedup or delay in the recoating schedule must cause film defects such as sags, runs, air bubbles, air craters, or poor intercoat adhesion. Neither the prime coat nor any other coat to be walked upon or be subjected to any other abrading action until it has hardened sufficiently to resist mechanical damage.

3.2.10.2 Vinyl Zinc-Rich Primer

Field mix primer combining components A, B, and C. Perform mixing in accordance with label instructions. After mixing, keep the paint covered at all times to avoid contamination and ensure the paint is applied within eight days after it is mixed. When the ambient and/or steel temperature is below about 80 degrees F, the paint will not normally require thinning; however, the paint must at all times contain sufficient volatiles (thinners) to permit it to be satisfactorily atomized and to provide a wet spray and to avoid deposition of particles that are semidry when they reach the surface. Continuously stir the paint during application at a rate that will prevent the zinc dust from settling. When spraying is resumed after any interruption of longer than 15 minutes, the entire length of the material hose is to be whipped vigorously until any settled zinc is redispersed. Long periods of permitting the paint to remain stagnant in the hose is to be avoided by emptying the hoses whenever the painting operation is to be suspended for more than one hour. The material (paint) hoses is to be kept as short as practicable, preferably not more than 50 feet in length. Do not use equipment used for spraying this zinc primer for spraying other vinyl-type paints without first being thoroughly cleaned, since many of the other paints will not tolerate zinc contamination; do not use any type of hot spray. An average dry film thickness of up to 2.5 mils may be applied in one double-spray coat. Unless specifically authorized, application of succeeding coats are to be complete no more than eight days after application of a VZ-108d zinc-rich coat.

3.2.10.3 Vinyl Paints

Vinyl Paints (Formulas V-102e, V-103c, V-106d, and V-766e) are ready-mixed paints designed to be spray applied over a wide range of ambient temperatures by field thinning with the proper type and amount of thinner. For spray application, they are to be thinned as necessary up to approximately 25 percent (1 quart per gallon of base paint) with the appropriate thinner; when ambient and steel temperatures are above normal, up to 40-percent thinning may be necessary for satisfactory application.

3.3 PAINT SYSTEMS APPLICATION

The required paint systems and the surfaces to which they are to be applied are shown in this paragraph, and/or in the drawings. Supplementary information follows:

3.3.1 Fabricated and Assembled Items

Items that have been fabricated and/or assembled into essentially their final form and that are customarily cleaned and painted in accordance with the manufacturer's standard practice will be exempted from equivalent surface preparation and painting requirements described herein, provided that:

- a. Surfaces primed (only) in accordance with such standard practices are compatible with specified field-applied finish coats.
- b. Surfaces that have been primed and finish painted in accordance with the manufacturer's standard practice are of acceptable color and are capable of being satisfactorily touched up in the field.
- c. Items expressly designated herein to be cleaned and painted in a

specified manner are not coated in accordance with the manufacturer's standard practice if different from that specified herein.

3.3.2 Surface Preparation

The method of surface preparation and pretreatment shown in the tabulation of paint systems is for identification purposes only. Cleaning and pretreatment of surfaces prior to painting is to be accomplished in accordance with detailed requirements previously described.

3.3.3 System No. 5-E-Z

Apply paint by spray to an average dry film thickness of a minimum of 7.0 mils for the completed system, with the thickness at any spot of not less than 5.5 mils. The dry film thickness of the zinc-rich primer must be approximately 2.5 mils with no spot less than 2.0 mils. The specified film thickness must be attained in any event, and any extra coats needed to attain the specified thickness must be applied at no additional cost to the Government. Attaining the specified film thickness by applying fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application of more than 2.0 mils (dry film thickness) per double spray coat nor more than 1.0 mil per single spray pass of nonzinc paint typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

3.3.4 System No. 21-A-Z

Apply the epoxy zinc-rich paint 19C in two single half-lapped spray coats to an average dry film thickness of a minimum of 3.0 mils, and a thickness at any spot of not less than 2.5 mils or greater than 6.0 mils. After a drying period of not less than 6 hours or more than 96 hours, apply at least two coats of epoxy polyamide paint to produce an average dry film thickness totaling 12 mils and a thickness at any spot of not less than 10 mils. 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 must be abraded and recoated with an additional thin tack coat of the zinc-rich paint, which in turn must be overcoated within 96 hours with the first coat of the epoxy polyamide paint. Apply MIL-DTL-24441 in accordance with the manufacturer's recommendations regarding type of thinner, amount of thinning, and required induction time. The drying time between non-zinc coats must not be less than 12 hours nor more than 96 hours.

3.3.5 System No. 23-A-Z

Apply the coating system by spray in accordance with the manufacturer's written instructions. It must be a 3-coat system plus an additional stripe coat applied by brush to all edges, corners, welds, fasteners, and other surface irregularities. Allow the stripe coat to dry as recommended by the manufacturer, prior to the application of the first full coat. Application of the system in less than three coats will not be accepted. Procure all materials from the same coating manufacturer. The individual paints comprising the system must have been tested and passed all requirements of the applicable SSPC standards. SSPC Paint 38 topcoat must meet the requirements of Accelerated Weathering Level 3. Limited use of brush and roller application is permitted provided the specified film thicknesses are achieved. Comply with the manufacturer's recommendations regarding mixing and thinning requirements, and pot life requirements, dry film thickness per coat and minimum and maximum dry time between coats.

Do not use coating material that has thickened appreciably. Areas of bubbling noted upon curing of any individual coat must be removed by sanding or screening, the edges feathered, and the coat reapplied to the repaired areas before a subsequent coat is applied.

3.3.6 Protection of Nonpainted Items and Cleanup

Maintain walls, equipment, fixtures and all other items in the vicinity of the surfaces being painted free from damage by paint or painting activities. Promptly repair any paint spillage and painting activity damage.

3.4 INSPECTION

Surface preparation and painting inspections must be conducted by an approved Certified Coating Inspector. The inspector must inspect and document all work phases and operations on a daily basis and submit daily inspection reports. As a minimum, the daily report must contain the following:

- a. Inspections performed, including the area of the structure involved and the results of the inspection.
- b. Surface preparation operations performed, including the area of the structure involved, the mode of preparation, the kinds of solvent, abrasive, or power tools employed, and whether contract requirements were met.
- c. Thinning operations performed, including thinners used, batch numbers, and thinner/paint volume ratios.
- d. Application operations performed, including the area of the structure involved, mode of application employed, ambient temperature, substrate temperature, dew point, relative humidity, type of paint with batch numbers, elapsed time between surface preparation and application, elapsed time for recoat, condition of underlying coat, number of coats applied, and if specified, measured dry film thickness or spreading rate of each new coating.

3.5 PAINTING SCHEDULES

| SYSTEM NO. 5-E-Z | | | | |
|---------------------------------|---|---|--|---------------------------------------|
| Items or surfaces to be coated: | | Butterfly Valve, interior, valve disc and body, 3'-6" upstream and 3'-6" downstream of valve disc centerline, with exception to sealing surfaces. | | |
| SURFACE PREPARATION | 1st COAT | 2nd COAT | 3rd COAT | 4th COAT |
| White metal blast cleaning | Vinyl zinc-rich VZ-108d (double spray coat) | Gray Vinyl V-766e (double spray coat) | White Vinyl V-766e (double spray coat) | Gray Vinyl V-766e (double spray coat) |

| SYSTEM NO. 21-A-Z | | | |
|---------------------------------------|-------------------|---|---|
| Items or surfaces to be coated: | | Surfaces coming in contact with grease and hydraulic fluids, such as by-pass piping, penstock exterior, and grease lubrication system mounting panel. Touch-up paint repairs of areas disturbed by contractor work. | |
| SURFACE PREPARATION | 1st & 2nd COAT | 3rd & 4th COAT | 5th COAT |
| As specified for each type of surface | MIL-DTL-24441/19B | MIL-DTL-24441, Machinery Gray | as needed to obtain specified thickness |

| SYSTEM NO. 23-A-Z | | | |
|---------------------------------|-----------------------|--|--|
| Items or surfaces to be coated: | | All other equipment furnished under this Contract, other than items which come with factory coating exempted by criteria herein. | |
| SURFACE PREPARATION | 1st COAT | 2nd COAT | 3rd COAT |
| White metal blast cleaning | SSPC Paint 40 Type II | SSPC Paint 41 | SSPC Paint 38 Finish color: Machinery Gray |

-- End of Section --

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SEISMIC RESTRAINT FOR MECHANICAL AND ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

The work covered in this section consists of furnishing all labor, equipment and materials to select, design, and provide seismic restraints for new systems and equipment provided as part of work performed for the Fort Peck butterfly valve refurbishments.

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 INTERNATIONAL (ACI)

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)

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 693 (2005) Recommended Practice for Seismic Design of Substations

IEEE Std 628 (2011) Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. 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, HDC

SD-03 Product Data

Concrete Anchors; G, HDC

Seismic Equipment Certification; G, HDC

SD-05 Design Data

Structural Design Calculations for Seismic Restraints; G, HDC

SD-06 Test Reports

Concrete Anchor Test Reports; G, HDC

Contractor Qualification Testing; G, HDC

1.4 DESIGN OF SEISMIC RESTRAINT

1.4.1 General Requirements

a. Apply the requirements for seismic protection measures described in this section to the equipment and systems below. Accomplish resistance to lateral forces induced by earthquakes without consideration of friction resulting from gravity loads. Existing concrete strength is taken as $f'c = 3,000$ pounds per square inch (psi).

b. Submit within 90 calendar days of Notice to Proceed, detail drawings as per paragraphs "EQUIPMENT" and "SYSTEMS." Submit together with Structural Design Calculations for Seismic Restraints.

c. For detail drawings include catalog cuts, templates, anchorage system including mechanical specifications of anchor bolts, erection and installation details for the items listed. Provide submittals complete in detail; indicate thickness, type, grade, class of metal, and dimensions; and show construction details, anchorage, and installation. Stamp all drawings with the Professional Engineer (PE) stamp who performs and stamps the calculations required above.

d. Submit structural design calculations performed by qualified civil or structural engineers who are presently registered professional engineers (PE). The calculations verify the capability of the seismic restraints and of structural members to which seismic restraint are attached for carrying the seismic design loads. The design includes seismic anchorage design and details. Provide all calculations stamped and signed by a PE.

1.4.2 Code Requirements for Equipment Restraint

Complete seismic design for equipment restraint in accordance with Chapter 13, "Seismic Design Requirements for Nonstructural Components," of ASCE 7 with the seismic design force computed as per Section 13.3 "Seismic Demands on Nonstructural Components". Design electrical equipment restraint in accordance with the provisions in IEEE 693, or Section 13.3 of ASCE 7 whichever produces the more adverse seismic effects. For ASCE 7, use a spectral acceleration $S_{DS} = 0.1$, $I_p = 1.50$, and $z/h=1$. For IEEE 693, use a seismic qualification level of Low.

1.4.3 Code Requirements for Systems Restraint

Complete seismic design for systems restraint in accordance with Chapter 13, "Seismic Design Requirements for Nonstructural Components," of ASCE 7

with the seismic design force computed as per Section 13.3 "Seismic Demands on Nonstructural Components". For ASCE 7, use a spectral acceleration $S_{DS} = 0.1$, $I_p = 1.50$, and $z/h=1$. Design restraint of electrical systems to the requirements of IEEE Std 628.

1.4.4 Requirements for Equipment Certification

Design, construct, and assemble all equipment listed in paragraph "Equipment", to be provided under this contract to withstand the seismic forces specified in paragraph "Code Requirements for Equipment Restraint." Provide Seismic Equipment Certification supported by testing or analysis stating the seismic capability of the equipment.

1.5 EQUIPMENT

Develop the structural design calculations for seismic restraints and detail drawings for the following new equipment provided under this contract in accordance with the requirements of this specification:

- (a) Electrical Cubicles
- (b) Hydraulic Power Units
- (c) Platforms and Ladders

1.6 SYSTEMS

Develop the structural design calculations for seismic restraints and detail drawings for the following new systems provided under this contract in accordance with the requirements of this specification:

- (a) Piping
- (b) Conduit
- (c) Cable Trays/Raceways

1.7 DEFINITIONS

a. Sway Brace. An assembly intended to be attached to piping, conduit, bus, or raceways to resist horizontal earthquake loads.

b. Four-Way Brace. A sway brace intended to resist differential movement in all horizontal directions.

c. Lateral Brace. A sway brace intended to resist differential movement perpendicular to the axis of piping, conduit, bus, or raceways.

d. Longitudinal Brace. A sway brace intended to resist differential movement parallel to the axis of piping, conduit, bus, or raceways.

e. Undercut anchor. Undercut concrete anchors are bearing-type anchors designed to be installed in cured concrete in a hole with a conical undercut near its blind end.

f. Expansive anchor. Expansive concrete anchors are designed to be installed in cured concrete in a straight hole. Anchorage relies on an torque-controlled expansion wedge and the friction developed between the drilled hole and the expanded wedge.

g. Adhesive anchor. Adhesive concrete anchors are designed to be installed in cured concrete in a straight hole drilled with a

roto-impact drill. Anchorage relies on a chemical adhesive bond to the threaded rod and to the concrete.

h. Monolith Expansion Joint. Expansion /contraction joint separating two adjacent, structurally independent monoliths.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 SEISMIC SWAY BRACING

3.1.1 Sway Bracing Design Requirements

Design and provide sway bracing conforming with the requirements of these specifications for both mechanical and electrical systems. Apply seismic forces both in lateral and vertical directions. Base the design of sway braces on the water filled weight of pipe combined with the seismic forces. Base the design of sway braces for electrical conduit or raceways on the design weight of the completely filled conduit or raceway.

3.1.2 Sway Bracing Required for Systems

Provide sway bracing for all suspended systems with the following exceptions. Provide sway bracing for all piping greater than 2-1/2 inch in diameter, or for piping larger than 1 inch in diameter in boiler rooms or for gas piping, or for all pipe diameters if the piping is used as part of a fire protection system. Provide sway bracing for all conduit larger than 2-1/2 inches in diameter. Provide sway bracing for HVAC ducts larger than 6 square feet in cross sectional area or 28 inches in diameter. Provide sway bracing at junctions, and at horizontal or vertical transitions for electrical service raceways and bus ducts. Sway bracing is not required for piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the structure the piping is attached to.

3.1.3 Sway Bracing Required for Equipment

Provide sway bracing for equipment supported from overhead floor or roof structural systems.

3.1.4 Sway Bracing Layout

3.1.4.1 General

Sway bracing consists of transverse, longitudinal, and 4-way braces. Design piping such that sway bracing attachment and configuration does not interfere with thermal expansion of the piping.

3.1.4.2 Transverse Braces

Provide transverse sway braces for piping and conduit at every fourth hanger for diameter sizes 1/4 through 2-1/2 inches and at every third hanger for pipe diameter sizes 3 inch through 8 inch. Provide transverse sway braces for bus ducts and electrical raceways at vertical or horizontal transitions. Brace vertical systems at not more than 20-foot intervals and locate bracing above the center of gravity of the item being

braced.

3.1.4.3 Longitudinal or Four-Way Braces

Provide longitudinal braces or four-way braces at least once per monolith. Provide longitudinal or four-way braces at least once per straight length of piping or conduit that is greater than 10-feet in length. Provide four-way sway braces for bus ducts and electrical raceways at junctions.

3.1.5 Seismic Isolation for Piping Systems

Provide spreaders or rack type hangers between adjacent piping runs to prevent contact during seismic activity whenever pipe surfaces are less than 4-inches apart and at the same interval as sway bracing at an equal distance between sway braces.

3.2 BUILDING OR MONOLITH EXPANSION JOINTS

Do not rigidly attach equipment on each side of a building or a monolith expansion joint. For systems which are rigidly attached on each side of a monolith expansion joint, provide flexible connections or system configurations that are capable of accommodating displacements equal to twice the full width of the joint in both orthogonal directions or a minimum of 2-inches in both orthogonal directions. Do not attach an individual seismic sway brace to the structure on each side of a monolith joint.

3.3 SPREADERS

Provide spreaders between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches apart. Apply spreaders at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack.

3.4 CONCRETE ANCHORS

Submit manufacturer's product data within 90 calendar days after receiving the Notice to Proceed. Manufacturer's product data includes but is not limited to detail drawings showing dimensions, material data, allowable loads and detailed installation instructions, and anchor test data in accordance with ICC ES Evaluation Services Reports (ESR).

3.4.1 Limitations on Allowable Fasteners to Concrete

Do not utilize powder actuated fasteners, screw or coil type anchors to secure equipment or systems to the powerhouse. Do not use expansive drop-in threaded insert type anchors to suspend equipment or systems from the powerhouse. Do not use expansion anchors to resist vibratory loads due to rotating machinery. Do not use chemically bonded adhesive anchors to resist pull-out in overhead and wall installations if the adhesive is manufactured with temperature sensitive epoxies and the location is susceptible to effects of a building fire or if the adhesive is unsuited to static tension load application. For chemically bonded adhesive anchors for use in low temperature or under-water applications, provide product data indicating suitability for use and pass on-site installation test(s) under anticipated environmental conditions.

3.4.2 General Requirements for Fasteners to Concrete

Provide anchors at least 1/2 inch in diameter unless otherwise indicated in the plans or this specification section. Provide chemically bonded adhesive anchors with an embedded depth equal to at least 12 times nominal diameter of the bolt. Provide expansive or undercut anchors with a minimum embedded depth of at least 4 inches. Compute anchor capacity as per Chapter 17 of ACI 318 and reduce the anchor capacity to account for the effect of spacing between anchor bolts and the distance between anchor bolt and the nearest concrete edge. Provide anchor test data in accordance with ICC ES Evaluation Services Reports (ESR) for each type and class of concrete anchor verifying the suitability of an anchor for the intended application.

3.4.3 Floor Mounted Equipment

Anchor floor mounted equipment to concrete that is reinforced and integrally connected to the reinforced concrete structure. Intermittent tension developed due to laterally applied seismic force of 1000 pounds (lbs) or less may be resisted with expansive concrete anchors capable of resisting dynamic loading in cracked and un-cracked concrete unless otherwise indicated on the drawings. Resist intermittent tension developed due to laterally applied seismic force greater than 1000 lbs with undercut concrete anchors. Epoxy anchors are permitted in applications where concrete foundation pads are not integrally connected to the reinforced concrete structure. Embedment is only considered to occur in structural concrete. Embedment solely in architectural floating slabs and house-keeping foundation pads not integrally connected to the reinforced concrete structure will not be accepted. For anchors installed in an environment subject to water intrusion and freeze thaw cycles, provide epoxy adhesive anchors or alternately use undercut anchors and seal with a flexible sealant recommended by the anchor manufacturer and as indicated on the drawings and approved by the CO.

3.4.4 Suspended Systems

Secure all sway brace assemblies including the vertical support component(s) to the concrete with undercut anchors. Expansive concrete anchors capable of resisting dynamic loading in cracked and un-cracked concrete may only be used to secure hangers at locations without sway bracing. Suspended piping or conduit may be secured with 3/8 inch minimum diameter anchors for pipe and conduit nominal diameters of 3/8 inch through 2 inch to allow compatibility with piping requirements for threaded rod used as hangers. For systems not required to have sway bracing, secure the system a minimum of every 40 feet with undercut anchors.

3.4.5 Wall Mounted Systems

Secure Wall mounted systems with undercut anchor(s) at least once every 40 feet and when direct tension above 500 lbs develops due to gravity loads or laterally applied seismic force. Wall mounted systems may be secured with expansive anchors capable of resisting dynamic loading in cracked and un-cracked concrete at other locations.

3.4.6 Wall Mounted and Suspended Equipment

Secure wall mounted and suspended equipment with undercut anchors if the

equipment weighs 50 lbs and above.

3.5 QUALITY CONTROL

3.5.1 Contractor Installation Qualification

Install concrete anchors using only individuals qualified to install the type and class of concrete anchors indicated in the Contractor's approved shop drawings. Qualify individuals by installing an anchor as per manufacturer's instructions in the position indicated on the drawings and then having that anchor tested by Contractor personnel as per this specification and manufacturer's recommendations. The location where Contractor Qualification Testing is performed may be in the exact location shown on the shop drawings or in another location on-site as approved by the CO. Remove any anchors installed as part of the testing that are not used and repair the hole with non-shrink grout. Provide written notice of Contractor Qualification Testing 10 days prior to performing the testing. Contractor Qualification Testing will be witnessed by the CO.

3.5.2 Concrete Anchor Testing

3.5.2.1 General

Test expansion, undercut, and chemically bonded anchors in place after installation at no further cost to the government. Conduct the tests using an independent testing agency; perform tests on anchor bolts as described below. Submit Concrete Anchor Test Reports within 10 days of the completion of any on-site testing performed. Test at least one anchor of each type and class of anchor. Test no less than 10 percent of the total installed anchors and at least one anchor for every piece of equipment containing more than two anchors. The test load corresponds to the manufacturer's allowable load.

3.5.2.2 Torque Wrench Testing

Perform torque wrench testing only if recommended by the anchor manufacturer. Calibrate torque wrenches at the beginning the job. Maintain the applied torque between 20 and 80 percent of wrench capacity. If any anchor fails the test, test similar anchors not previously tested until 10 consecutive anchors pass. Re-tighten and retest failed anchors to the specified torque; if the anchor still fails the test, replace the anchor and retest.

3.5.2.3 Direct Pull Testing

Test chemically bonded anchors by applying a pullout load using a hydraulic ram attached to the anchor bolt. Other types of anchors may also be tested by direct pull testing as recommended by the anchor manufacturer. Apply the load to the anchor without removing the nut; when that is not possible, remove the nut and install a threaded coupler of the same tightness as the original nut. Check the test setup to verify that the anchor is not restrained from withdrawing by the base plate, the test fixture, or any other fixtures. Provide support for the testing apparatus at least 1.5 times the embedment length away from the bolt being tested. Load each tested anchor to the allowable tension value for the anchor. The anchor must have no observable movement at the test load. Anchors must not spin in the hole. If any anchor fails the test, test similar anchors not previously tested until 100 percent pass. Retighten and retest failed anchors to the specified load; if the anchor still fails the

test, replace the anchor and retest.

-- End of Section --

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SECTION 22 00 00.00 26

BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING

PART 1 GENERAL

Fort Peck Dam has two powerhouses, each with about a mile long tunnel that serves each powerhouse, and 10 story surge towers. Powerhouse 2 has two Francis turbines each with a 216 inch inlet butterfly valve; these units are designated as "Unit 4" and "Unit 5". The penstock tunnel bifurcates just upstream of the butterfly valves. The inlet butterfly valves are for turbine shutoff/isolation service as well as emergency full flow shutoff duty.

1.1 SUMMARY

a. The work covered by this Section of the specifications consists of refurbishment and replacement of existing mechanical equipment, piping, and associated systems for two penstock butterfly valves (BFV) of Powerhouse 2 at Fort Peck Dam. The specifications include detailed requirements for the design, modification, fabrication and manufacturing, installation, and testing of existing and new equipment and systems, as specified and as shown. This includes but is not limited to the list below:

- (1) Refurbishment of two 216 inch diameter penstock BFVs:
 - (a) Refurbishment of valve disc seal;
 - (b) Refurbishment of stainless steel overlay body seat;
 - (c) Refurbishment of valve internal surfaces;
 - (d) Inspect butterfly valve welds;
 - (e) Repair butterfly valve welds (OPTION);
 - (f) Removal and replacement of upper stub shaft (trunnion) bearing and seals;
 - (g) Removal and replacement of lower stub shaft (trunnion) bearing and seals, and thrust bearing assemblies;
 - (h) Adjust and align disc leaf seals (contact bluing check);
- (2) Two new complete penstock BFV grease lubrication systems:
 - (a) Removal and replacement of grease lines;
 - (b) Removal and replacement of grease lubrication components and supporting systems;
- (3) Refurbishment of two penstock BFV bypass systems:
 - (a) Removal and replacement of Limitorque motor operated gate valve with manual handle;
 - (b) New manually operated isolation gate valve;
 - (c) Removal and replacement of bypass system piping;
 - (d) Removal and replacement of absolute pressure switch, and provide new equalizing line pressure monitoring system;
 - (e) Removal and replacement of system controls;
- (4) Refurbishment of two spiral case drain valves:
 - (a) Removal and replacement of manual gate valve with new manual operated gate valve;
 - (b) Removal and replacement of insulation;

- (c) Removal and replacement of limit switch;
- (5) Refurbishment of tunnel drain valve:
 - (a) Removal and replacement of one manual gate valve (current location, as shown);
 - (b) Provide new second manual operated gate valve located as shown;
 - (c) Removal and replacement of piping and insulation;
 - (d) Removal and replacement of heating cable and thermostat;
- (6) New maintenance platforms, ladders and guardrails for each BFV;
- (7) Modify access hatch for each BFV;
- (8) Training for and development of Operation and Maintenance (O&M) manuals.
- (9) Furnish spare parts, including two sets of bronze metal disc seals.

b. Specifications and detailed requirements for the work associated with the BFV operators (hydraulic cylinder actuators with integral mechanical locking device), hydraulic power units (HPU), and associated plumbing is specified in SECTION 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES.

c. Design and installation of the mechanical equipment, piping, and associated systems for the penstock butterfly valves must be in accordance with the provisions of these specifications, complete and fully operational, in direct correlation with the other Sections of this contract.

d. The refurbishment work on Unit 4 and Unit 5 butterfly valves and associated systems must occur simultaneously and completed during the tunnel outage dates specified in Section 01 12 00 CONSTRUCTION GENERAL. Some pre-work activities may be performed prior to the tunnel outage start date and must be coordinated with the government and approved by the Contracting Officer.

1.2 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|-------------------|---|
| ANSI/AWWA C507-18 | (2018) Ball Valves, 6 In. Through 60 In. (150 mm Through 1,500 mm) |
|-------------------|---|

AMERICAN WELDING SOCIETY (AWS)

| | |
|----------------|--|
| AWS D1.1/D1.1M | (2020) Structural Welding Code - Steel |
|----------------|--|

ASME INTERNATIONAL (ASME)

| | |
|--------------|--|
| ASME B1.20.1 | (2013; R 2018) Pipe Threads, General Purpose (Inch) |
|--------------|--|

| | |
|--------------|--|
| ASME B16.5 | (2017; R 2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard |
| ASME B16.9 | (2012; R 2018) Factory-Made Wrought Buttwelding Fittings |
| ASME B16.11 | (2016; Errata 2017) Forged Fittings, Socket-Welding and Threaded |
| ASME B16.21 | (2011; R 2016) Nonmetallic Flat Gaskets for Pipe Flanges |
| ASME B16.34 | (2017; R 2020) Valves - Flanged, Threaded, and Welding End |
| ASME B18.2.1 | (2018; R 2020; Errata 2013) Square and Hex Bolts and Screws (Inch Series) |
| ASME B30.20 | (2021) Below-the-Hook Lifting Devices |
| ASME B31.1 | (2018; R 2020) Power Piping |
| ASME B40.100 | (2013) Pressure Gauges and Gauge Attachments |
| ASME BTH-1 | (2020) Design of Below-the-Hook Lifting Devices |

ASTM INTERNATIONAL (ASTM)

| | |
|-----------------|---|
| ASTM A36/A36M | (2019) Standard Specification for Carbon Structural Steel |
| ASTM A53/A53M | (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A105/A105M | (2021) Standard Specification for Carbon Steel Forgings for Piping Applications |
| ASTM A193/A193M | (2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications |
| ASTM A194/A194M | (2020a) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both |
| ASTM A269/A269M | (2015a; R 2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service |
| ASTM A576 | (2017) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality |
| ASTM A733 | (2016) Standard Specification for Welded |

and Seamless Carbon Steel and Austenitic
Stainless Steel Pipe Nipples

ASTM A789/A789M (2020) Standard Specification for Seamless
and Welded Ferritic/Austenitic Stainless
Steel Tubing for General Service

ASTM C534/C534M (2020a) Standard Specification for
Preformed Flexible Elastomeric Cellular
Thermal Insulation in Sheet and Tubular
Form

ASTM E84 (2021a) Standard Test Method for
Surface Burning Characteristics of
Building Materials

ASTM E709 (2015) Standard Guide for Magnetic
Particle Examination

ASTM F844 (2007a; R 2013) Washers, Steel, Plain
(Flat), Unhardened for General Use

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-25 (2018) Standard Marking System for Valves,
Fittings, Flanges and Unions

MSS SP-44 (2019) Steel Pipeline Flanges

MSS SP-58 (2018) Pipe Hangers and Supports -
Materials, Design, Manufacture, Selection,
Application, and Installation

MSS SP-72 (2010a) Ball Valves with Flanged or
Butt-Welding Ends for General Service

MSS SP-85 (2011) Gray Iron Globe and Angle Valves,
Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 255 (2006) Standard Method of Test of Surface
Burning Characteristics of Building
Materials

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J514 (2012) Hydraulic Tube Fittings

UNDERWRITERS LABORATORIES (UL)

UL 723 (2018) Standard for Safety - Test for
Surface Burning Characteristics of
Building Materials

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

Manual

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. Unless otherwise stated, submit the following submittals within 100 calendar days after receiving Notice to Proceed and at least 45 calendar days prior to any construction or manufacturing. Unless otherwise stated, all durations specified as "days" shall be considered "calendar days". Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Registered Professional Engineer Credentials; G HDC

Submit within 30 days after receiving Notice to Proceed.
Designer Resumes; G HDC

Submit within 30 days after receiving Notice to Proceed.

Assembler Resumes; G HDC

Submit at least 60 days prior to any on-site construction or manufacturing.

Early On-Site Inspection Procedure; G HDC

Submit at least 60 days prior to the early on-site inspections.

Early On-Site Inspection Report; G HDC

Submit within 30 days after completing inspections and field measurements.

Load Handling And Lift Plans; G, HDC

Submit at least 100 days prior to any on-site construction.

Butterfly Valve Refurbishment Plan and Procedure; G HDC

Submit a complete plan and procedure for the refurbishment of the two existing 216 inch diameter penstock butterfly valves, and removal and installation of associated systems.

Plan and Procedure for Documentation of Accessible Areas of Bearing Assemblies; G, HDC

Submit at least 60 days prior to any on-site construction.

Plans and Instructions for the Removal and Installation of the Bearing Assemblies; G, HDC

Submit at least 60 days prior to any on-site construction.

Temporary Support Plan; G, HDC

Submit at least 60 days prior to any on-site construction.

Plan for Determination of The Dimensions of Bearing Assembly Components to Be Provided; G, HDC

Submit at least 60 days prior to any on-site construction.

Initial Shop Inspection Plan for Each Furnished Bearing Assembly Component; G, HDC

Submit at least 60 days prior to any on-site construction.

Revised Shop Inspection Plan for Each Furnished Bearing Assembly Component; G, HDC

Submit at least 7 days prior to Final Machining of Bearing Assembly Components.

Revised Plans and Instructions for The Removal and Installation of the Bearing Assemblies; G, HDC

Submit at least 7 days Prior to Removal of Bearing Assembly Components.

Grease Lubrication System Plan and Procedure; G HDC

Plan and Procedure for Refurbishing the BFV Bypass System; G HDC

Plan and Procedure for Refurbishing the Spiral Case Drain Valves; G HDC

Plan and Procedure for Refurbishing the Tunnel Drain Valve System; G HDC

Refurbished Penstock Butterfly Valve Systems Field Testing Procedure; G, HDC

Submit at least 90 days prior to any on-site construction, a complete set of Field Testing Procedures for the two Refurbished Penstock Butterfly Valves.

Grease Lubrication System Field Testing Procedure; G, HDC

Submit at least 90 days prior to any construction, a complete set of Field Testing Procedures for the New Penstock Butterfly Valve Grease Lubrication System.

BFV NDE Inspection Plan; G, HDC

Submit the BFV NDE Inspection Plan at least 60 days prior to planned on-site NDE inspections. On-site inspection cannot begin without approval from the Government.

BFV PAUT Scan Plan; G, HDC

Submit the BFV PAUT Scan Plan at least 60 days prior to planned on-site NDE inspections. On-site inspection cannot begin without approval from the Government.

SD-02 Shop Drawings

Butterfly Valve Detailed Refurbishment Drawings; G, HDC

Submit together with the Butterfly Valve Refurbishment Design and the Butterfly Valve Refurbishment Plan and Procedure.

Grease Lubrication System Schematics, Component Detailed Drawings and Installation Drawings; G, HDC

Submit together with Grease Lubrication System Design and the Grease Lubrication System Plan and Procedure.

BFV Bypass System Schematics, Component Detailed Drawings and Installation Drawings; G, HDC

Submit together with BFV Bypass System Design and the Plan and Procedure for Refurbishing the BFV Bypass System.

Spiral Case Drain Valve System Schematics, Component Detailed Drawings and Installation Drawings; G, HDC

Submit together with Spiral Case Drain Valve System Design and the Plan and Procedure for Refurbishing the Spiral Case Drain Valves.

Tunnel Drain Valve System Schematics, Component Detailed Drawings and Installation Drawings; G, HDC

Submit together with Tunnel Drain Valve System Design and the Plan and Procedure for Refurbishing the Tunnel Drain Valve System.

Drawings of Rough or Partially Machined Parts for Bearing Assemblies; G, HDC

Submit at least 30 days prior to any construction or manufacturing; submit together with Initial Bearing Assembly Dimensional Analysis.

Initial Drawings of Final Parts for Bearing Assemblies; G, HDC

Submit at least 30 days prior to any construction or manufacturing; submit together with Drawings of Rough or Partially Machined Parts for Bearing Assemblies.

Revised Drawings of Final Parts for Unit 4 Bearing Assemblies; G, HDC

Submit no more than 7 days after Existing Bearing Assembly Component Inspection, and 7 days before final machining of components.

Revised Drawings of Final Parts for Unit 5 Bearing Assemblies; G, HDC

Submit no more than 7 days after Existing Bearing Assembly Component Inspection, and 7 days before final machining of

components.

Final Revised Butterfly Valve Assembly Drawings; G, HDC

Submit no more than 30 days after demobilization.

As-Built Drawings; G, HDC

SD-03 Product Data

Manufacturers Data, General Equipment; G, HDC

Butterfly Valve Disc Seal Product Data; G, HDC

Submit together with the Butterfly Valve Refurbishment Design and the Butterfly Valve Refurbishment Plan and Procedure.

Butterfly Valve Internal Coating Product Data; G, HDC

Submit together with the Butterfly Valve Refurbishment Plan and Procedure.

Butterfly Valve Disc Filler Product Data; G, HDC

Submit together with the Butterfly Valve Refurbishment Design and the Butterfly Valve Refurbishment Plan and Procedure.

Butterfly Valve Trunnion Bearings and Seals Product Data; G, HDC

Submit together with the Butterfly Valve Refurbishment Design and the Butterfly Valve Refurbishment Plan and Procedure.

Grease Lubrication System Product Data; G, HDC

Submit together with new Grease Lubrication System Design and the Grease Lubrication System Plan and Procedure.

New Lubrication Grease Product Data; G, HDC

Submit together with the new Grease Lubrication System Design and the Grease Lubrication System Plan and Procedure.

Bypass System Product Data; G, HDC

Submit together with the BFV Bypass System Design and the Plan and Procedure for Refurbishing the BFV Bypass System.

Spiral Case Drain Valve System Product Data; G, HDC

Submit together with the Spiral Case Drain Valve System Design and the Plan and Procedure for Refurbishing the Spiral Case Drain Valves.

Tunnel Drain Valve System Product Data; G, HDC

Submit together with the Tunnel Drain Valve System Design and the Plan and Procedure for Refurbishing the Tunnel Drain Valve System.

SD-05 Design Data

Butterfly Valve Refurbishment Design; G, HDC

Grease Lubrication System Design; G, HDC

BFV Bypass System Design; G, HDC

Spiral Case Drain Valve System Design; G, HDC

Tunnel Drain Valve System Design; G, HDC

Initial Bearing Assembly Dimensional Analysis; G, HDC

Submit at least 30 days prior to any construction or manufacturing.

Revised Bearing Assembly Dimensional Analysis for Unit 4; G, HDC

Submit no more than 7 days after Existing Bearing Assembly Component Inspection and with Revised Drawings of Final Parts for Bearing Assemblies.

Revised Bearing Assembly Dimensional Analysis for Unit 5; G, HDC

Submit no more than 7 days after Existing Bearing Assembly Component Inspection and with Revised Drawings of Final Parts for Bearing Assemblies.

Spare Parts; G HDC

Submit at least 60 days prior to mobilization, a complete list of spare parts for the Refurbished Penstock Butterfly Valves. Update list with any changes within 30 days after demobilization.

SD-06 Test Reports

Existing Bronze Metal Disc Seal Inspection Report - U4; G, HDC

Submit within 7 days of removing the seals from each butterfly valve.

Existing Bronze Metal Disc Seal Inspection Report - U5; G, HDC

Submit within 7 days of removing the seals from each butterfly valve.

Stainless Steel Overlay Body Seat Inspection Report - U4; G, HDC

Submit within 10 days of completing inspection.

Stainless Steel Overlay Body Seat Inspection Report - U5; G, HDC

Submit within 10 days of completing inspection.

Butterfly Valve Disc and Body NDE Test Report - U4; G, HDC

Submit within 5 days of performing the examinations for the purpose of identifying areas of repair.

Butterfly Valve Disc and Body NDE Test Report - U5; G, HDC

Submit within 5 days of performing the examinations for the purpose of identifying areas of repair.

Valve Seal Contact Bluing Measurement Results - U4; G, HDC

Submit within 5 days of completing the adjustment and alignment of the valve seals.

Valve Seal Contact Bluing Measurement Results - U5; G, HDC

Submit within 5 days of completing the adjustment and alignment of the valve seals.

Documentation of Accessible Areas Associated with The Bearing Assemblies Report for Unit 4; G, HDC

Submit no later than 14 days after completion of disassembly of unit, and no later than with the submittal of the Revised Bearing Assembly Dimensional Analysis for Unit 4.

Documentation of Accessible Areas Associated with The Bearing Assemblies Report for Unit 5; G, HDC

Submit no later than 14 days after completion of disassembly of unit, and no later than with the submittal of the Revised Bearing Assembly Dimensional Analysis for Unit 5.

Furnished Bearing Assembly Component Initial Shop Inspection Report; G, HDC

Submit no later than 7 days after completion of the shop inspection.

Existing Bearing Assembly Component Inspection Report; G, HDC

Submit no later than 7 days after completion of each unit's inspection.

Revised Shop Inspection Report for Each Furnished Bearing Assembly Component; G, HDC

Submit no later than 7 days after completion of the shop inspection and 7 days prior to component installation.

Refurbished Penstock Butterfly Valve Systems Field Testing Report; G, HDC

Submit within 14 days of performing the Refurbished Penstock Butterfly Valve Field Testing, a complete Report of the Field Test Results for both Refurbished Penstock Butterfly Valves.

Grease Lubrication System Field Test Report; G, HDC

Submit within 14 days of completing the New Penstock Butterfly Valve Grease Lubrication System Field Test, a complete Report of the Field Test Results for the New Penstock Butterfly Valve Grease Lubrication System.

New Grease Lubrication System Cleaning and Flushing Test Results;
G, HDC

Submit within 10 days of completion of the cleaning and flushing.

SD-07 Certificates

Inspection and Test Notification; G, HDC

Notifications of date and location of all inspections and tests. Submit at least 14 days prior to the inspection or test within the United States and 60 days prior to the inspection or test outside of the United States. Unless otherwise specified herein in which case the earlier notification deadline governs.

Materials and Equipment Certificates; G, HDC

Proof of compliance to codes and standards; submit with associated system/routing designs.

Valve Disc Seal Material Certificates; G, HDC

Proof of compliance to codes and standards; submit with associated system/routing designs.

Bearing Assembly Component Material Certifications; G, HDC

Proof of compliance to codes and standards; submit with associated system/routing designs.

SD-10 Operation and Maintenance Data

Training Manuals; G, NWO

Submit at least 30 days prior to the first scheduled on-site training class.

Draft Operation and Maintenance Manual; G, HDC

Submit at least 45 days prior to field testing or first scheduled on-site training class.

Revised Draft Operation and Maintenance Manual; G, HDC

Submit within 14 days of completion of on-site training session.

SD-11 Closeout Submittals

Final Operation and Maintenance Manual; G HDC

O&M Manual with details for all systems associated with, modified, removed, tested, and installed for this Contract must be

submitted within 14 days following approval of the Revised Draft Operation and Maintenance Manual submittal.

As-Constructed Drawings; G HDC

As-Constructed drawings for all systems associated with, modified, removed, and installed for this Contract must be submitted within 30 days following installation.

1.4 GENERAL REQUIREMENTS

1.4.1 Designer Qualifications

a. Personnel responsible for design and engineering of the butterfly valve refurbishment, new BFV grease lubrication system, BFV bypass system, spiral case drain valves, tunnel drain valves, and ancillary equipment must have a minimum working experience performing similar design and engineering tasks for at least five years over the past ten years. Similar tasks are defined as the design, engineering, and catalog component selection of systems that have similar features and function as the System/Routing Designs specified in this Section. Personnel design experience must include experience designing to applicable codes and standards, industry standard practice, and similar performance requirements specified in this Section.

b. The Registered Professional Engineer(s) is(are) responsible for ensuring all components (whether custom designed for this project, or commercial and off-the-shelf items) and systems selected for use are appropriately sized, integrated, and capable of performing the intended functions as they pertain to this project. Submit for approval, Designer Resumes and Registered Professional Engineer Credentials for the engineer(s) approving and stamping design calculations, drawings, and associated system design submittals for each System/Routing Design.

1.4.2 Assembler Qualifications

The supervising personnel overseeing all assembly work of the butterfly valve refurbishment, new grease lubrication system, BFV bypass system, spiral case drain valves, tunnel drain valves, and all ancillary equipment must have a minimum work experience of three consecutive calendar years performing similar assembly tasks as required by this effort (inclusive of mechanical work and intricate electrical wiring). Similar tasks are defined as assembly of systems that have similar features and function as the quarter-turn butterfly valve disc with bronze metal seals, adjustment of bronze seals, valve disc NDE and weld repairs, valve body and disc sand blast and re-coating, trunnion bearing replacements, and piping system replacements. Submit for approval, Assembler Resumes.

1.4.3 Early On-Site Inspections (Verification of Dimensions)

a. Field verify existing dimensions and conditions as part of the development of the System/Routing Designs (design data) specified in paragraph 1.7 SYSTEM/ROUTING DESIGNS, and the development of the refurbishment plans and procedures specified in paragraph 1.3 SUBMITTALS SD-01 Preconstruction Submittals. Submit Early On-Site Inspection Procedure for approval.

b. Field verification inspections and measurements performed outside

the penstock (i.e. outside the water passage) can be performed anytime after approval of the "Early On-Site Inspection Procedure" and must be coordinated with the Contracting Officer. Inspections and measurements to be performed inside the unwatered spiral case (i.e. everything downstream of the butterfly valve) must be performed during the early on-site work window specified in Section 01 12 00 CONSTRUCTION GENERAL. The tunnel will **NOT** be unwatered during the early on-site work window for Contractor measurements and inspections. Each unit spiral case will be unwatered during the fall maintenance schedule dates listed in Section 01 12 00, and during these dates the spiral case will be open and the downstream side of the valve may be viewed (coordinate access with the Contracting Officer). It is not permitted to disassemble existing equipment for early on-site work window verification of dimensions and inspection.

c. The Contractor must become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy, through submission of an Early On-Site Inspection Report, before finalizing design work of replacement equipment. The Contractor is responsible for correcting the design and installation to remedy any discrepancies to the satisfaction of the Government. As part of the Contractor's verification of dimensions and inspection report, include at a minimum the following:

- (1) Verification of all work areas and working clearances surrounding the equipment specified in this Section for refurbishment, replacement, demolition, installation, and modification.
- (2) Verification of all access points and dimensions for equipment removal and installation, including but not limited to powerhouse 2 surge tank structure service door, freight elevator, hatch covers at EL 2070.0 and 2052.0, and spiral case access door (manhole or mandoor).
- (3) Inspection and verification of connection details of butterfly valve operator to valve body.
- (4) Preliminary work planning and necessary measurements for supporting valve disc during butterfly valve trunnion and thrust bearing refurbishment work.
- (5) Note the close clearance between the butterfly valve and the surrounding butterfly valve pit, inclusive of all clearances to the butterfly valve maintenance platforms and access ladder, out to out dimension of the pit against the out to out dimension of the butterfly valve, and the clearance from the bottom of the valve pit to the top of the butterfly valve.
- (6) Verification of ancillary equipment needing to be removed to gain access to systems being replaced.

1.4.4 Equipment

All equipment must be properly installed, completely interconnected, and placed in working order. Where two or more items of the same type of equipment are required, they must be the product of the same manufacturer.

1.4.5 Protection of Existing Work

Before beginning any dismantling, drilling, cutting, removal, or other modification of existing work, take precautions to ensure against damage to the existing work. Any damage to such work must be repaired or replaced as directed by the Contracting Officer at the Contractor's expense.

1.4.6 Coordination

a. Install system components in the most direct and workmanlike manner so that interference between other piping, ducts, conduit, mechanical, electrical and structural features is avoided. Prior to developing layout and installation plans for piping, valves, ducting, and accessories, examine previously installed work first to determine that installation can be made without interference with other work. In case interference does develop, the Government will decide which work to be relocated regardless of which work was first installed. The rerouting must be made without additional cost to the Government. Do not cut or weaken structural portions of the Powerhouse to install any accessories.

b. Notify the Government prior to inspections and tests as specified. Final inspection and testing of each butterfly valve shall be witnessed by the Contracting Officer and a representative of the Hydroelectric Design Center (HDC) unless otherwise approved in writing. Submit Inspection and Test Notification within the timeline specified in paragraph SUBMITTALS SD-07 for all Government witness inspections and tests. Clearly identify the dates of notifications and test start dates in the overall work schedule for this job.

1.5 SYSTEM DESCRIPTION

This Section of the specifications consists of requirements for the design, refurbishment, and testing of the Refurbished Penstock Butterfly Valves, new Grease Lubrication System, Refurbishment of the BFV Bypass System, Refurbishment of Spiral Case Drain Valves, and Refurbishment of Tunnel Drain Valves. Requirements for the new butterfly valve Hydraulic Power Unit (HPU) and butterfly valve operator are specified in Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES.

1.6 BUTTERFLY VALVE DESIGN PARAMETERS

The refurbishment of the two existing butterfly valves must be such that all new, refurbished, and existing BFV components specified in this Section are able to perform without failure under the principal design parameters for the penstock butterfly valves, which are as follows:

a. Designed to fully close and fully open the valve within the operating times specified in Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES.

b. Design for a functional disc seal life of 50 years or more, in a maximum flow condition of 3900 cfs.

c. Zero external leakage under any operating condition up to 213 feet of head, with the valve fully open, fully closed or in any transition position.

d. Achieve butterfly valve disc seal contact specified in paragraph ADJUST AND ALIGN DISC LEAF SEALS. When fully closed against a static head up to 213 feet the valve internal leakage must not overwhelm the 4" spiral case by-pass drain with the 12" spiral case drain line closed.

e. Valve internal coatings with a design life 30 years or more.

1.7 SYSTEM/ROUTING DESIGNS

1.7.1 General

a. The Contractor is responsible for coordination and compliance of the refurbished and replaced systems and their components as listed in paragraph SUMMARY, with the requirements of the other Contract Sections, as well as each of the installed systems with applicable codes and standards, industry standard practice, and performance requirements of this Contract.

b. Mechanical components and systems must be reviewed by a mechanical engineer, and the other systems by their respective disciplines. Submit Designer Resumes and Registered Professional Engineer Credentials for the engineer(s) responsible for the compliance review for this project, per the requirements of paragraph DESIGNER QUALIFICATIONS.

1.7.2 Design Data

Submit for approval complete system designs which detail how each will meet all of the requirements within this Section, other applicable sections of this contract, and as shown on contract drawings. Include design calculations and documentation for each system to be refurbished, replaced and serviced showing how the equipment and/or approach adheres to the design requirements of these specifications and the operating conditions for which it will experience in conjunction with any existing equipment.

System/Routing Designs (design data) to be submitted:

- a. Butterfly Valve Refurbishment Design
- b. Grease Lubrication System Design
- c. BFV Bypass System Design
- d. Spiral Case Drain Valve System Design
- e. Tunnel Drain Valve System Design

1.7.2.1 Design Calculations

Submit design calculations for all components provided as per this Contract for approval. Submit design calculations for new components (or system of components) concurrent with the drawings and product data specific to the designed component (or system of components). Include within the calculations a list of assumptions made, a list of all codes and standards referenced, equations, specified efficiencies, limits, factors of safety, component ratings, sources of values used, free body diagrams or sketches of each load case, and reference to the applicable

Contractor shop drawings. Clearly define all equations, constants, and variables in the calculations with sources cited. Calculations must show that the systems clearly meet the requirements as detailed within these Contract specifications.

1.7.2.2 Finite Element Analysis (FEA)

When FEA data is submitted, it must be submitted in addition to, not instead of, the design calculations defined in paragraph DESIGN CALCULATIONS above. Present FEA in a report format. FEA report is to include clear indication of all load scenarios, visual and narrative description of load location and and application, boundary conditions/fixtures, contact settings between components, global mesh attributes, detailed mesh attributes where mesh refinement is required, reasoning for mesh refinement, verification that actual material is consistent with material used in the model, narrative explanation of any peak stresses noted, and narrative explanation of any peak deflections noted. Submit electronic files for any FEA performed (in the FEA software file type). Post-processing FEA data, such as graphics output, submitted alone will be cause for rejection.

1.7.3 Product Data

Submit complete descriptive literature and specifications of each product or system of products with original, legible manufacturer's cut sheets and data sheets to clearly indicate physical construction, operation, mechanical and structural characteristics and associated hardware, electrical characteristics, equipment class, options, design ratings including temperatures, pressures and compatible fluids, any associated code numbers, material properties, testing results, as applicable. For sheets with extraneous data, clearly indicate which data applies by crossing out other models, circling the correct options, etc. Include manufacturer's catalog numbers and designations, and clearly cross-reference with shop drawings as appropriate. Product data submitted for approval must clearly show conformance with these specifications, including but not limited to product manufacturers' declarations of conformance to applicable technical standards. Product data must be approved prior to procurement of associated materials and equipment. Indicate if the material or component is a direct replacement to the OEM conditions or a requested alternative.

Product Data to be submitted with each system and component design:

a. Manufacturers Data, General Equipment submittals are to be included, but not be limited to the Manufacturer's Catalog Data for each new or modified piece of equipment proposed for use in any system that is not addressed by a separate, system specific data submittal. Data must indicate the name of the manufacturer of each item of equipment. In addition, submit a complete equipment list which includes equipment description, model number and quantity; submit together with each System/Routing Design.

b. The product data submittals for the Refurbishment of the Penstock Butterfly Valves must indicate the name of the manufacturer, and include description of component location. The product data for this refurbishment includes but is not limited to:

(1) Butterfly Valve Disc Seal Product Data

(2) Butterfly Valve Internal Coating Product Data per Section
09 97 02.00 26 PAINTS AND COATINGS

(3) Butterfly Valve Disc Filler Product Data

(4) Butterfly Valve Trunnion Bearings and Seals Product Data

c. Grease Lubrication System Product Data must include all provided components, indicate the name of the manufacturer, and include a description of component location. Provide the New Lubrication Grease Product Data that details the supplier's information, material properties, and testing results.

d. Bypass System Product Data must include all provided components, indicate the name of the manufacturer, and include a description of component location.

e. Spiral Case Drain Valve System Product Data must include all provided components, indicate the name of the manufacturer, and include a description of component location.

f. Tunnel Drain Valve System Product Data must include all provided components, indicate the name of the manufacturer, and include a description of component location.

1.8 DESIGN DRAWINGS

1.8.1 General

Submit system/routing drawings, detailed drawings, system schematics, and installation drawings in both hardcopy and electronic (MicroStation *.dgn and Adobe PDF) format and submitted with the System Design. On all drawings, clearly differentiate between new, refurbished, and existing components, and include legend of symbols and bill of materials (BOM) on each drawing. Submit the following drawings for Contracting Officer approval. Submit design calculations and documentation, and product data for each item at the same time as the drawings and schematics.

a. Butterfly Valve Detailed Refurbishment Drawings

b. Grease Lubrication System Schematics, Component Detailed Drawings and Installation Drawings

c. BFV Bypass System Schematics, Component Detailed Drawings and Installation Drawings

d. Spiral Case Drain Valve System Schematics, Component Detailed Drawings and Installation Drawings

e. Tunnel Drain Valve System Schematics, Component Detailed Drawings and Installation Drawings

1.8.1.1 Bill of Materials and Schedule of Equipment

Include bill of materials or parts lists on the drawings, consisting of total quantity, manufacturer, manufacturer's part number, material type, size, and weight of item or equipment; or bill of materials drawings that are part of the drawing set, having a title block, border, and sheet number compatible with the drawing set. For the bill of materials,

provide a cross reference between manufacturer data and shop drawings.

1.8.2 System Schematics and System Installation Drawings

1.8.2.1 System Schematics Drawings

System schematics must include schematic piping, hoses and other component layouts symbolically indicating, using standard system symbols, all system piping, and other components, including their sizes, materials, heights, spacing, and locations. Show both new and refurbished components on the schematic with any interfaces to existing equipment noted. Indicate all set point and size parameters for each component. Show component support types and locations, anchor points versus sliding supports, flex joints, and seismic supports. Include proposed pertinent installation details. Indicate required capacities and system pressures as well as direction of system flow or motion.

1.8.2.2 System Installation Drawings

System Installation Drawings must include the plan, isometric, and section views of all system equipment. Installation Drawings must include outline drawings in section views of all of the components which make up the system/routing designs, including piping, pipe fittings, valves, pipe supports, ducting, and all other equipment as applicable required to fasten a complete and working system. Indicate loadings and the type and kinds of frames, brackets, or other supports as necessary. Indicate materials, dimensions and sizes. Any associated structure or other components must be indicated to show location and integration. Submit a minimum of one section view per area.

1.8.3 Component Detailed Drawings

Provide component detailed drawings, including fabrication details for all mechanical and structural parts or components, except those which are of standard manufacture and can be supplemented with product data sheets to provide details. The drawings must show complete details of materials, tolerances, machined surface finishes, connections, any applicable instructions for paint, applicable instructions for installation, and proposed welding sequences which differentiate shop welds and field welds.

1.8.4 Shop Drawings

Detailed shop drawings must include fabrication, shop assembly, delivery, and field installation drawings. If departures from the Contract drawings are deemed necessary by the Contractor, submit details of such departures, including changes in related portions of the project and reasons therefore, with the shop drawings.

1.8.5 Butterfly Valve Detailed Refurbishment Drawings

The Butterfly Valve Detailed Refurbishment Drawings must detail how the existing components will be refurbished. The drawing must detail the modifications, rework, and final state of all the components involved in the refurbishment. Clearly identify locations and amount of material to be added and removed.

1.8.6 BFV Bypass System Refurbishment Drawings

The BFV Bypass System Schematics, Component Detailed Drawings and

Installation Drawings must detail the new components, how the existing components will be refurbished, and how each will interface. Detail the modifications, rework, and final state of all the components involved in the refurbishment. Clearly identify what is to be added and removed.

1.8.7 BFV Bypass System Refurbishment Drawings

The BFV Bypass System Schematics, Component Detailed Drawings and Installation Drawings must detail the new components, how the existing components will be refurbished, and how each will interface. Detail the modifications, rework, and final state of all the components involved in the refurbishment. Clearly identify what is to be added and removed.

1.8.8 Bearing Assembly Drawings

Submit the drawings for the components to be involved in the refurbishment of the Upper Trunnion, Lower Trunnion and Thrust Bearing assemblies. All features detailed in government provided drawings and found on the existing installed components, including material, are to be recreated on the new components unless approved by government. Identify all features and dimensions on submitted drawings if it is an existing or an added feature, and if to OEM conditions or a requested alternative. Clearly identify any feature to be added in the field. Detail the material of each component and if to OEM conditions or a requested alternative. Incorporate into the drawings the information obtained from the Initial Bearing Assembly Dimensional Analysis. The drawings include:

a. The Drawings of Rough or Partially Machined Parts for Bearing Assemblies are to address the components that will be initially supplied in an unfinished state in order to reduce the lead time in producing the final components for the Upper Trunnion, Lower Trunnion and Thrust Bearing assemblies. This includes but is not limited to Upper and Lower Trunnion bearing housing (shell or bearing carrier), bushing and glands. Identify dimensions that are to be final and those that include additional material for final sizing.

b. The Initial Drawings of Final Parts for Bearing Assemblies are to include all those components that are being supplied and finalized for each bearing assembly refurbishment. Any dimensions to be established from examination of existing components of the Upper Trunnion, Lower Trunnion and Thrust Bearing assemblies must be identified and the draft dimension from initial analysis of the government provided drawings detailed. Submitted drawings must include assembly drawings for each of the bearing assemblies, including bill of materials with part numbers, quantities, and materials where applicable.

1.8.9 Revised Bearing Assembly Drawings

After completion of the Revised Bearing Assembly Dimensional Analysis and Existing Bearing Assembly Component Inspection Report submit for the upper trunnion bearing, lower trunnion bearing, and thrust bearing assemblies for the two penstock butterfly valves the Revised Drawings of Final Parts for Unit 4 Bearing Assemblies and Revised Drawings of Final Parts for Unit 5 Bearing Assemblies. All features detailed in drawings and found on the existing installed components are to be recreated on the new components unless approved by government. All features and dimensions on supplied drawings must be finalized and identify if it is an existing or an added feature. Detail in each drawing the features, including dimensions, that

are applicable to both Unit 4 and 5, and any of those specific to either unit.

1.8.10 Final Revised Butterfly Valve Assembly Drawings

Submit the final butterfly valve assembly drawings detailing all changes made to both butterfly valve assemblies and overall layout. All drawing details must clearly differentiate between new, refurbished, and existing components. Include a complete bill of materials for the assemblies including part numbers, quantities, and materials where applicable. Include the final dimensional and feature details of both the valve body and valve disk shafts in the areas associated with the bearing assembly replacements.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

a. Materials and equipment must conform to the drawings and these specifications. Submit Materials and Equipment Certificates of compliance, where materials or equipment are specified to comply with requirements of Hydroelectric Power Plants, ASME, ASHRAE or other standards organizations. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency.

b. Materials and equipment must be the products of manufacturers regularly engaged in the manufacture of such products. Items of equipment must essentially duplicate equipment that has been in satisfactory use at least two years prior to bid opening. Materials differing in minor respect from that specified may be proposed, provided such differences are clearly stated (submitted as a variance). Any materials required which are not covered on the drawings or these specifications must conform to applicable specifications. In cases where material is not covered by one of the listed specification groups, furnish the highest commercial grade of material or product available. Particular attention shall be given to the marking of valves to indicate body and trim material and pressure rating.

c. The standard product of any reputable manufacturer regularly engaged in the commercial production of the type and quality of material or equipment referred to will not be excluded on the basis of minor differences, provided essential requirements of the specifications relative to materials, capacity, certification, and performance are met. In accordance with paragraph SUBMITTALS, furnish for approval, performance capacities and other pertinent information concerning the manufacturer's standard products intended for incorporation in the work. Standard products installed or used without such approval is at the risk of subsequent rejection.

2.1.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, Class, model and serial number, pressure rating and/or

voltage and current rating, and catalog number, on a corrosion-resistant steel plate permanently affixed to the equipment with corrosion-resistant fastener materials. Lettering on nameplates must be machine engraved or metal stamped with a black background. Plates must be mounted in a location easily visible without use of a mirror or removal of any components.

2.2 REFURBISH PENSTOCK BUTTERFLY VALVES

2.2.1 Purpose

The purpose of the penstock butterfly valves includes the shutoff of the flow of water to the turbines to relieve the pressure on the turbine wicket gates when they are closed, for emergency shut-off of the water to the turbine in case of failure of the normal speed regulating equipment, for shut-off of the turbine to permit maintenance of the turbine wicket gates, and to allow isolation of one unit for maintenance while allowing full operation of the other unit.

2.2.2 General Butterfly Valve Arrangement

The two existing penstock butterfly valves are 216 inches in diameter; see reference drawings for more detailed information. They were manufactured in 1959 by Willamette Iron and Steel Company (WISCO) and made to be identical, but length in service could have resulted in alteration of some dimensions, features, and components. The two butterfly valves operate in the vertical axis of rotation and are each actuated by their own dedicated valve operator system. Each valve operator system consists of a quarter-turn hydraulic cylinder actuator (BFV operator) installed horizontally positioned atop the butterfly valve, and each powered by its own HPU located at one floor level above at elevation 2052.0.

2.2.3 Refurbish Valve Disc Seals

The current bronze metal disc seal design was used predominantly in the 1940's and 1950's to provide sealing on large valves between the valve body and disc. The existing bronze seal rings are the original rings installed in 1960 and have provided 60+ years of acceptable service. There are two continuous bronze seals per disc, with each half originally constructed from four Ampco Gr. 8 bronze bar leaf segments, as shown on WISCO drawing H-4074 and H-4077. The metal bronze seal mates with the body seat which is a stainless steel overlay as show on WISCO drawing H-4069 and H-4070.

a. The existing bronze leaf seals (WISCO P/N 3301 and 3302) must be removed, cleaned, and inspected. Inspection results will determine whether existing seals can be re-used as-is, or if the new spare bronze metal seals must be used (see paragraph SPARE PARTS). If the new spare bronze metal seals are used, the existing seals are to be retained for repair and will become the spares. Construct the new metal seal segments from bronze metal that is equal or better than the existing seals. Use existing bronze metal seal measurement dimensions, valve body seal seat measurements, and reference dimensions on WISCO drawings for fabrication and machining of new seals. Any deviations from the original dimensions and tolerances shown on drawings must be submitted for Government review and approval, and incorporated into the final dimensions for the new seals. Contractor is responsible for final dimensions to achieve the specified seal contact and the leakage performance requirements for

when the valve is fully closed against a static head as specified in paragraph BUTTERFLY VALVE DESIGN PARAMETERS.

b. All mounting hardware and rubber sealing elements must be replaced with new, equal or better materials as existing, unless specified otherwise, and includes but not limited to the following:

(1) Provide new seal mounting bolts and washers (P/N 3001 and 3002), constructed from NITRONIC 60, UNS S21800 in ASTM A193/A193M

(2) Provide new square head bolts, wedge jacking bolts, and jam nuts (P/N 3004, 3305, and 3005), constructed from NITRONIC 60, UNS S21800 in ASTM A193/A193M.

(3) Provide new disc seal end seals (P/N 3303) constructed from neoprene rubber that is 40/50 durometer hardness, and mounting screws (P/N 3006) constructed from NITRONIC 60, UNS S21800 in ASTM A193/A193M.

(4) Provide new disc seal joint seals (P/N 3304) constructed from neoprene rubber and cork, or an equivalent material.

(5) Provide new o-rings (P/N 3003) to be installed in the o-ring groove of the bronze leaf, and constructed from neoprene rubber that is 40/50 durometer hardness.

c. Submit Valve Disc Seal Material Certificates for each new assembly component of the valve disc seals.

2.2.4 Valve Disc Filler

Filler material for disc must be compatible with the disc material and have an operational life of 50 years or more in the environment and operation conditions for which it will be used.

2.2.5 Valve Disc Coating

Perform valve disc sand blasting and re-coating in accordance to the requirements of this contract with a design life of 30 years or more for the application and environment of these valves. Section 09 97 02.00 26 PAINTS AND COATINGS details the requirements for vinyl paint systems.

2.2.6 Valve Upper Trunnion, Lower Trunnion and Thrust Bearing Assemblies

2.2.6.1 BFV Bearing Assembly Components

For both Unit 4 and 5, provide all of the components for each of the Upper Trunnion, Lower Trunnion and Thrust bearing assemblies for both Penstock Butterfly Valves to OEM conditions or formally government approved alternative. The bearing assemblies for the Upper Trunnion, Lower Trunnion and Thrust include, but are not limited to the bearing housing (shell or bearing carrier), bushing, glands, packings, dowels, retainers, screws and nuts for each assembly. The mechanical trunnion seals are to be considered part of the upper and lower trunnion bearing assemblies.

a. Components are to be in accordance with provided reference drawings including WISCO drawing H-4072. Manufacture components, such as the upper and lower trunnion bushings and bearing shell (bearing carrier) to a partially finished condition for both valves prior to Units 4 and

5 being taken out of service. Perform an Initial Bearing Assembly Dimensional Analysis using the drawings and knowledge of the components for each bearing assembly to determine the base dimension and their tolerances to set for the partially finished conditions. Determine which features of the components need adequate margin for adjustment to account for potential variation with existing components of Units 4 and 5, and detail what margin has been incorporated. Submit that analysis with the component drawings. Determine and identify which features are to be produced in the shop and which are to be produced in the field.

b. Materials must be in accordance with those detailed on WISCO drawing H-4072. If an equivalent material specification or type is to be used, then a formal request must be made to the government detailing the change in specification and why the change is needed and recommended. Any replacement or alternate piece due to obsolete or other must be clearly identified as such in all submitted materials. Submit Bearing Assembly Component Material Certifications for each assembly component of the Upper Trunnion, Lower Trunnion and Thrust Bearing assemblies.

2.2.6.2 Finished BFV Bearing Assembly Components

The procured components of the Upper Trunnion, Lower Trunnion and Thrust bearing assemblies for both Penstock Butterfly Valves are to be finished to a ready to install condition. The bearing assembly dimensional analysis shall be performed in accordance with approved plans using the Existing Bearing Assembly Component Inspection results to determine the final dimensions of the components that were not previously to a ready to install condition. Submit the Revised Bearing Assembly Dimensional Analysis for Unit 4 and Revised Bearing Assembly Dimensional Analysis for Unit 5 with the unit's revised component drawings. In addition, new component features resulting from the Existing Bearing Assembly Component Inspection are to be generated on any of the applicable bearing components, provided the government has formally approved the feature.

2.3 NEW PENSTOCK BFV GREASE LUBRICATION SYSTEM

Completely replace the two existing grease lubrication systems of the two penstock butterfly valves. The new system must include for each of the two systems a New Butterfly Valve Grease Lubrication System Pump, Distribution Manifolds, System Routing (Piping, Hoses and Fittings), and any additional components needed to provide the necessary lubrication grease to the existing butterfly valves and operator bearings. The new stainless steel tubing and distribution manifolds (or metering valves with adjustable orifices) to field adjust flow rates of grease to provide necessary lubrication to meet both the Contractor's design and the manufacturer's recommendations must be made possible without special tools. Mount the pump and distribution manifolds (metering valves) assembly on its own painted steel plate panel, located next to the BFV controls as shown, and mounted to the powerhouse wall in accordance with SECTION 13 48 00.00 26. Provide labels for all grease lines and associated components clearly detailing their function and what component the associated line supplies grease to. Provide lube interval chart in the O&M Manual.

2.3.1 Grease

The existing grease that the project currently uses is Mobilgrease XHP 221

NGLI Grade 1. New grease furnished as part of the replacement grease lubrication system is to be compatible with what is currently in use at the project.

2.3.2 Grease Pumps

Size the New Butterfly Valve Grease Lubrication System Pump for proper distribution of grease through the routing, with additional margin. The additional margin must be such that not one adjustable orifice in each distribution manifold will need to be over 75% open to provide the proper identified amount of grease. Provide new hand actuated pumps that have the equivalent characteristics as the existing in-service pumps at Fort Peck, including reservoir with follower plate, double-acting pump piston operated by a pump handle that results in charge of lubricant being drawn into pumping chamber. The existing in-service pump is Farval Model DA 6 Series 1A as shown on WISCO drawing H-4088.

2.3.3 Strainers

Provide grease strainers located in an area of easy access and rated for a minimum of twice system pressure. Determine the pressure and flow rating of the strainers to be compatible with the provided design.

2.3.4 Gauges

Provide pressure gauges conforming to ASME B40.100, have a black enameled metal case, a 4-1/2 inch dial, and a stainless steel Bourdon tube. The scale range of the gauge must be approximately 150 percent of the maximum pressure of the line in which installed. Gauges must be the safety type with solid fronts and blowout backs. Provide each gauge with a pressure snubber. Gauge mounting must be readable while working the pump hand lever. Gauges and gauge lines must be bottom tapped in horizontal pressure lines.

2.3.5 Valves

Provide valves and manifolds with a minimum pressure rating of 1.5 times the system pressure unless stated otherwise. Valves must have SAE straight thread ends and Buna-N o-rings with tube fittings. Valves must be specifically designed and rated for grease system applications. Unless otherwise stated, valves must be marked per MSS SP-25.

2.3.5.1 Ball Valves

Provide ball valves constructed of stainless steel, be designed for use with the lubricant, and include handles capable of locking the valve in the open or closed position. The valves must have replaceable seats and be repairable without disturbing the connections. Valves must be in accordance with ANSI/AWWA C507-18.

2.3.5.2 Needle Valves

Provide needle valves constructed of stainless steel and designed for fine flow regulation. The stem sealing o-rings must be Buna-N.

2.3.5.3 Metering Valves

Provide a metering or measuring valve for each butterfly valve bearing. It must be fully hydraulic in its operation, requiring no internal springs

or check valves. The valve for any given lubricated device must have sufficient capacity to deliver a maximum quantity of lubricant needed in accordance with the bearing manufacturer, each time the measuring valve is discharged with the valve adjusted to no more than 75% open. Example manufacturers that provide a suitable product include Alemite (SKF), Farval (Devco Corp), Perma, and Trico. The existing in-service valves are Farval Dualine DM series as shown on WISCO drawing H-4088. Provide stainless steel indicator pins with an aluminum or steel manifold. Grease orifices must be adjustable with an Allen wrench or other common tool.

2.3.5.4 Pressure Relief Valves

Provide pressure relief valves that are adjustable with a body designed for a set pressure to protect the system. The Contractor is responsible for determining the flow capacity.

2.3.5.5 Spring Loaded Check Valves

Provide spring loaded check valves of stainless steel construction and be the ball or poppet type with a body designed for high shock and system service.

2.3.6 Grease Lubrication Routing

Design and route all grease lubrication plumbing for the system working pressure. Provide a check valve in each lubricating line of the butterfly valve bearings to prevent the entrance of water into the respective measuring valves. Similarly, provide a relief valve in each lubricating line of the butterfly valve bearings to prevent over pressurization of greasing. Minimize grease line length. Securing of any grease plumbing or components to the removable valve pit covers will be cause for design rejection; maintain existing routing to the maximum practicable extent.

2.3.6.1 Tubing

Provide stainless steel tubing conforming to applicable requirements of ASTM A269/A269M for Grade TP 304, Seamless ASTM A789/A789M. Select wall thickness to provide a safety factor of 6 based on the manufacturer's ratings for burst strength in relation to the maximum working pressure.

2.3.6.2 Tube Fittings

Provide tube fittings made of stainless steel and be the 37-degree JIC flare type or be flareless type with SAE straight threads and Buna-N o-ring seals. The fittings must conform to SAE J514. Only use NPS flanged fittings in specific locations where the connection of the existing component is NPS, and in those cases they shall be in accordance with ASME B16.5.

2.3.7 Bolts, Nuts, and Washers

In addition to the requirements outlined in this section of the Contract specifications, see specification SECTION 05 05 23.18 26 BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION for supplemental bolted connection requirements. Where specification requirements vary, the requirements for bolts, nuts, and washers set forth in this specification section governs.

2.3.7.1 Stainless Steel Bolts and Nuts

Provide stainless steel bolts and nuts conforming to ASTM A193/A193M, Grade B8M, and ASTM A194/A194M, Grade 8M nuts.

2.3.7.2 Flat Washers

Flat washers must be stainless material of the same type as the bolt and nut of stainless bolted connections and meet dimensional tolerances of ASME B18.2.1. Provide flat washers conforming to ASTM F844 for bolted connections where washer is in direct contact with carbon steel surface of one component.

2.3.8 Grease Fittings

Provide industrial button-type grease fittings and tubing fittings made from stainless steel. Fittings are not to be located anywhere that fall protection is required to access the lubrication point.

2.4 REFURBISH PENSTOCK BFV BYPASS SYSTEMS

The BFV Bypass System consists of a 14 inch bypass line and the pressure monitoring system that are integral to the opening of the BFV. The bypass line provides water from upstream of a closed BFV to the downstream side of the BFV, filling the cavity between the BFV disc and unit wicket gates. The purpose is to equalize the upstream and downstream pressure levels before opening the BFV, to reduce both seal friction and stress on the assembly. The bypass water flow is controlled by a 14 inch diameter motorized gate valve system with manual back-up. The differential pressure across the valve from the water pressure lines connecting upstream and downstream of the BFV disc is monitored and relayed to the BFV controls by the BFV Bypass Valve. New mechanical equipment, components, and materials for the Refurbish Penstock BFV Bypass System, designed in accordance with this Section, includes but not limited to the following:

- a. Motorize gate valve (Bypass Valve)
- b. Manual gate valve
- c. Equalizing line pressure monitoring system
- d. Carbon steel piping system
- e. Flange gaskets
- f. Pipe insulation

2.4.1 New Motorize Gate Valve (Bypass Valve)

The new 14 inch diameter Electro-Mechanical gate valve must connect to new bypass piping with Class 150 flange interfaces, and located as shown on drawing M-420. New motorize gate valve per paragraph ELECTRO-MECHANICAL VALVES below. See Section 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT for electrical requirements, power, and controls for bypass valve. Gate valve mechanical construction and installation requirements per paragraph VALVES below.

2.4.2 New Manual Gate Valve

The new 14 inch manual gate valve with Class 150 flange interfaces, and located upstream of motorized gate valve (BFV bypass valve) for isolating penstock pressure and performing maintenance on motorized gate valve. Manual gate valve mechanical construction and installation requirements per paragraph VALVES below.

2.4.3 New Equalizing Line Pressure Monitoring System

For each butterfly valve, replace the existing absolute pressure switch and provide a new differential pressure switch and associated plumbing required to monitor pressure on both sides of the penstock butterfly valve, as shown on contract drawing M-601. Design the new equalizing line pressure monitoring system as follows:

- a. Utilize the existing pressure tap location of the absolute pressure switch located downstream of the BFV, and provide a new pressure tap location upstream of the BFV for routing the new equalizing line pressure monitoring system, and together this configuration monitors the differential pressure across the BFV.
- b. Locate, drill and tap new upstream pressure tap location similar to existing downstream location (see WISCO reference drawing H-4086 for existing). Note: except for this drill and tap location requiring NPT, use SAE o-ring fittings to the largest extent possible.
- c. Provide snubbers for absolute pressure switch, differential pressure switch, and pressure gauges.
- d. Provide appropriate isolation valves for performing maintenance on the system; per paragraph VALVES below.
- e. Use the pressure switch output contact signal as a permissive interlock for the hydraulic directional control valves that operate the respective butterfly valve operator. Opening the butterfly valve must only be possible when a balanced pressure has been detected in the penstock, reference contract drawing E-601 for details. Provide a system in accordance with the Contract specifications and drawings. See SECTION 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT.

2.4.3.1 Tubing

Provide stainless steel tubing conforming to ASTM A269/A269M for Grade TP 304, Seamless ASTM A789/A789M. Select wall thickness to provide a safety factor of 6 based on the manufacturer's ratings for burst strength in relation to the maximum working pressure.

2.4.3.2 Tube Fittings

Provide tube fittings made of stainless steel with 37-degree JIC flare type fittings and with flareless type SAE straight threads and Buna-N o-ring seals. Fittings must conform to SAE J514. Provide dielectric fittings or isolation joints between all dissimilar metals.

2.4.3.3 Pressure Switch

Provide new differential pressure switch and absolute pressure switch in accordance with Section 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND

EQUIPMENT.

2.5 REFURBISH SPIRAL CASE DRAIN VALVES

Unit 4 and 5 each have spiral case drain valves used for draining the spiral case after the butterfly valves have been closed. The existing spiral case drain valves are manually operated 12 inch gate valves. The piping and valves are insulated with asbestos free insulation (Contractor to verify). The existing spiral case drain valves are equipped with a limit switch, which provides a permissive contact to open the butterfly valve when the main spiral case drain valve is closed. The existing limit switch is MICRO SWITCH by Honeywell.

2.5.1 New Manual Gate Valve (Spiral Case Drain Valve)

Provide new 12 inch manual gate valves with Class 150 flange interfaces, and installed in same location as existing, as shown on drawing M-420. Manual gate valve mechanical construction and installation requirements per paragraph VALVES below.

2.5.2 New Limit Switch

Provide new limit switch in accordance with Section 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT.

2.6 REFURBISH TUNNEL DRAIN VALVE

There is one tunnel drain valve located upstream of the bifurcation to units 4 and 5 intakes which is used to drain the power tunnel of any remaining water after the intake gates have been closed. The existing tunnel drain valve is a manually operated 12 inch gate valve. The piping upstream of the valve, and the existing valve, are insulated with asbestos free insulation (Contractor to verify).

2.6.1 New Manual Gate Valves (Tunnel Drain Valves)

Provide two new 12 inch diameter manual gate valves with Class 150 flange interfaces, and installed in the configuration as shown on drawing M-430. Manual gate valve mechanical construction and installation requirements per paragraph VALVES below. Provide new insulation of equal or better quality than existing insulation.

2.7 BFV MAINTENANCE PLATFORMS, LADDERS AND GUARDRAILS

Provide new butterfly valve maintenance platforms, ladders and guardrails in accordance with Section 05 51 33.00 26 MISCELLANEOUS STEEL STRUCTURES.

2.8 BFV ACCESS HATCH MODIFICATIONS

Provide butterfly valve access hatch modifications in accordance with Section 05 51 33.00 26 MISCELLANEOUS STEEL STRUCTURES.

2.9 ELECTRO-MECHANICAL VALVES

Provide electro-mechanical valves for the locations identified within this Section of this specifications and as shown on the Contract drawings. The electro-mechanical valves must have remote, local, and manual operation capabilities. Provide non-intrusive actuator type valves consisting of a mechanical gearbox powered by an electrical motor, see specification

SECTION 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT, for motor requirements. The existing BFV bypass valve Limitorque SMA model is an approved electro-mechanical valve, or similar. Remote mode will be the standard operating mode. Local switch at the valves is for operational testing and integration into the new valve controller. Ensure that the valves have a means of manual operation independent of the electrically commanded actuation. The manual mode must involve an attached wheel or hand crank to drive the valve position open and closed. The valves must have a means for external, visual verification of valve movement, such as a dial mounted on the valve stem. Actuator assembly must be rated to withstand direct exposure to water with out impact to functionality or component life.

2.10 PIPE THREADS

2.10.1 Threaded Joints

If present, threaded joints must conform to ASME B1.20.1. Screwed threads must be made up with lubrication applied on the male threads only. Caulking of screwed joints to stop or prevent leakage will not be permitted (includes liquid teflon). Joints must be made with Teflon tape; the Teflon tape must not wrap around the last two remaining threads of the male end of the threaded joint. Coat exposed threads on ferrous pipe with zinc rich paint after assembly.

2.10.2 Pipe Nipples

Provide pipe nipples conforming to ASTM A733.

2.11 CARBON STEEL PIPING SYSTEM

2.11.1 Carbon Steel Pipe, General

The carbon steel piping system applies to the BFV bypass and tunnel drain piping systems.

2.11.2 Carbon Steel Pipe

Provide carbon steel pipe meeting the requirements of ASTM A53/A53M seamless, Grade B, and hot-dipped galvanized. Pipes must be Schedule 40.

2.11.3 Carbon Steel Joints

Join carbon steel piping by welding fittings and flanges. Fitting type and location must match existing. Provide dielectric fittings or isolation joints between all dissimilar metals.

2.11.4 Carbon Steel Fittings

2.11.4.1 General

Acceptable fitting types for the carbon steel piping system are specified in the paragraphs below.

2.11.4.2 Welding Fittings

Welding fittings must be butt-welding. Provide forged steel welding fittings per ASTM A105/A105M Class 150 conforming to ASME B16.9, or ASME B16.11. Complete welding and inspection in accordance with the

requirements of Section 05 05 23.18 26 BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION.

2.11.4.3 Flanged Fittings

The internal diameter bores of flanges and flanged fittings must be the same as that of the associated pipe. Use slip-on welding flanges on pipe and welding neck flanges on fittings. Flanges and flanged fittings must be forged steel, ASTM A105/A105M, per the requirements of ASME B16.5 or MSS SP-44, Class 150 with a flat face. Wall thickness of flanges must be equal to, or exceed that of the pipeline that it is installed in. For tie-in to existing flanges, field check existing flanges for non-standard bolt hole configurations and design as required to assure new pipe and flange mate properly. Provide flange gaskets per paragraph FLANGE GASKETS below.

2.11.4.4 Branch Connection Fittings

Branch connection fittings must be specifically designed to be welded into steel lines. They must be of forged carbon steel construction and meet or exceed the pressure rating and wall thickness of the line in which they are installed. The branch end must be suitable for butt welding, socket welding or threaded as needed.

2.11.5 Carbon Steel Coatings

Carbon steel piping components must be coated with corrosion resistant materials. Coatings and finishes must be 100 percent holiday free. Carbon steel pipe must be hot-dipped galvanized in accordance with ASTM A53/A53M; electroplated zinc or cadmium plating is unacceptable.

2.12 FLANGE GASKETS

Provide flange gaskets made from fiber, plastic, or other synthetic material suitable for the pressure and service, and meeting the requirements of ASME B16.5. Nonmetallic gaskets must conform to ASME B16.21. Use electrically isolative flange gasket kits on any connection between dissimilar metals.

2.13 ISOLATION JOINTS AND COUPLINGS

2.13.1 Flange Connections

Insulated flange connections must prevent electrical current flow between the adjacent flanges. The insulation parts must include flange gasket, bolt sleeves, and washers. Provide special flanges if necessary. All parts must be suitable for the required operating pressure, temperature, and fluid.

2.13.2 Dielectric Unions

Make dielectric unions of two dissimilar metals that will isolate any current flow between the union, and the ends must match the materials and connection type of the new or existing piping or equipment.

2.14 VALVES

2.14.1 General Requirements For Valves

Provide valves with operator, handwheel, and all other accessories required for a complete operation. The valves must be suitable for the intended service, with published pressure ratings not less than 1.5 times the maximum pressure ratings for the system in which installed. Valves must be the same size as adjoining pipe. Valve ends must be compatible with adjacent piping system. An operator must be sized to operate the associated valve for the full range of pressures and velocities. All valves must be lockable, in order to comply with standard lockout/tagout requirements. Factory mount all operators, actuators, and accessories. Mark all valves in accordance with MSS SP-25.

2.14.2 Factory Finishing

Valves must have an epoxy coating unless otherwise specified. The epoxy must be either a two-part liquid material or a heat-activated (fusion) material except that only a heat-activated material must apply if a valve coating is specified as "fusion" or "fusion bonded" epoxy. The epoxy coating must have a minimum 7.0 mils dry film thickness except where it is limited by valve operating tolerances.

2.14.3 Ball Valves

Provide ball valves that are full-bore with 1/4 turn operation. Provide manually operated valves with short lever handles of galvanized steel construction. Ball valves must conform to the following additional requirements:

- a. Ball valves installed in steel piping must be three-piece construction. Valves must conform to the requirements of ASME B16.34 and MSS SP-72. Valves must be full port, have class 150 flanges with a steel body, stainless steel ball, RTFE seat rings, and PTFE packing.

2.14.4 Globe Valves

Provide globe valves installed in steel piping conforming to the requirements of MSS SP-85, Type I or II, Class 125, bronze trim, and flanged ends.

2.14.5 Gate Valves

Provide gate valves that are full flanged body design, rated ASME Class 150 and designed, manufactured and installed in accordance with ASME B16.34. Must be capable of bolting to existing flange connections where applicable.

2.14.6 Operators

- a. All valves provided under this Specification section must be provided with a manual operator. The force required to operate a manual operator must not exceed 40 pound under any operating condition, including initial breakaway. Equip operators with gear reduction when force exceeds 40 pound. Provide a position indicator on quarter-turn valves.

- b. Operators must have painted handwheels. Lever operators are allowed on quarter-turn valves 8 inch and smaller. Cranks must be

supplied on gear type operators. Valve handles must be capable of padlocking, and wheels must be lockable with a chain and padlock.

2.15 PIPE SUPPORTS

2.15.1 Pipe Supports, General

Pipe supports must conform to the requirements of MSS SP-58. Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither will have a deteriorating action on the other. Provide auxiliary steel where the support of piping systems and equipment is required between building structural elements. Light gauge and structural steel shapes must conform to the requirements of ASTM A36/A36M. The Contractor has the option to use pre-engineered support systems. However, a mixture of support system manufacturers products is not permitted.

2.15.2 Hanger Types

All hanger types are per Figure A1 of MSS SP-58

a. Prohibited Types: Support Types 5, 12, and 26 are not permitted to be used.

b. C-Clamps: Only Type 19 and Type 23 C-clamps are permitted. Use manufacturer furnished locknuts and retaining devices. Field fabricated C-clamps or retaining devices are not acceptable.

c. Hangers: All hanger types, except those listed above are acceptable. Type 24 may only be used on trapeze hanger systems or on fabricated frames.

d. Horizontal Pipe Supports: Space horizontal pipe supports as specified in MSS SP-58 and install a support not over 1 foot from the pipe fitting joint.

2.15.3 Riser Clamps

Vertical runs of piping must be supported at each floor, or closer where required, with ASTM A36/A36M carbon steel clamps bolted around pipes and attached to the powerhouse structure.

2.15.4 Brackets

Where piping is run adjacent to walls, provide welded ASTM A36/A36M steel brackets, pre-punched with a minimum of two fastener holes.

2.15.5 Offset Pipe Clamp

Where pipes are indicated as offset from wall surfaces, supply a double-leg design two-piece pipe clamp.

2.15.6 Racks

Multiple pipe racks or trapeze hangers shall be fabricated from ASTM A36/A36M steel, and designed to suit the conditions at the points of installation. Pipes shall be kept in their relative positions to each other by the use of clamps or clips. Pipelines subject to thermal expansion must be free to slide or roll.

2.15.7 Hangers

Hangers must be fabricated of ASTM A36/A36M carbon steel and must be MSS SP-58 Type 24. All hangers must be of a uniform type and material for a given pipe run and application. Coated or plated hangers must be used to isolate steel hangers from dissimilar metal tube or pipe. Hangers for pipe sizes 2.5 inch or larger must incorporate a means of vertical adjustment after erection while supporting the load.

2.15.8 Hanger Rods

Hanger rods must be carbon steel conforming to ASTM A576. The diameter of the rods for piping system support must conform to ASME B31.1.

2.16 PIPE INSULATION

Pipe insulation material must be closed cell foam flexible elastomeric cellular pipe type insulation meeting ASTM C534/C534M type II Grade 1. Ensure the water vapor permeability does not exceed 0.28 grain per foot per inch per hour per square foot mercury pressure difference for 1 inch thickness of cellular elastomer. The exterior surface must have a smooth skin. Pipe insulation must be in tubular form and shall be at least 2 inch thick. Unless otherwise specified, insulation must have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84, NFPA 255 or UL 723.

2.17 SPARE PARTS

2.17.1 General

Identify all Spare Parts in a list submitted to the Government. Include approved list in the O&M Manual specified in PART 3 of this Section. Package the spare parts for long-term storage in accordance with requirements in this Section and Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES, paragraph DELIVERY, STORAGE, AND HANDLING. Where conflicting requirements exist, the most conservative requirement governs. Package spare parts with external labeling (on both the top and side of the container) including but not limited to: the contents date packaged, storage instructions, ambient temperature requirements, and any dates of importance such as packaging expiration. For rubber seal elements, use 7 silicone compound or approved equal to treat the seals prior to packaging for storage, and then seal the package for storage in a box that prevents exposure to UV. Include in the O&M Manual detailed instruction on removal and installation of all spare parts, including the spare disc seal.

2.17.2 Spare Parts List

Furnish the following spare parts, which must be duplicates of and interchangeable with the original parts furnished. Each spare part must have an attached identifier listing the part number, vendor or manufacturer and a contact address and phone number. Furnish spare parts as follows:

- a. Two sets of bronze metal disc seals (a set constitutes fully outfitting the butterfly valve with the component);

- b. Ten percent of the total quantity required for disc seal stainless steel mounting hardware and disc seal adjusting bolts (wedge jacking bolts);
- c. One spare set disc leaf seal end seal (P/N 3303);
- d. One spare set disc leaf seal joint seal (P/N 3304);
- e. One spare set disc leaf seal o-ring (P/N 3003);
- f. One thrust bearing carrier seal (P/N 1013);
- g. One thrust bearing carrier o-ring (P/N 1014);
- h. One thrust bearing carrier o-ring (P/N 1015);
- i. One spare set trunnion bearing carrier seals (P/N 1103);
- j. One spare set trunnion bearing carrier seals (P/N 2404);
- k. One trunnion bearing carrier-to-valve body o-ring (P/N 1104);
- l. One spare set trunnion chevron packing (P/N 1107);

PART 3 EXECUTION

3.1 GENERAL EXECUTION

The refurbishment, replacement, demolition, installation, and modification must be in accordance with the applicable provisions of the publications referenced herein and requirements of this specification, and detailed in submitted Refurbishment Plan and Procedure for each system, detailing all procedures for all the work listed below. Notify the Government prior to all shop and field testing and inspections that is specified to be witnessed by the Government, per the requirements specified in paragraph COORDINATION.

3.1.1 Unit Outage Coordination

The start of the outage window in which the units are taken out of service will not begin until all of the following have been met:

- a. Conditional approval from the Contracting Officer has been granted for the shop test results of the butterfly valve operators and HPU systems, inclusive of the hydraulic reservoirs, and all electrical control panels.
- b. All construction materials have arrived to the project site, including but not limited to: butterfly valve refurbishment materials, grease lubrication system, bypass valve and piping system components, spiral case drain valves, tunnel drain valves and associated materials, HPU systems, BFV operators, electrical control panels, all ancillary electrical and hydraulic equipment necessary for proper installation, and all tools and equipment necessary to execute the rehabilitation work. Exception will be any components that require final machining to finished dimensions after existing equipment is removed for dimension verification (i.e. trunnion bearings, BFV operator crank, etc). All spare parts to be provided as

part of this contract, throughout all specification sections, must be delivered to the project site prior to the start of unit outage.

c. The Government has reviewed and approved the Contractor submitted detailed extraction and lifting plans for removing existing equipment and installation of the new equipment, controls equipment, HPUs, BFV operators, bypass system valves, etc.

d. The Government has reviewed and approved the Contractor submitted Butterfly Valve Field Testing Procedure, and Grease Lubrication System Field Testing Procedure.

e. The Contractor has submitted the intake gate leakage diversion plan for capturing all leakage beyond the intake gates, and diverting the leakage to the draft tube or tailrace.

3.1.2 Unit Outages VS Tunnel Outages & Unwatering Scenarios

The Government will perform all tasks associated with taking unit outages, tunnel outages, unwatering and drying out the tunnel, penstock and spiral case. The following is provided for information only (FIO) and for contractor work planning purposes. Note that some contractor work sequencing will be affected by unwatering scenarios described below.

a. Drawing MFP-OPN87E1651.1 includes the powerhouse 2 unwatering and drainage flow diagram. The tunnel drain includes a 12" line that drains into the station unwatering sump. For each unit a 12" spiral case drain line connects the spiral case to the draft tube and is used for draining the spiral case during unit unwatering and refilling the draft tube during unit rewatering. A 4" spiral case bypass drain line is used when the 12" spiral case drain valve must be closed in scenarios described later. The 4" bypass line drains into the station unwatering sump.

b. The tailwater elevation is higher than the 12" spiral case drain line and will back feed into the spiral case if draft tube bulkheads are not installed, or if the 12" spiral case drain valve is not closed.

c. For unit outages, with draft tube bulkheads installed, the normal practice is to use the 12" spiral case drain line to drain butterfly valve leakage to the draft tube; which is then pumped from the unwatering header/sump by the sump drainage pumps and/or unwatering pumps. There is only one set of draft tube bulkheads in powerhouse 2, which means that only one draft tube can be unwatered at a time.

d. The "unit outage" condition described above does not work for tunnel outages. Also, there is no tunnel door in powerhouse 2, which means tunnel access and BFV access is only possible from the spiral case doors of units 4 & 5.

e. For tunnel outages, the conditions are as follows: Both 12" spiral case drain valves are shut to keep the tailrace water from backing up into the spiral cases. The 4" auxiliary spiral case drains are opened, which drain directly to the station sump. The auxiliary spiral case drains will drain the water downstream of the bifurcation; and the 12" tunnel drain line will drain the water upstream of the bifurcation. There will be emergency gate leakage running down the tunnel for the duration of the tunnel outage; but the area downstream

of the bifurcation will eventually be drained out completely and will be almost completely dry.

3.1.3 Demolition and Installation Damage

Take precautions to ensure against damage to existing work before beginning any dismantling, drilling, cutting, removal, or other modification of existing work. Any damage done to structure or other equipment to be re-used, left in service, or turned over to the Government must be repaired or replaced at the Contractor's expense. Touch up any paint on any surfaces damaged during this work.

3.1.4 Workmanship

Workmanship must be of the best quality throughout and in accordance with the best standard practice, notwithstanding any omissions in the drawings or specifications.

3.2 AS-BUILT DRAWINGS

The Contract and reference drawings are intended as guidelines and for information only, respectively. Any omissions from the Contract drawings must be corrected and added to the Contract drawings by the Contractor, and the Government notified. If departures from the Contract drawings are deemed necessary by the Contractor, details of such departures, including changes in related portions of the project and the reasons therefore, must be submitted as part of each System/Routing Design. Submit As-Built Drawings in accordance with the guidelines set forth in specification SECTION 01 33 00 SUBMITTAL PROCEDURES.

3.3 SHOP TESTS

Perform shop test on all components provided by this Contract and relevant to this specification section unless otherwise approved by the Government in writing. The Government reserves the right to witness all shop tests pertaining to any aspect of this Contract. Coordinate dates for all shop tests and notify the Government of test dates and locations per the requirements specified in paragraph COORDINATION. See Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES for shop assembly and testing requirements of BFV Operators and HPU Systems.

3.4 GENERAL REMOVAL OF EXISTING EQUIPMENT

a. The existing equipment covered by this Section identified for removal, replacement, refurbishment, and/or inspection is shown on contract drawings and/or specified in this Section and listed in paragraph SUMMARY. All equipment not specified to be salvaged becomes the property of the Contractor, removed from the Project site, and disposed of in a legal manner. Materials that cannot be removed daily may be temporarily stored on-site at an approved area. Salvaged materials cannot be sold on the project site.

b. Submit existing equipment removal procedures detailing the sequence and procedures for all systems and components to be removed or affected by the removal as a section of each system's Refurbishment Plan and Procedure submittal detailed in the following paragraphs. The Contractor must include as part of the existing equipment removal procedure, detailed calculations and assumptions showing the estimated pick weight of all components based on field verified conditions and reference drawings.

Include as part of the procedure, a plan for weight reduction of component picks in the event that picks are heavier than anticipated as means to mitigate on-site construction delays. Where applicable, ensure compliance with other sections of these specifications. Procedures are to include but not be limited to the detailing of:

- (1) Items to be removed.
- (2) Temporary arrangement or storage of items.
- (3) Special containment and disposal procedures.
- (4) Protection procedures for open routing.
- (5) Extraction and lifting plans.

3.5 LOAD HANDLING AND LIFT PLANS

Submit Load Handling and Lift Plans for Government review and approval. The load handling and lift plan will be reviewed for clarity and detail of plan and procedure as to prevent schedule delays to the greatest extent possible. The load handling and lift plan must detail the extraction, lifting, installation, transportation and lay down for all systems and components as part of this Contract. Furnish Critical Lift Plan documentation in accordance with EM 385-1-1. Additionally, provide detailed drawings (to scale) showing rigging configuration with Powerhouse features shown on the drawings. Include details, certificates, and product data of all rigging used. Any Contractor provided lifting beams must conform to the requirements detailed in ASME B30.20 and ASME BTH-1. Detail, in the plans, the sequence of operation and methods of keeping loads stable. Include detailed calculations taking into account for placement and floor loading of equipment when handling large (heavy enough to require a Critical Lift Plan in accordance with the above referenced EM). The erection bay floor slab is designed for 1000 psf and any loads exceeding this value will require Government approval. Submit all heavy loads for review and Government approval.

3.6 GENERAL INSTALLATION AND MODIFICATION OF SYSTEMS

a. Modify and install systems and components including all seals, piping, hoses, valves, fittings and related accessories per the approved installation procedures. Refer to drawings for more details. Install material and equipment suitable for the pressures, flows, and temperatures encountered. Installation must be in accordance with the manufacturer's written instructions and under the direction of the erection engineer or manufacturer's representative. Necessary supports for all appurtenances, pumps, tubing, and other equipment or components must be provided in accordance with SECTION 13 48 00.00 26 SEISMIC RESTRAINT FOR MECHANICAL AND ELECTRICAL EQUIPMENT. If necessary, clean work area in each penstock and temporarily install a small sump pump or provide other means of disposing of leakage past the bulkhead gate.

b. Installation procedures submitted as part of this specification section must also be in direct correlation with the requirements of SECTION 13 48 00.00 26 SEISMIC RESTRAINT FOR MECHANICAL AND ELECTRICAL EQUIPMENT, SECTION 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT, SECTION 26 05 19.00 26 INSULATED WIRE AND CABLE, and SECTION 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS

STRUCTURES. See paragraph LOAD HANDLING AND LIFT PLANS for additional details to be included as part of the installation of equipment procedures.

3.6.1 General

3.6.1.1 Piping and Tubing Routing

Piping and tubing must run parallel with the lines of the building, unless otherwise distinctly shown or noted on the drawings. Cut pipe accurately to measurements established at the structure by the Contractor. Remove burrs from pipes by reaming and cut into proper lengths by the use of a wheel type mechanical cutting tool or other approved device. Install piping and hoses without inducing stress into valves or fittings. Piping, hose, valves, and fittings must be kept at a sufficient distance from other work and other services to permit not less than 1/2 inch between finished coverings on the different services. Use fittings to change direction plumbing. Install unions or flanges, as applicable, at valves and other equipment unless otherwise indicated. The pipe and hose alignment must be such that there will be no perceptible bends or kinks. Misalignment will be cause for rejection, and rework of the piping sections involved will be required. Secure and neatly support all equipment such that it cannot be damaged by equipment vibration. Anchors and branches must be installed with due consideration for pipe temperature and future expansion. Install system components in locations that are protected from mechanical or chemical damage. Install all materials in accordance with the manufacturer's recommendations.

3.6.1.2 Protection of Pipe, Tube, Hose, and Related Materials

Prior to and during installation, the pipe, valves, fittings, hose, ducting, and related materials must be kept clean and handled to prevent injury to these materials as well as the finished materials. Store materials and equipment in an approved area with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants. Openings on pipe, tube, hose, valves and related materials must be tightly covered with caps or plugs during installation to prevent entry of foreign material. Pipe, tube, hose, and related materials must be covered and protected against dirt, water, and chemical or mechanical injury.

3.6.1.3 Piping and Tubing in Exposed Areas

Install exposed piping and tubing as not to reduce exit access widths, corridors or equipment access. Exposed horizontal plumbing, including drain piping and tubing, must be installed to provide maximum headroom. Locate all plumbing and pipe/tube penetrations to reduce the amount of piping/tubing routed along the floor and to prevent tripping hazards in primary walkways.

3.6.1.4 Expansion and Contraction of Piping

a. Allowance must be made throughout for expansion and contraction of the pipe or tube. Horizontal runs of pipe/tube over 50 feet in length must be anchored to the wall or the supporting construction approximately midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility must be provided on branch run-outs from mains and risers to provide for expansion and contraction of piping/tubing. Provide flexibility by installing one (1) or more turns in the line such that the associated line has

sufficient spring to allow for expansion without developing excessive stress.

b. Fabricated expansion joints may be permitted where space limitations restrict bends. Submit manufacturer's data on expansion joint, including type, dimensions, material, maximum pressure, temperature rating, end connections, and installation instructions as per paragraph SUBMITTALS.

3.6.1.5 Reducers

Changes in pipe and tube sizes are to be made with one-piece concentric reducing fittings. The use of grooved end or rubber-gasket reducing couplings are not be permitted. Use of bushings are not be permitted.

3.6.1.6 Cleaning

a. The interior and ends of new and existing plumbing affected by the Contractor's operations must be kept thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

b. Pull a stainless steel wire brush through tubing and piping several times, followed by clean cloths treated with a non-combustible metal cleaner designed for the purpose. Valves and fittings which have not been sealed at the factory, must be thoroughly cleaned with a solvent-soaked cloth or pipe brush prior to installation. Piping, valves, ducting and fittings must be inspected for water, foreign matter or other loose material before placing into position.

3.7 REFURBISH PENSTOCK BUTTERFLY VALVES

The two 216 inch penstock butterfly valves are to be refurbished in accordance with the approved Butterfly Valve Refurbishment Plan and Procedure submittal. Unless otherwise approved, the valves and components must be refurbished in place, except as noted below. Care must be taken when working or removing components and material to avoid causing structural or functional damage to the valves and their components. Include as a section in the Butterfly Valve Refurbishment Plan and Procedure submittal, the detailing of the procedure for all the work listed below, including work sequence, list of cleaning agents, and required tools.

3.7.1 Refurbishment of Valve Disc Seals

Refurbish the butterfly valve disc seals in accordance with the following:

a. The existing bronze metal disc seals and stainless steel mounting and adjusting hardware must be removed without damage to the valves or the bronze leaf segments.

b. Clean and inspect the bronze metal disc seals (WISCO P/N 3301 and 3302). Attach label to each seal segment immediately after removal to identify the valve the seal was removed from (for example: "U4-LH", "U4-RH", "U5-LH", and "U5-RH"). Inspect seals using visual and NDE methods. Submit an Existing Bronze Metal Disc Seal Inspection Report - U4 and Existing Bronze Metal Disc Seal Inspection Report - U5 within

the timeline specified in paragraph SUBMITTALS SD-06. Inspection results will determine whether existing seals can be re-used as-is, or if the new spare bronze metal seals supplied under this contract must be used (see paragraph SPARE PARTS). If new spare bronze metal seals are used, the existing seals must be retained for repair and will become the spares.

c. With the bronze leaf seals removed, perform refurbishment of the valve disc and seal mounting surface as specified below. The bronze metal disc seal mounting surface and mounting hardware threaded holes must not be damaged during the disc refurbishment.

d. After valve disc refurbishment, install the bronze metal seals. The attachment of the bronze metal leafs to the valve disc must utilize the existing attachment points, mating surfaces, and new NITRONIC 60 hardware (square head bolts, wedge jacking bolts, jam nuts, etc.) and rubber sealing elements (end seals, joint seals, o-rings, etc.). Use polysulfide sealant (MIL-PRF-81733 or MIL-S-8802 or similar) "wet" when re-installing seals, generously applied between all mating surfaces of bronze metal leaf seals and the existing carbon steel disc, and fully coat threads of NITRONIC 60 hardware during assembly; to assist with dielectric insulation.

3.7.1.1 Valve Disc Leaf Seal End Seals

Inspect and document condition of the bronze metal leaf ends (WISCO P/N 3301 and 3302), leaf seal end seals (WISCO P/N 3303), and how each mates with the bearing carrier and the carrier seal (WISCO P/N 2404 and 1103). Existing arrangement is shown on WISCO drawing H-4068 (Detail B and Detail C) and drawing H-4074 (Detail C). There are four locations per butterfly valve to clean, inspect, refurbish and restore to a condition that will receive new resilient end seals to mate with the new carrier seals. These are critical sealing points to refurbish since they are the primary source of internal leak points of the existing butterfly valves when the valves are closed.

3.7.2 Refurbishment of Stainless Steel Overlay Body Seat

Clean all surfaces of existing stainless steel overlay body seat and inspect the surfaces for damage. Grinding or other mechanical means that can damage the sealing surface is not allowed. Protect the stainless steel overlay body seat against damage during sand blasting specified below. After the valve body internal surfaces are sand blasted and prior to re-coating, inspect the stainless steel overlay and adjacent surfaces with NDE methods and submit a Stainless Steel Overlay Body Seat Inspection Report - U4 and Stainless Steel Overlay Body Seat Inspection Report - U5 within the timeline specified in paragraph SUBMITTALS SD-06. Do not paint the sealing surfaces of the stainless steel overlay body seat.

3.7.3 Refurbishment of Valve Internal Surfaces

Refurbish the butterfly valve internal surfaces in accordance with the following:

a. The entire internal surface of both penstock butterfly valves, including a minimum of three feet six inches upstream and three feet six inches downstream of the valve disc centerline, must be cleaned and prepared, lead abated per Section 02 83 13.00 10, LEAD IN CONSTRUCTION, sand blasted, coated with paint systems, and inspected

per Section 09 97 02.00 26 PAINTS AND COATINGS. Submit paint inspection results to the Government and included in the O&M Manual.

b. After sand blasting and prior to coating with the approved paint system, the butterfly valve internal body and disc welds must be inspected with NDE, as specified below.

c. Re-clean and sand blast the valve internal surfaces after NDE to remove all contaminants from the NDE process and achieve the specified surface profile and condition required by the paint system, prior to painting.

d. If filler material is required for the valve disc seal mounting surfaces, the product used must be compatible with the disc material and have an operational life of 50 years. The filler material must be submitted for approval in the Butterfly Valve Refurbishment Plan and Procedure submittal.

3.7.4 Inspect Butterfly Valve Welds

3.7.4.1 General

Immediately after sand blasting the butterfly valve interior, inspect all butterfly valve welds and submit a report of findings for the purpose of documenting existing condition of welds, flaw size, and identifying areas for potential repair action. Inspect butterfly valve interior welds with NDE methods defined below, to include visual inspection (VT), Phased Array Ultrasonic Testing (PAUT), and magnetic particle (MT). Inspection of the welds on the exterior of the butterfly valve is limited to VT only (without disturbing paint).

3.7.4.2 NDE Inspector Qualifications

All inspectors must be ASNT NDE Level II or III certified in PAUT in accordance with ASNT SNT-TC-1a and ASME BPVC Sec V Article 1 Mandatory Appendix II. All NDE technicians must be qualified in accordance with this standard to Level II or III for each applicable method. Submit inspector qualifications in accordance with Section 05 05 23.17 26 WELDING (STEEL), FABRICATION, AND MACHINE WORK, and Section 05 05 23.18 26 BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION.

3.7.4.3 Butterfly Valve NDE

a. The butterfly valves were built in 1960's to neither ASME Boiler and Pressure Vessel Code or AWS D1.1/D1.1M code, but rather Willamette Iron and Steel Company Welding Procedure A-3385. Stress relief was carried out to ASME BPVC Sec VIII. For this inspection, perform NDE to applicable requirements from ASME BPVC Sec V, and AWS D1.1/D1.1M. Complete a fracture mechanics analyses to identify targeted flaw sizes and desired safety factors specific to the butterfly valve.

b. Inspector must prepare an NDE Inspection Plan, perform weld NDE, and analyze PAUT on the two 18-foot diameter butterfly valves and define indications in welds. All valve disc welds to be inspected are structural welds that join the disc halves, attach the disc plates to the ribs and disc hub casting of the butterfly valve, and the seam welds joining the plate sections, as shown on WISCO valve disc weldment drawing. All valve body welds to be inspected are structural welds that join rolled plate sections as detailed on the upper half

body weldment and lower half body weldment WISCO drawings.

3.7.4.4 Weld Inspection Items

- a. Visual Inspection (VT). Perform 100% visual inspection of all interior and exterior welds of the butterfly valve disc and body. Perform visual inspection in accordance with ASME BPVC Sec V, AWS D1.1/D1.1M visual acceptance criteria, and ASME BPVC Sec VIII visual examination acceptance criteria for fabrication related weld defects.
- b. Magnetic Particle Testing (MT). Perform 100% MT on all interior welds of the butterfly valve disc and body. The work area is damp and all surfaces to be inspected shall be considered wet, therefore liquid suspended MT shall be used, and performed in accordance with ASTM E709.
- c. PAUT. Perform 100% PAUT on all butterfly valve disc welds, in accordance with the approved NDE Inspection Plan and Scan Plan. Perform a fracture mechanics-based weld discontinuity evaluation in accordance with ASME BPVC Sec V Mandatory Appendix VIII - Ultrasonic Examination Requirements for Fracture-Mechanics-Based Acceptance Criteria. The length of each flaw shall be the dimension of the rectangle that is parallel to the weld center line. The height of the flaw shall be the dimension of the rectangle that is the thickness direction of the shell thickness.
- d. Document all findings from VT, MT, and PAUT with photographs with labels that clearly identify valve number, and appropriate naming convention to discern exact location on the valve; and include in the NDE test report.

3.7.4.5 BFV NDE Inspection Plan

Submit an NDE Inspection Plan within the timeline specified in paragraph SUBMITTALS SD-01. The NDE Inspection Plan must include written procedures in accordance with ASME BPVC Sec V Article 1, to describe the inspection procedures and practices in detail for all inspection processes including training and examination methods, visual inspection, magnetic particle testing, and phased array ultrasonic testing.

3.7.4.6 BFV PAUT Scan Plan

- a. Prior to PAUT data collection, prepare and submit a Scan Plan detailing the intended procedure and equipment necessary for performing the PAUT. Scan Plans will be based upon the requirements of ASME BPVC Sec V. PAUT examination shall consist of both manual raster examination (Appendix IV) and E-Scan and S-Scan Linear Scanning (Appendix V). Upon review and comment from the USACE Technical Reviewer, the Contractor shall finalize their effort associated with the Scan Plan. Adapting the Scan Plan parameters as in-situation information becomes available is at the discretion of the inspector in order to produce results that provide measurable locations and sizes of indications with the welds. Items to include with the PAUT Scan Plan include:

- (1) Written procedures for performing PAUT, including parameters to be used.
- (2) Listing of all equipment to be used, including calibration

certificates.

(3) Material Safety Data Sheet (MSDS) showing that the couplant is a benign water based gel or equal for the couplant product if used.

b. Following finalization and approval of the Scan Plan, perform the on-site PAUT for data collection. Any alteration of the approved Scan Plan will be documented and an updated version shall be submitted upon completion of testing. The submittal shall include the written portion of the product, as well as the figures, charts, tables, exhibits, and/or appendices associated with the written portion, as necessary. Analyze the results, prepare and submit a report of the findings, and submit all raw data to the Government. If assistant personnel are proposed, such personnel must maintain a minimum Level I certification in UT.

c. Submit the PAUT Scan Plan within the timeline specified in paragraph SUBMITTALS SD-01.

3.7.4.7 Evaluation Report

a. The Evaluation Report is to detail all the findings of the inspection, PAUT examination will be conducted with the purpose of classifying all reflectors. Reflectors not classified as geometric will be further classified as to type (i.e. porosity, crack, lack of fusion etc.) and X, Y and Z dimensions provided.

b. Data analysis is to be performed by an ASNT NDT Level II or III PAUT technician with PAUT data analysis training/experience.

c. Structure the report in such a way which mirrors the structure guidance set forth by ASME BPVC Sec V. The report is to include details regarding test equipment, test setup, resulting conclusions and lessons learned. The report is to be clear and concise enough to be able to replicate the inspection if necessary. Refer to each weld by name, and detail the location of each weld.

d. Reporting includes data files provided via computer media (excluding USB devices), or via secure website data transfer such as DoDSAFE, or approved equal.

e. Submit Butterfly Valve Disc and Body NDE Test Report - U4 and Butterfly Valve Disc and Body NDE Test Report - U5. Submit within the timeline specified in paragraph SUBMITTALS SD-06.

3.7.5 Repair Butterfly Valve Welds (OPTION)

Perform weld repairs on the butterfly valve body and disc if directed by the Contracting Officer. This work is an optional bid item and cannot be exercised until the Butterfly Valve Disc and Body NDE Test Reports for both units are submitted and approved by the Government. Perform weld repairs in accordance with Section 05 05 23.17 26 WELDING (STEEL), FABRICATION, AND MACHINE WORK. All weld repairs and NDE of repaired welds must be performed within the scheduled unit outage - and extensions for completing the butterfly valve work will not be granted.

3.7.6 Replacement Parts and Planning Documents for Valve Upper and Lower Trunnions and Thrust Bearing Assemblies

Provide the components for the Upper Trunnions, Lower Trunnions and Thrust Bearing Assemblies for Units 4 and 5 penstock butterfly valves as detailed in PART 2 and below. Submit the planning documents as detailed below. All plans and procedures are to detail where (at project or offsite location) and how each activity will be accomplished and with what equipment. Include diagrams and drawings of assemblies and arrangements to explain the activities and steps of the plans and procedures. Detail if features are existing, temporarily new, or permanently new. Explain any modifications to equipment or components, referencing the applicable drawings that detail either the work, or the before and after conditions with instructional notes.

3.7.6.1 Removal and Installation Plans

a. Submit Plans and Instructions for The Removal and Installation of the Bearing Assemblies. The plans and instructions are to address all aspects of the removal and installation of the Unit 4 and 5's BFV upper trunnion and lower trunnion bearing assemblies, including removal of existing and installation of new BFV operator and thrust bearing assembly. Detail any adjustments that will need to be made for the valve operator and thrust bearing assembly after installation. Detail how alignments will be obtained, and how components will be separated and how they will be assembled. Detail how surfaces such as the valve shaft will be protected during the entire process. Detail fits and tolerances for any temporary blocking or similar. Include diagrams and images to explain processes and arrangements. Include all steps involving rework of interfacing surfaces such as the shaft of the valve disks and the valve body. Plan must detail how and where features identified in provided government drawings as being produced in the installed state with the valve body will be produced. Including but not limited to:

(1) The upper and lower bearing shell (bearing carrier) and thrust bearing housing to body assembly reamed dowel holes.

(2) The bearing shell (carrier), bushing and valve body grease gland assemblies.

b. Facilitate a walk-through of the examination plans and the removal and installation plans and instructions with the Government prior to outage of the units. Any changes identified during the walk-through must be incorporated into the plans and instructions and submitted to the government as Revised Plans and Instructions for The Removal and Installation of the Bearing Assemblies. Walk-through must allow for virtual attendance in which both audio and visual connection is utilized.

3.7.6.2 Documentation of Accessible Areas Associated with the Bearing Assemblies

Prior to start of work on either BFV, submit Plan and Procedure for Documentation of Accessible Areas of Bearing Assemblies. Detail in the plan what areas will be examined, when they will be examined, with what instruments, and what documentation will be generated from the examination of accessible upper trunnion, lower trunnion, and thrust bearing assembly areas visible in the field starting when the disc seals are removed, and

during each step of the removal process detailed in the submitted removal and installation plans. Photographs of the areas are to be obtained during each step of the process, including any component examinations. Plan and procedure can reference information detailed in the Plan for Determination of the Dimensions of Bearing Assembly Components to be Provided. Results of performing the plan and procedure to be submitted as Documentation of Accessible Areas Associated with The Bearing Assemblies Report for Unit 4 and Documentation of Accessible Areas Associated with The Bearing Assemblies Report for Unit 5.

3.7.6.3 Plan to Determine Bearing Assembly Dimensions

Submit Plan for Determination of the Dimensions of Bearing Assembly Components to be Provided. Detail the plan and processes for determination of the dimensions of the bearing assembly components to be provided including tolerances. Include a formal Existing Bearing Assembly Component Inspection Plan to determine final dimensions, surface finishes, and features for existing components of both units. Inspection to include not only the bearing assembly components but also areas of the valve body and valve disc shafts that interface with the bearing assemblies. Include draft dimensional recording instruction and forms. Component inner and outer diameters are to be measured a minimum of 3 times, 45 degrees apart at a minimum of 3 equally spaced elevations. If there is any tapering or steps in the item being measured, then additional elevations must be measured to address the change in dimension.

3.7.6.4 Temporary Support Plan

Submit a temporary support plan for any temporary support of the butterfly valves. The plan must include a narrative and any supporting drawings, calculations, and product data, and must be designed and certified by a civil or structural engineer who is a registered Professional Engineer. The plan must detail how the valve will be supported and the general sequence of work. Submit the resume and qualifications of the registered Professional Engineer as required per paragraph DESIGNER QUALIFICATIONS.

- a. Temporary supports must not damage or permanently modify the butterfly valves, penstocks, or any other ancillary components in an adverse manner.
- b. Welding or bolting to the shaft, valve disc, valve body, or penstock is prohibited.
- c. Support of the valve disc or shaft from within the penstocks as the primary load bearing supports is prohibited unless otherwise approved by the Government.
- d. Installation of any concrete anchors and repairs to concrete must be in accordance with the requirements in Section 03 60 00.01 26, CONCRETE DEMOLITION AND MINOR REPAIR OF CONCRETE SURFACES.

3.7.6.5 Bearing Assembly Components

For both Unit 4 and 5, provide the Initial BFV Bearing Assembly Components as detailed in PART 2. Submit Initial Shop Inspection Plan for Each Furnished Bearing Assembly Component detailing the means, methods and locations to confirm components meet the requirements of this specification section and the approved component drawings. Article verification will involve 100%-dimensional and feature inspection and

documentation with recording of the actual dimensions. Include any planned data record sheets to be used. Sheets to include details on the instruments used including documentation of any identifier that correlates to equipment calibration certification to be submitted. ID and ODs measured at a minimum of 3 times 45 degrees apart and three equally spaced elevations. If there is any tapering or steps in the item being measured than additional elevations must be measured to address the change in dimension. Have photos of the components taken, and any issues or modifications performed on the components due to inspection results must be documented. Furnished Bearing Assembly Component Initial Shop Inspection Report must be submitted for each component being provided. Report to include the complete results from the actions outlined in the approved inspection plan. Include documentation of equipment calibration certifications in report.

3.7.7 Removal and Replacement of Valve Upper and Lower Trunnions and Thrust Bearing Assemblies

Perform for both Unit 4 and 5 the replacement of the upper trunnion, lower trunnion, and thrust bearing assemblies. The removal process is to be performed one unit at a time. Once the first unit's bearing assemblies have been removed, commencement of removal of bearing assembly components in accordance with approved submittals for the second unit is not to occur unless approved by the Contracting Officer.

a. Provide materials in accordance with the approved Temporary Support plan including any necessary fixtures and temporary lifting devices. Unless otherwise formally notified the government is to retain any fixtures. Any proposed changes to the submitted and approved Temporary Support Plan is to be resubmitted for review and approved prior to any commencement of work to remove and replace bearing assemblies.

b. Perform removal of assembly components in accordance with approved submittals.

c. Perform Documentation of Accessible Areas Associated with the Bearing Assemblies and Existing Bearing Assembly Component Inspections per approved plans and procedures.

d. Perform approved Plan for Determination of The Dimensions of Bearing Assembly Components to Be Provided. Submit Existing Bearing Assembly Component Inspection Report, Documentation of Accessible Areas Associated with The Bearing Assemblies Report, and Revised Bearing Assembly Dimensional Analysis for each unit.

e. Generate and submit the Final Drawings of Final Parts for Bearing Assemblies detailed above.

f. Submit the Revised Shop Inspection Plan for Each Furnished Bearing Assembly Component. Plan will address the same requirements as required for the Initial Shop Inspection Plan but updated to address the revised dimensions and features resulting from the examination of the existing bearing assembly components for each unit.

g. Notify government of final shop inspection dates for the bearing shells and bushings a minimum of 14 days prior to inspection if to occur within continental United States, 60 days prior if outside continental United States, and Government reserves the ability to witness the inspections in person.

h. Perform bearing assembly component revised shop inspections in accordance with approved submittals. Submit results of inspections as Revised Shop Inspection Report for Each Furnished Bearing Assembly Component. Report's requirements are equivalent to those outlined for the Initial Shop Inspection Report of this specification section, including recorded dimensions and photographs.

i. In accordance with approved submittals, perform replacement of the upper trunnion, lower trunnion, and thrust bearing assemblies on both units, including rework of interfacing surfaces such as the shaft of the valve disc and the valve body, and any necessary reassembly.

3.7.8 Adjust and Align Disc Leaf Seals

Adjust and align new disc leaf seals to provide 95 percent contact along the entire circumference of the bronze metal leaf seal to the valve body seal with the butterfly valve closed, on squeeze, and BFV operator mechanical locking device engaged. All adjustments are performed with the penstock unwatered.

a. The leaf seal joint details that connect each segment are shown on WISCO drawing H-4077. Each disc seal (half) is attached using (58) 3/4" diameter stainless steel bolts. The adjustments to each bronze seal leaf segment are made using disc seal wedge jacking bolts (WISCO P/N 3305) to provide alignment and mating contact with the stainless steel overlay body seat in the valve body as shown on WISCO drawings H-4069 and H-4070. Procedures for seal adjustment are included on WISCO drawing H-4090.

b. Measure contact between the bronze metal leaf seals to the valve body seals by using non-drying blue marking compound (Permatex Prussian Blue) designed to identify points of interference and high spots on precision parts to be fitted. With the butterfly valve open, carefully apply marking compound to the bronze metal sealing surface such that the thickness will be from 0.0005 to 0.001 inches. Close the butterfly valve, on squeeze, and engage BFV operator mechanical locking device. Disengage mechanical locking device and open butterfly valve to inspect and measure contact area of bluing transfer to the valve body seal. Areas that are considered "contacting" are contact patterns that are a consistent length and depth along the sealing surface (i.e. a rectangle).

c. Repeat adjustment and alignment steps until the required contact is achieved.

d. After achieving required contact, repeat bluing contact check for the Contracting Officer or designated alternate.

e. Document final contact achieved with detailed high resolution photographs.

(1) With the butterfly valve open, the entire contact sealing surface must be recorded and photographed, documenting the bluing transfer. Include measuring tape in photograph for scaling purposes.

(2) With butterfly valve closed and on squeeze, and flood lights shining on one side of valve, photograph and video the opposite

side of the valve, along the entire length of the sealing surface to document any light passing through the seal.

f. Submit Valve Seal Contact Bluing Measurement Results - U4 and Valve Seal Contact Bluing Measurement Results - U5 within the timeline specified in paragraph SUBMITTALS S-06. Include the high resolution photographs in the submitted measurement results. Provide digital files of the original quality photographs and video to the Government.

3.8 NEW PENSTOCK BUTTERFLY VALVE GREASE LUBRICATION SYSTEM

Remove the existing and install the new grease lubrication system for both butterfly valves in accordance with the following:

a. Remove the existing grease lubrication system in accordance with paragraph GENERAL REMOVAL OF EXISTING EQUIPMENT. Remove the pump, mounting panel, metering valves, tubing, and hoses, from the hand pump to all the ports on the BFV and its operator. Contractor is responsible for extraction, containment and disposal of all existing grease for both valves and their lubrication systems.

b. All provided grease lubrication system and components must be new and meet the requirements specified in PART 2 PRODUCTS. New system must utilize the existing mounts and fitting ports on the BFV. Any additional porting or mounting must be submitted to government for approval in either the design or installation procedure submittals for the system, including those to connect to the new BFV operator. Contractor must provide all new hardware for the replacement mounting or new mounting provisions.

c. Submit a Grease Lubrication System Plan and Procedure which details, at a minimum, the following:

- (1) Removal of the existing grease lubrication system.
- (2) Existing grease removal.
- (3) Installation of the new grease lubrication system and approximate plumbing routing and locations of mounting points.
- (4) New grease lubrication system cleaning and flushing procedures.

3.8.1 Existing Grease Removal

The Contractor is responsible for the extraction, containment, transportation, and disposal of all the existing grease in the bearings, system routing, metering valves, and hand pump. Details of the Contractor's plan and procedure to remove existing grease are to be included in the submitted Grease Lubrication System Plan and Procedure.

3.8.2 New Grease Lubrication System Cleaning and Flushing Procedure

a. Submit as a section in the submitted Grease Lubrication System Plan and Procedure the detailed procedures for flushing and cleaning of all grease system piping, components, and systems replaced, modified, installed, or reinstalled under this Contract, including the system fluid reservoir. The procedure must demonstrate that the complete system will be flushed and kept clean once flushed. At a minimum, perform a complete system cleaning and flushing which consist of the

use of compressed air and cleaning rags, as well as new, approved, grease for flushing. Perform complete system flushing such that as the new grease is pumped through the entire system with no less than 1-pound of waste flush grease captured at the discharge.

b. Include a detailed description of the equipment, materials, approved product data of grease to be used, as well as the method of capturing and measuring the discharged waste flush grease. When flushing is completed, the system reservoir must be filled to proper service level detailed in the O&M Manual.

c. Take special care when flushing portions of assemblies and subassemblies system components with small flow paths and other precision clearance mechanisms. If necessary, bypass the mechanism(s) or remove before flushing, initially flushed separately to avoid particulate build-up, and then perform specific port cleaning before the reconnection of mechanism(s) after the flushing has been performed. Any removal and reinstallation of any mechanism(s) as part of the flushing must be detailed in the submitted cleaning and flushing procedures.

3.8.3 New Grease Lubrication System Cleaning and Flushing Test Results

Final system cleanliness sampling testing must be in accordance with the requirements detailed above and manufacturer's recommendations. Include all testing results in the New Grease Lubrication System Cleaning and Flushing Test Results submittal which is only for the grease lubrication system after field installation. Include with the results all fluid testing any testing that necessitated re-flushing of the system. Note, if the system is operated with an unapproved cleanliness level, the decontamination of all components affected and any additional corrective action is the sole responsibility and expense of the Contractor.

3.9 REFURBISH PENSTOCK BFV BYPASS SYSTEMS

Remove the existing and install the new BFV bypass system and controls for both butterfly valves in accordance with the following:

a. Remove the existing BFV bypass system in accordance with paragraph GENERAL REMOVAL OF EXISTING EQUIPMENT. Removal and replacement involves all components and systems as detailed below, as shown on contract drawings, and any system level testing.

b. All provided BFV bypass system and components must be new and meet the requirements specified in PART 2 PRODUCTS.

c. Submit a Plan and Procedure for Refurbishing the BFV Bypass System. Include a narrative describing all work associated with the refurbishment of the two BFV bypass systems, including component by component refurbishment or replacement as detailed below. The main sub-systems involved in the BFV bypass system are:

(1) The 14 inch, Class 150 flanged piping assembly and motorized bypass valve.

(2) The 14 inch, Class 150 flanged manually operated isolation valve.

(3) The equalizing line pressure monitoring system.

(4) Piping insulation.

(5) BFV bypass system controls.

3.9.1 Install New Motorized Bypass Valve

Existing flange mounted Limitorque/Flowserve motorized gate valve must be removed and new 14 inch motorized gate valve with manual backup installed. Install new valve assembly vertically with similar layout of the existing, with the manual valve handle located at the same elevation. Provide any necessary gaskets and flanged spacers to connect to the new bypass piping. Valve motor's associated wiring and controls must be removed and new installed per Section 26 00 00.00 26 and the contract drawings.

3.9.2 Install New Isolation Gate Valve

Install new 14 inch isolation gate valve upstream of the motorized gate valve, as shown. Install new valve assembly diagonally with manual hand wheel accessible from new BFV maintenance and inspection platforms. Provide any necessary gaskets and flanged spacers to connect to the new bypass piping.

3.9.3 Replace Bypass Piping

Remove and replace existing bypass valve pipe assembly as shown. New piping sections must be shop assembled and welded as much as practicable, shipped to site, field fitted, with final joint field welded. Clean new pipe assembly both internally and externally, and examine with both visual and NDE methods as specified in Section 05 05 23.18 26 BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION. Provide all new flange gaskets. Provide all new bolted flange hardware. Provide all new piping insulation; any removed insulation shall not be re-installed and must be replaced with new.

3.9.4 Remove and Replace Complete Pressure Monitoring System

Remove and replace the absolute pressure switch and provide complete new pressure monitoring system, as shown on M-601. Route and install new pressure monitoring lines using new mounting points approved on installation and routing drawings. New routing must connect the existing pressure port where the existing absolute pressure switch is currently located and a new port located upstream of the BFV for connecting to the new differential pressure transducer. The pressure monitoring system, including associated wiring, must be removed and new installed per SECTION 26 05 19.00 26 and the contract drawings.

3.9.5 Remove and Replace System Controls

Remove and replace existing bypass system pushbutton controls, including associated wiring, installed per SECTION 26 05 19.00 26 and the contract drawings.

3.10 REFURBISH SPIRAL CASE DRAIN VALVES

Remove the existing and install the new spiral case drain valve for both butterfly valves in accordance with the following:

a. Remove the existing spiral case drain valves in accordance with paragraph GENERAL REMOVAL OF EXISTING EQUIPMENT. Removal and replacement involves all components and systems as detailed below, as shown on contract drawings, and any system level testing.

b. All provided spiral case drain valve components must be new and meet the requirements specified in PART 2 PRODUCTS.

c. Submit a Plan and Procedure for Refurbishing the Spiral Case Drain Valves. Include a narrative describing all work associated with the refurbishment of the two spiral case drain valves, including component by component refurbishment or replacement as detailed below. The main sub-systems involved with this work are:

- (1) The 12 inch, Class 150 flanged manually operated drain valve.
- (2) The drain valve position limit switch.
- (3) Piping insulation.

3.10.1 Remove and Replace Spiral Case Drain Valve

For each unit, remove the existing 12 inch manually operated spiral case drain valve and limit switch, and install new 12 inch manually operated gate valve and limit switch. Install new valve assembly vertically with similar layout of the existing. Provide any necessary gaskets and flanged spacers to connect to the existing 12 inch spiral case drain piping. Replace all insulation that is disturbed as part of this work. See Section 26 00 00.00 26 for limit switch requirements.

3.10.2 Spiral Case Drain Valve Work Sequencing

The spiral case drain valve can only be replaced when the draft tube bulkheads are installed. There is only one set of draft tube bulkheads for powerhouse 2, which means only one draft tube can be unwatered at a time. Plan all work associated with the spiral case drain valve replacement accordingly, and coordinate with the Government for draft tube bulkhead placement. See paragraph UNIT OUTAGES VS TUNNEL OUTAGES & UNWATERING SCENARIOS for additional background.

3.11 REFURBISH TUNNEL DRAIN VALVE

Remove the existing and install the new tunnel drain valve system in accordance with the following:

a. Remove the existing tunnel drain valve system in accordance with paragraph GENERAL REMOVAL OF EXISTING EQUIPMENT. Removal and replacement involves all components and systems as detailed below, as shown on contract drawings, and any system level testing.

b. All provided tunnel drain valve components must be new and meet the requirements specified in PART 2 PRODUCTS.

c. Submit a Plan and Procedure for Refurbishing the Tunnel Drain Valve System. Include a narrative describing all work associated with the refurbishment of the tunnel drain valve system, including component by component refurbishment or replacement as detailed below. The main sub-systems involved with this work are:

- (1) The 12 inch, Class 150 flanged piping assembly.
- (2) Two 12 inch, Class 150 flanged manually operated isolation valves.
- (3) The heating cable and thermostat controls.
- (4) Piping insulation.

3.11.1 Install Two New Tunnel Drain Valves

Remove the existing 12 inch manually operated tunnel drain valve, associated pipe lengths to nearest pipe flanges, and heating cable. Install two new 12 inch manually operated gate valves, new piping, and new heating cable and thermostat as shown on drawings. Install new valve assemblies vertically with similar layout of the existing, except one valve may need to be rotated off vertical for valve handle clearance. Provide any necessary gaskets and flanged spacers to connect to the existing 12 inch tunnel drain piping. Provide new pipe support. Replace all insulation that is disturbed as part of this work. See Section 26 00 00.00 26 for heating cable and thermostat requirements.

3.11.2 Replace Piping

New piping sections must be shop assembled and welded as much as practicable, shipped to site, field fitted, with final joint field welded. Clean new pipe assembly both internally and externally, and examine with both visual and NDE methods as specified in Section 05 05 23.18 26 BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION.

3.12 PAINTING

Paint all refurbished and new systems and components in accordance with Section 09 97 02.00 26 PAINTS AND COATINGS. All exposed exterior surfaces of assemblies and equipment except stainless steel, bronze, synthetic rubber, and plastic, must be shop primed and coated as specified in Section 09 97 02.00 26, unless the equipment is given a standard factory finish as allowed by other paragraphs of this specification. Insofar as is practicable, the complete coating system must be applied to individual components and items before assembly to ensure complete coverage and maximum protection against corrosion. Equipment such as the pumps which have a factory-finished coating do not need to be recoated. Chips, scratches, and other damage to shop-applied painted surfaces must be repaired and repainted in the field.

3.13 VALVE AND PLUMBING IDENTIFICATION

3.13.1 Valve Identification Tags

Provide all new, modified, and refurbished valves with permanently marked corrosion-resisting metal identification tags in accordance with MSS SP-25, and securely attached by means of No. 12 gauge copper wire or stainless steel wire. Make identification tags of brass, stainless steel, or engraved anodized aluminum. Tag sizes are to be 2 inch by 3-1/2 inch. The size and form of type must correspond to 3/8 inch high lettering and a line width of 1/32 inch or approved equal. Engrave identification tags with the first line reserved for the valve code number only with the remaining valve descriptive information engraved below the valve code number after double spacing. Keep abbreviations to a minimum; however, in

order to provide a reasonable amount of margin at all edges of the tag, descriptive materials that appear to take up excessive space may be abbreviated. Orient tags such that they are readily readable in their normal hanging position and have color stripes noting the normal operating position of the valves; see color legend below.

3.13.2 Identification of Normal Position of Valves

Paint valve hand-wheel's or operating levers in accordance with the following listed colors to indicate the normal position of the valves.

| <u>Normal Operating Position of Valve</u> | <u>Color of Hand-wheel or Operating Lever</u> |
|---|---|
| Closed | Red |
| Open | Green |
| Either Open or Closed | Yellow |

3.13.3 Plumbing Identification

Use piping symbols as indicated and stamp with 3/4 inch high lettering. Attach tags to piping, tubing, and hoses by means of No. 12 gauge copper wire. Install markers at intervals no greater than 15 feet, unless otherwise approved by the Contracting Officer.

3.13.4 Part Numbering

Identify all valves in a valve list that is to be included in the system drawings and the O&M Manuals. Stamp the part number on the item in a conspicuous place or firmly affix a tag with the legibly printed or stamped part number.

3.14 FIELD OPERATIONAL TESTS

All units modified, refurbished and/or reworked by this Contract must have all the Operational Tests performed with satisfactory results as approved by the Government. Provide all non-permanent equipment required to perform all operational testing activities. Any cost or schedule impact due to retesting to meet satisfactory results is the sole responsibility of the Contractor. Any rework of already modified components to meet satisfactory test results is also the sole responsibility of the Contractor. The Contracting Officer and a representative of the Hydroelectric Design Center (HDC) must be present to witness all final inspections, field testing, and all acceptance testing specified, unless otherwise approved in writing. Notify the Government prior to inspections and tests as specified in paragraph COORDINATION.

3.14.1 General

Provide procedures that demonstrate that all requirements listed herein have been met. Record and submit results as part of each unit's field test report. Include in each report a detailed description and timeline of all discrepancies and failures encountered during the testing including the implemented resolutions. Use photographs and graphics in the reports to support the written details. Also include in each systems test report, detailed tabulation showing values of pressures, flow rates, and all adjustments recorded during the final tests, and adjustment and calibration of the entire system. All field test reports must be submitted to the Government for review no later than 10 days following the

last day of testing of the respective system, unless otherwise stated in paragraph SUBMITTALS SD-06. During each test run, record the following data and observations and include all of the following information in each systems test report:

- a. Control operation
- b. Voltages
- c. Currents
- d. Pressures
- e. Speeds and times
- f. Valve settings
- g. Alignment and operating clearances
- h. Excessive vibration, by component
- i. Temperature of fluids and components
- j. Pertinent observations regarding such events as unusual sounds, malfunctions or difficulties encountered, and adjustments required.

3.14.2 Visual Inspection

The following visual inspection requirements are applicable to all field tests performed as part of this Contract.

- a. A visual inspection plan shall be submitted as part of each system field testing procedure for approval. Inspections shall include, but not be limited to, a thorough visual inspection of the installed, refurbished, and serviced systems and protected areas, inspecting all piping, operational equipment, sizing and location of components, and locations of alarms. All device labeling and nameplate data shall be verified.
- b. Record and submit results as part of each system's Field Test Report.

3.14.3 Grease Lubrication System Field Testing and Inspections

After installation is completed, perform an operational field test of the new Penstock Butterfly Valve Grease Lubrication System to verify proper operation, in the presence of the Government and in accordance with the approved Grease Lubrication System Field Testing Procedure. Make system adjustments as necessary or as requested by the Government. Submit a Grease Lubrication System Field Test Report for approval and include the procedures, issues encountered, corrective action/adjustments performed, and the results of the tests for each unit. Checks of control manifold adjustments must be performed, verification that control manifolds are not at the end of their adjustments must be made for all control manifolds. Testing of the system must involve all possible modes of operation and deployment. Testing must verify that the components are properly arranged and adjusted to provide the necessary grease lubrication to all current areas of the valves. Testing of each unit's grease lubrication system must occur prior to field testing of the associated butterfly valve.

3.14.4 Butterfly Valve Systems Field Testing and Inspections

After refurbishment is completed, perform an operational field test of each Penstock Butterfly Valve to verify proper operation, including the entire butterfly valve system (including all new, refurbished, and existing systems) in the presence of the Government and in accordance with the approved testing procedure. Testing of the refurbished penstock butterfly valve system must involve all possible modes of operation and deployment. Testing must include but not be limited to dry testing and wet testing. Disc must fully seat using only the planned closure method. If the closure method is the butterfly valve operator powered by the energized HPU, then only the butterfly valve operator powered by the HPU must be used to fully open and fully close the valve of that test sequence. If the closure method is the butterfly valve operator being actuated by the manual hand pump, then only the hand pump must be used to fully close and fully open the valve for that test sequence. Submit a Refurbished Penstock Butterfly Valve Systems Field Testing Procedure for approval per the timeline specified in paragraph SUBMITTALS SD-01. The procedure must address the following:

- a. A visual inspection plan per paragraph VISUAL INSPECTION above.
- b. Outline all activities including test points, step by step procedures, and documentation points (also refer to sub-part 'General' above under paragraph FIELD OPERATIONAL TESTS).
- c. Include what will be recorded, when will it be recorded, from what will it be recorded, and detail any expected outcome.
- d. Monitor and note all systems and component responses; recording of issues and discrepancies encountered, corrective action/adjustments performed, and the results of the re-tests for each unit. Make adjustments as deemed necessary by the Contractor or the Government.
- e. Verify proper functionality of the equalizing line pressure monitoring system.
- f. If a second party testing or inspection contractor is to be used in any portion of the testing, identify this in the procedure, identifying how and when the testing will occur, what it is they will address, and how it will be incorporated into the submitted field testing report.
- g. Testing of either penstock butterfly valve must not commence until the Contracting Officer has approved the submitted Grease Lubrication System Field Test Report.

3.14.4.1 Valve Dry Test

Dry test is testing the valve with the bulkheads in place and the penstock dry. The intent of the dry test is to verify the operational range of the butterfly valves as to quickly identify and resolve any potential installation issues. Include procedures for measuring contact surface area (bluing check) of bronze metal disc seal with valve fully closed, and repeat contact surface area measurements in the presence of the Government during the Field Operational Tests. Include results of contact surface area (bluing check) in the Refurbished Penstock Butterfly Valve Systems Field Testing Report.

3.14.4.1.1 Motorized Gate Valve Dry Operational Test

After installation is completed, perform an operational field test of the bypass valve system in the dry to verify proper operation in all possible modes of operation and deployment. Perform in accordance with the approved Refurbished Penstock Butterfly Valve Systems Field Testing Procedure. If needed, adjustments must be made as deemed necessary by the Contractor or the Government.

3.14.4.1.2 BFV Manual Locking Device Operational Test

While the BFV is in the dry, the refurbished BFV manual locking device functionality shall be confirmed by fully engaging and fully disengaging the locking device on each BFV. Perform in accordance with the approved Refurbished Penstock Butterfly Valve Systems Field Testing Procedure. If needed, adjustments must be made as deemed necessary by the Contractor or the Government.

3.14.4.1.3 Spiral Case Drain Valve Operational Test

After installation is completed, perform an operational field test of the spiral case drain valve in the dry to verify proper operation in all possible modes of operation and deployment, including the function of the limit switch. Perform in accordance with the approved Refurbished Penstock Butterfly Valve Systems Field Testing Procedure. If needed, adjustments must be made as deemed necessary by the Contractor or the Government.

3.14.4.1.4 Tunnel Drain Valve Operational Test

After installation is completed, perform an operational field test of the tunnel drain valves in the dry to verify proper operation in all possible modes of operation and deployment. Verify operation of heating cable and thermostat. Perform in accordance with the approved Refurbished Penstock Butterfly Valve Systems Field Testing Procedure. If needed, adjustments must be made as deemed necessary by the Contractor or the Government.

3.14.4.2 Valve Wet Test

Wet testing is testing under the full head available from the intake pool at the time of testing. The pool levels must be recorded and included in the test report. During wet testing the internal leakage from either valve must not exceed the maximum allowable leakage rate specified in paragraph BUTTERFLY VALVE DESIGN PARAMETERS, and external leakage is not acceptable. If any leakage is present, the leakage where occurring must be approximately uniform around the periphery of the disc or around any other part of the apparatus, and not concentrated at one or more points of the circumference or contact surface. Concentrated leakage at various points at any head as determined by the test as described above, or in any other test within the guarantee period, will be considered a defect within the meaning of this paragraph. Leakage rates may be qualitatively assessed, and must be monitored and recorded when tested in the wet. In the wet, a minimum time of 20 minutes shall pass in the closed position before the next cycle is restarted. During the visual inspection of internal leakage, document any leakage with photographs and video and submit to the Government.

3.14.4.2.1 Air/Vacuum Release Valve Wet Test

The Refurbished Penstock Butterfly Valve Systems Field Testing Procedure must include that during all test events involving the watering up of the cavity between BFV disc and wicket gates, the performance of the existing Air/Vacuum Release valve is to be evaluated and recorded for inclusion in the Penstock Butterfly Valve Field Testing Report. Valve must release air but once seated no longer leak. No leakage allowed at the flange interface. Valve must open when vacuum is generated in the above detailed cavity.

3.14.4.2.2 Motorized Gate Valve Wet Operational Test

Field test must include a test of the new gate valve's ability to seal in the wet. With the BFV closed but watered on the upstream side, and dewatered on the downstream side, the new motorized gate valve is to be fully opened then fully closed. Visual verification of valve sealing is then performed. This is to be performed in both electrical and manual modes of operation and deployment. This must be performed in accordance with the approved Refurbished Penstock Butterfly Valve Systems Field Testing Procedure. If needed, adjustments must be made as deemed necessary by the Contractor or the Government.

3.14.4.3 Valve Field Testing Conditions

Any discrepancies must be corrected by the Contractor at no additional expense to the Government. In each test below, one cycle includes operating the butterfly valve from fully open to fully closed then fully open, unless stated otherwise. The procedures must include but not be limited to:

- a. Each penstock butterfly valve open and closure system, using the BFV operator and HPU, tested through a minimum of two complete cycles in the dry.
- b. Each penstock butterfly valve open and closure system, using the BFV operator and HPU in the emergency backup power configuration, tested through a minimum of two complete cycles in the dry.
- c. Each penstock butterfly valve open and closure system, using the BFV operator and HPU manual hand pump, tested through a minimum of one complete cycle in the dry.
- d. Each penstock butterfly valve open and closure system, using the BFV operator and HPU, tested through a minimum of four complete cycles in the wet. After the final test the spiral case will be unwatered and the mandoor opened to inspect for internal leakage past the closed valve.
- e. Each penstock butterfly valve open and closure system, using the BFV operator and HPU manual hand pump, tested by operating the butterfly valve from fully open to fully closed in the wet. Record the total time to close the valve using the manual hand pump.
- f. Emergency closure of each butterfly valve in the wet utilizing the BFV operator and HPU. Tested by operating the butterfly valve from fully open to fully closed in the wet with water flowing. This test will be performed a minimum of four times for each valve, and plan for a minimum of five hours between each emergency closure test operation

to allow time for government personnel to inspect, measure, and evaluate results of turbine-generator monitoring systems. Perform all aspects of this test at the low pressure setting of the HPU system.

g. Emergency closure of each butterfly valve in the wet utilizing BFV operator and HPU in the emergency backup power configuration. This test will be performed a minimum of two times for each valve, and plan for a minimum of five hours between each emergency closure test operation.

3.14.5 Test Reports

Prepare and complete test reports showing in detail the results of the field testing. Submit Refurbished Penstock Butterfly Valve Systems Field Testing Report for approval and include the procedures, issues and discrepancies encountered, corrective action/adjustments performed, and the results of the tests for each unit. The test report must include a detailed tabulation showing values of pressures, flow rates, and all adjustments recorded during the final tests, and adjustment and calibration of the entire system. Include in the report the data and observations that were to be recorded during each run. If a second party testing or inspection contractor was used in any portion, their report must also be included in the submitted field testing report.

3.15 QUALITY CONTROL

In conjunction with Section 01 45 00.00 10, QUALITY CONTROL, quality control must include but not be limited to, the following:

- a. Ensure that materials and equipment comply with the plans, specifications, and approved shop drawings.
- b. Submit detailed shop drawings, operations and maintenance data, and installation, cleaning and testing procedure for approval.
- c. Maintain testing and acceptance records and deficiency lists.
- d. Verify qualifications of workmen.
- e. Inspect work for proper installation.
- f. Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

Furnish a copy of these records and tests, as well as the records of corrective action taken, to the Government.

3.16 FINAL VERSIONS OF AS-CONSTRUCTED DRAWINGS

Upon completion of all the testing and work on-site, submit the final versions of As-Constructed Drawings for approval, incorporating any field redlines or corrective action taken during testing. All final versions of as-constructed drawings are to be submitted in MicroStation (.dgn) files as well as Adobe Acrobat (.pdf), unless otherwise approved by the Government in writing.

3.17 OPERATION AND MAINTENANCE MANUAL

Furnish complete sets of instructions containing the manufacturer's operation and maintenance instructions for the refurbished aspects of the

penstock butterfly valve system in a single integrated Operation and Maintenance Manual to the Contracting Officer. The integrated Operation and Maintenance Manual must include all the systems and components detailed in this Section, and Section 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT, Section 26 05 19.00 26 INSULATED WIRE AND CABLE, and Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES. Provide a draft version of the manual to the government prior to the field testing and training in order to revise the manual with the lessons learned from those events. The Final Operation and Maintenance Manual must not be submitted until a Draft Operation and Maintenance Manual (with lessons learned and Government review comments incorporated) has been approved. Provide Operation and Maintenance Manuals complying with the following requirements:

a. Inscribe the following identification on the covers:

- (1) "OPERATING AND MAINTENANCE INSTRUCTIONS FOR THE REFURBISHED PENSTOCK BUTTERFLY VALVE SYSTEMS"
- (2) "FORT PECK DAM - POWERHOUSE 2 - UNITS 4 & 5"
- (3) "MISSOURI RIVER, MONTANA"
- (4) Contractor name
- (5) Contract number
- (6) Contract award year

b. Place a flysheet before instructions covering each subject. Use 8 1/2 by 11 inch paper for the instruction sheets and 11 by 17 inch paper for drawings with the drawing sheets folded in. Drawing sheets to be printed on one side only. The operation and maintenance instructions must address the following, but are not limited to:

- (1) Penstock BFV disc seals;
- (2) Penstock BFV trunnion bearings and seals;
- (3) Instructions for adjusting the valve seals;
- (4) Penstock BFV grease lubrication system;
- (5) Penstock BFV HPU and controls;
- (6) Penstock BFV operator and integral manual locking device;
- (7) Penstock BFV HPU emergency operation, and manual operation;
- (8) Penstock BFV bypass system;
- (9) Penstock BFV spiral case drain system;
- (10) Penstock BFV tunnel drain system;
- (11) Hydraulic oil and grease lubricant;

b. The instructions must include, but not be limited to, the following:

(1) Cross-section drawings of all new and modified components and parts list including but not limited to:

(i) HPU assembly and individual custom fabricated and machined components such as manifold(s) fabrication drawings with dimensions and locations of pre-drilled passages and cavities, fabrication drawings for HPU reservoir and base plates, etc.;

(ii) BFV operator assembly including hydraulic cylinder arrangement and component detail drawings, quarter-turn valve actuator component detail drawings, and integral mechanical locking device component detail drawings;

(iii) All shop drawings of the new butterfly valve disc seal segments, with installation and adjustment details;

(2) Component and system layout drawings showing piping, valves, controls, and interconnects of all new equipment in conjunction with major existing items;

(3) All system hydraulic and lube schematics (hydraulic power unit, grease lubrication system, bypass system, spiral case drain system, tunnel drain system);

(4) All As-constructed drawings for this job;

(5) Electrical wiring and control diagrams;

(6) Operating and maintenance instructions;

(i) Any special instructions for component care and inspection;

(7) Manufacturer's bulletins, catalog cuts, and descriptive data;

(8) Design calculations;

(9) All shop test reports;

(10) All field test reports;

(11) All sampling test reports;

(12) All material test reports and certifications;

(13) A written control sequence describing startup, operation, and shutdown. Uniquely identify the control sequence and list the individual components of each system. Each component must have a narrative description as to the function, purpose, and limits of adjustment (if any) and method of adjustment for that component.

c. Provide the Operation and Maintenance (O&M) Manual with all information which may be needed or useful for operation, maintenance, repair, dismantling or assembling, troubleshooting, and for identification of parts for ordering replacements. Submit in accordance with this Section and Section 01 78 23 OPERATION AND MAINTENANCE DATA.

d. Provide hard copies and electronic copies of Operation and Maintenance Manuals specified in the following paragraphs. Electronic

copies must be word searchable, bookmark by chapter, .pdf file compatible with Adobe Acrobat, and include the same cover sheet in the digital copy that the hard copies have. Electronic copies provided via email if file size permits or sent via Government approved large file transfer site.

3.17.1 Draft Operation and Maintenance Manual

Furnish three complete hard copies and one electronic copy of the Draft Operation and Maintenance Manual per the timeline specified in paragraph SUBMITTALS SD-10.

3.17.2 Revised Draft Operation and Maintenance Manual

Furnish three complete hard copies and one electronic copy of the Revised Draft Operation and Maintenance Manual per the timeline specified in paragraph SUBMITTALS SD-10. The Revised Draft Operation and Maintenance Manual must incorporate all of the lessons learned and comment resolutions from the field testing, formal review of the draft O&M Manual, and the training session, as well as final drawings and other documentation. Incorporate all material, component, and system test reports.

3.17.3 Final Operation and Maintenance Manual

Following the approval of the Revised Draft Operation and Maintenance Manual submittal, submit the Final Operation and Maintenance Manual per the timeline specified in paragraph SUBMITTALS SD-11. Submit the Final Operation and Maintenance Manual in both hard copy and electronic media format:

a. Provide five complete sets of the hard copy format before the Contract is completed. Permanently bound each set, have a hard cover, and be in accordance the instructions listed above.

b. Provide the final O&M Manuals in digital .pdf format and split up by volume (where applicable) as specified above.

3.18 TRAINING FOR OPERATION AND MAINTENANCE

The training requirements for operation and maintenance detailed in this Section are for the refurbished penstock butterfly valves and associated systems and components, which includes all the systems and components detailed in this Section, and Section 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT, Section 26 05 19.00 26 INSULATED WIRE AND CABLE, and Section 35 05 40.14 26 HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES. The training must be an integrated training for operation and maintenance of the refurbished penstock butterfly valves and associated systems and components, including all electrical aspects of the systems replaced or modified.

3.18.1 General Operation and Maintenance

Provide two field-training courses for designated operating staff members. One training session is to occur after complete installation of all systems but prior to Field Testing. The second training session is to occur no later than ten calendar days after completion of Field Testing unless otherwise approved by the Contracting Officer. Provide training over a period of eight hours of normal working hours for the Project. Field training must cover all of the items contained in the Penstock

Butterfly Valve Operation and Maintenance Manuals. Instructor(s) must demonstrate how to use, inspect, and perform maintenance on all new and modified aspects of the refurbished penstock butterfly valves. Contractor-generated Training Manuals, being a condensed version of the Draft O&M Manual for the entire system, must be used in the training course, however the material must also reference to the O&M Manuals. Incorporate any lessons learned from the training session into the Revised Draft Operation and Maintenance Manual. Notify the Contracting Officer at least two weeks in advance of the planned training sessions. The Contractor is responsible for coordinating the training sessions with the Project to ensure minimum conflicts with ongoing Project work.

3.18.2 Trouble Shooting Training

As part of the field-training course, provide field training of personnel on the use, operation, and troubleshooting of components and equipment of refurbished penstock butterfly valves. The training includes evaluation of all equipment failure modes.

3.18.3 Training Manuals

Provide hard copy training manuals for four employees per class and submitted per the timeline specified in paragraph SUBMITTALS SD-10. The Government will provide the training location. Training manuals must include four hard copies and an electronic file (searchable, bookmark by chapter, .pdf file compatible with Adobe Acrobat) provided via email if file size permits or sent via Government approved large file transfer site. Include both lecture and hands-on type of work for the training. Where audio/visual materials are used in training classes, three copies (two in hard copy, one in electronic format on DVD or CD, and one in electronic file sent via Government approved large file transfer site) of such materials must be furnished to the Contracting Officer for use in future Project office training. In addition, provide four hard copy and an electronic file (searchable, bookmark by chapter, .pdf file compatible with Adobe Acrobat) of the draft O&M Manuals as reference material for use with the training manuals.

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SECTION 26 00 00.00 26

MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

This section specifies the miscellaneous electrical equipment and work required to connect and complete the installation of a hydraulic pumping system consisting of two pumps, pressure switches, level switches, meters, control valves, and associated control system designed to safely open and close the penstock butterfly valves for Fort Peck Powerhouse Plant 2. Provide two complete systems; one for unit 4 and other for unit 5. This work also includes:

1. Supply and installation of two (one for unit 4, other for unit 5) new motor actuators for the penstock fill bypass valves and associated remote operators, remote open/close indicators and control systems.
2. Supply and installation of limit switches and wiring for new manually operated spiral case drain valves (one for unit 4 and other for unit 5). Supply and installation of new limit switches and wiring for the butterfly valve and its mechanical locking device.
3. Supply and installation of new wall mounted 480VAC panels which contain disconnect switch, motor starter and control power transformer as follows:
 - a. Four 480VAC panel (BVQ) for the hydraulic power unit (HPU) pump motors for each unit:
 - For Unit 4,
 - i. BVQ1 - 480VAC panel for HPU pump 1
 - ii. BVQ2 - 480VAC panel for HPU pump 2
 - For Unit 5,
 - i. BVQ3 - 480VAC panel for HPU pump 1
 - ii. BVQ4 - 480VAC panel for HPU pump 2
 - b. Two oil filtration system 480VAC panels (FSQ), one for each unit's HPU.
 - c. Two 480VAC panel (VP), one for each bypass valve motor actuator.
4. Supply and installation of new heat tape and thermostat for the tunnel drain valve.

Work includes removal of existing equipment, conduit, and wiring, furnish and installation of conduit, power and control wiring, interconnecting wiring for power, control, and alarm circuits, control panels, and miscellaneous electrical accessories. Furnish and install all conduits, cables, and cable trays required to interface between Contractor furnished equipment and Government equipment. It is anticipated that conduits, cable trays and other miscellaneous electrical work will involve minor new work to support equipment in different locations from existing equipment locations.

This Contract installation must be in accordance with NFPA 70 and IEEE C2 unless where otherwise specifically indicated on the Contract drawings or called for in the specifications. Omission of details on the drawings or in the specifications must not be construed as permitting deviations from Code requirements.

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.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1 (2005) American National Standard for
Electrical Rigid Steel Conduit (ERSC)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2017; Errata 1 2017) National Electrical
Safety Code

IEEE 323 (2003) Qualifying Class 1E Equipment for
Nuclear Power Equipment

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

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 ICS 1 (2000; R 2015) Standard for Industrial
Control and Systems: General Requirements

NEMA ICS 2 (2000; R 2005; Errata 2008) Standard for
Controllers, Contactors, and Overload
Relays Rated 600 V

NEMA ICS 5 (2017) Industrial Control and Systems:
Control Circuit and Pilot Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4)
National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 360 (2013; Reprint Jan 2015) Liquid-Tight Flexible Steel Conduit

UL 489 (2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 50 (2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 514A (2013) Metallic Outlet Boxes

UL 514B (2012) Conduit, Tubing and Cable Fittings

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

Work Plan; G, HDC

Submit within 100 calendar days after receiving Notice to Proceed and at least 60 days prior to any construction or manufacturing.

SD-02 Shop Drawings

Assembly and Detail Drawings; G, HDC

Submit within 100 calendar days after receiving Notice to Proceed and at least 60 days prior to any construction or manufacturing.

Wiring and Schematic Diagrams; G, HDC

Submit within 100 calendar days after receiving Notice to Proceed and at least 60 days prior to any construction or manufacturing.

Escutcheon and Nameplate Drawings; G, HDC

Submit within 100 calendar days after receiving Notice to Proceed and at least 60 days prior to any construction or manufacturing.

Conduit and Cable Raceway Schedules; G, HDC

Submit within 100 calendar days after receiving Notice to Proceed and at least 60 days prior to any construction or manufacturing.

New Conduit Routing Installation; G, HDC

Submit within 100 calendar days after receiving Notice to Proceed and at least 60 days prior to any construction or manufacturing.

SD-03 Product Data

Within 100 calendar days after receiving Notice to Proceed, submit manufacturer's data, drawings, catalog cuts, warranty information, and wiring diagrams. As a minimum, submittals must be required for but not limited to, the following:

Conduit, Cable tray, Fittings, and Hangers; G

Outlet and Junction Boxes; G

Terminal Blocks;

Boxes, Cabinets, and Enclosures; G, HDC

Switches;

Indicating lights;

Level Switch; G, HDC

Pressure Switch; G, HDC

Differential Pressure Switch; G, HDC

Power Supplies; G, HDC

Auxiliary and Interposing Relays; G, HDC

Enclosure Heater; G

Escutcheons and Nameplates; G

Combination Reduced Voltage Starter with Disconnect; G, HDC

Fuses and Fuse Holders;

Circuit Breakers;

Limit Switches; G

Motors; G, HDC

Spare Parts;

Equipment Crate Size, Storage Location and Proposed Routing at Site;
G

SD-06 Test Reports

Field Test Reports; G HDC.

Submit within 10 calendar days after completion of tests.

Factory Test Reports; G, HDC

Submit within 10 calendar days after completion of witnessed tests.

SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions Manual; G

See requirements in Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING.

SD-11 Closeout Submittals

As-Built Drawings; G, HDC

Submit As-Built drawings for all systems associated with, modified, removed, and installed for this Contract within 30 calendar days following completion of installation and commissioning. Contracting Officer (CO) may provide updated drawings, showing other recent project installation work, for the purpose of completing As-Built drawings for this Contract.

1.4 GENERAL REQUIREMENTS

1.4.1 Materials, Equipment and Installation

Furnish new and unused materials and equipment and replace or repair any defective material or equipment damaged in the course of installation. The removal of electrical equipment will include the disconnection of existing conduits, associated wiring, and cables. In some cases, remove and replace existing wiring and cables disconnected with new materials. Reuse existing embedded conduits where practicable. Testing must be performed to check the installation of and the proper operational functions of the accessory electrical equipment. The installations must be in accordance with the National Electrical Code, NFPA 70, and the National Electrical Safety Code, IEEE C2, except where otherwise specifically shown or specified in which case the drawings and specifications must govern. Omission of details on the drawings or in the specifications must not be construed as permitting deviations from Code requirements.

1.4.2 Standard Products

Material and equipment must be the standard products of manufacturers regularly engaged in the manufacture of these products and must essentially duplicate items that have been in satisfactory use for at least two years prior to bid opening.

1.4.3 Environmental Requirements

Communication, control, and protective equipment must be rated for

continuous operation in ambient environmental conditions of 0 degrees C to 50 degrees C (32 degrees F to 120 degrees F), and 0 percent to 90 percent relative humidity, non-condensing. Power equipment must be rated as required in these specifications.

1.4.4 Storage and Handling

Ship electrical equipment completely assembled and wired as feasible so as to require a minimum of installation work. All electrical material and equipment delivered to site, must until immediately prior to installation, be protected from damaging environmental and construction activities. Take special care for panel boards, transformers, motors and control equipment. Control equipment must include, but not be limited to, relaying equipment, meters, wire and cables, and various types of switches. Keep the above equipment and devices dry and free from precipitation and condensation during storage, installation, and after installation. Store all electrical equipment in completely enclosed containers and in a humidity-controlled environment. Method of on-site storage and storage containers will be subject to approval by the Contracting Officer (CO). The Contractor is responsible for energizing the heaters mounted in the equipment or to provide other means as required to avoid damage to the equipment due to humidity, weather, etc.

1.4.5 Corrosion Prevention

Protect equipment to prevent deterioration from corrosion. The general requirements are specified below; however, other corrosion-resisting treatments that are the equivalent of those specified may be used.

a. Fastenings and Fittings. Screws, bolts, nuts, pins, studs, springs, washers and other miscellaneous fastening and fittings must be of corrosion-resistant material or must be treated in an approved manner to render them resistant to corrosion. Fastenings exposed directly to the weather must be of corrosion-resisting material.

b. Corrosion-Resisting Materials. Corrosion-resisting steel, copper, brass, bronze, copper-nickel-copper alloys are acceptable corrosion-resisting materials.

c. Corrosion-Resisting Treatments. Treatments must be in accordance with ASTM A123/A123M or ASTM A153/A153M.

d. Finish. Perform final painting in accordance with paragraph Painting.

1.4.6 Warranty

Supply warranty stating that all items are free from defects in material, design and workmanship for two years from the date of acceptance. Upon receipt of notice from the Government of failure of any of the items within the warranty period, furnish and promptly install new replacement parts.

1.5 CONTRACT DRAWINGS

1.5.1 General

The Contract drawings indicate the work to be accomplished in as much detail as is practical. Except for such modifications as may be required

for coordination with equipment actually furnished (either supplied by the Government or by the Contractor), they constitute the working drawings for construction and for purchase of required materials. When shop drawings for equipment to be furnished by the Government and installed by the Contractor have been "Approved", the appropriate Contract drawings for installation of embedded or exposed Contractor furnished material will be revised as required. Where design changes, required for coordination affect Contract drawings showing location or terminating details for conduit, grounding, wiring, piping, etc., prints of such Contract drawings, indicating necessary changes as approved, or equivalent field sketches, will be furnished by the CO.

1.5.2 Assembly and detail drawings

Assembly and detail drawings must include proposed equipment layout, mounting, cable and conduit routing and wiring. Submit no less than 60 days prior to start of construction. Drawings must conform to specifications Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.5.3 Wiring and Schematic Diagrams

Submit wiring and schematic diagrams of all new and modified equipment in this Contract no less than 60 days prior to start of construction. Diagrams must conform to specifications Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.5.4 Escutcheon and Nameplate Drawings

Submit escutcheon and nameplate drawings for all new and modified equipment no less than 60 days prior to start of construction. Drawings must include size, material, fastening method and conform to specifications Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.5.5 Conduit and Cable Raceway Schedules

Conduit and cable schedules must include the name, size, material, and length at a minimum. Submit no less than 60 days prior to start of construction. Conform drawings to specifications Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.5.6 New Conduit Routing Installation

New Conduit Routing Installation drawings must include proposed layout and dimensions. Submit no less than 60 days prior to start of construction. Drawings must conform to specifications Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.5.7 Departure From Drawings

If departures from the Contract drawings other than those required for equipment actually furnished, are deemed necessary by the Contractor, details of such departures and reasons therefore must be submitted to the CO for approval as soon as practicable, but not later than 30 days before scheduled installation date. No such departures must be made without prior approval. The control schemes shown on the Contract drawings for Contractor-furnished equipment are not intended to exclude available standard package units for the functions indicated. However, when alternate equipment proposed by the Contractor is approved, the Contractor must be responsible for any additional devices, conduit and wiring

required as a consequence and such additional devices, etc., must be furnished and installed at no additional cost to the Government.

PART 2 PRODUCTS

2.1 CONDUIT

All conduit must be galvanized rigid steel, except where specifically shown or specified otherwise. Manufacturer's descriptive literature must be submitted for approval for conduit, cable tray, fittings, and hangers.

2.1.1 Rigid Steel

Rigid steel conduit must conform to ANSI C80.1 and must be zinc-coated both inside and outside by hot-dip galvanizing method.

2.1.2 Flexible Steel

Flexible conduit must be liquid tight metal and must conform to UL 360, must have a hot-dip galvanized steel core, copper ground wire and a waterproof extruded cover. Use must be limited to equipment connections not exceeding 36 inches.

2.1.3 Fittings

Fittings for rigid conduit must be threaded and conform to UL 514B. Fittings for flexible conduit must provide positive bonding, and must conform to UL 514B.

2.1.4 Expansion Fittings

Expansion fittings must be weatherproof, with an internal bonding assembly and must provide at least 4 inches of conduit movement.

2.2 OUTLET AND JUNCTION BOXES

2.2.1 Sheet Metal

Sheet metal boxes and covers must conform to UL 50 and UL 514A.

2.2.2 Cast

Cast boxes and covers must conform to NEMA FB 1. All cast boxes must be supplied with integral cast hubs or with factory-brazed hubs. All hubs must be factory threaded.

2.3 INSULATED WIRE AND CABLE

Wire and cable used for power, lighting, control, metering, and relaying systems must be provided by the Contractor and must conform to the requirements specified in Section 26 05 19.00 26 INSULATED WIRE AND CABLE.

2.4 GROUNDING

Ground connectors must be exothermic or compression type. Solder type connectors will not be permitted. Exothermic connections and taps must be made by molded powdered metal weld similar and equal to "Cadweld" electrical connection. Compression type connections must be made with connectors and full cycle hydraulic tools similar and equal to those used

in Burndy "Hyground" system. Approved corrosion inhibiting joint compound must be applied to all compression type connections. Ground conductors must be bare unless routed along with the phase conductors in a motor feeder circuit. The ground conductors must be soft, or medium hard drawn Class A or Class B stranded copper cables.

2.5 TERMINAL BLOCKS

2.5.1 General

Terminal blocks must all be of the same manufacturer, DIN rail mounted, with quick circuit disconnecting ability unless specified.

2.5.2 Control Signal and Low Power Type

Terminal blocks for the control circuits and 120VAC/125VDC low power circuits below 20A must be of the modular DIN rail type, NEMA rated, minimum 20A at 600VAC, with push-turn knob disconnect. Terminals must be tubular screw type and must be able to accept at least one #8 AWG wire. Not less than 20 percent spare terminals must be provided on each block or group of blocks. The minimum number of spare terminals must be four.

Terminal blocks must be grouped by functions as practicable, especially in the HPU control panel assembly, and marked as such with terminal strip marker carriers installed at the top of the grouped terminal strip. Utilize same terminal block manufacturer for control signal and low power terminal blocks and accessories.

2.5.3 Ground Terminal Blocks

Terminal blocks for the ground circuits must be capable of grounding the circuit to the DIN rail and be of the same manufacturer as the Control Signal and Low Power Terminal Blocks. Terminals must be tubular screw type and must be able to accept at least one #8 AWG wire.

2.5.4 Power Terminal Blocks

Power terminal blocks for 120VAC and 125VDC applications above 20A and all 480VAC circuits must be molded or fabricated type with barriers, rated not less than 600 volts with a 30 amp capacity. The terminals must be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals must be not less than No. 10 in size and must have sufficient length and space for connecting at least two indented ring tongue terminals for No. 10 AWG conductors to each terminal. The terminal arrangement must be subject to the approval of the CO and not less than 20 percent spare terminals must be provided on each block or group of blocks. The Contractor must 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. Terminal blocks must be provided to terminate all external cables. Terminal Blocks must meet the requirements for class 1E per IEEE 323.

2.5.5 Designations

Each device to which a connection is made must be assigned a device designation in conformance with NEMA ICS 1 and each device terminal to which a connection is made must be marked with a distinct terminal marking corresponding to the wire designation used on the schematic and connection

diagrams. Special attention must be given to wiring and terminal arrangement on the terminal blocks to permit each external individual conductor entering to be terminated on adjacent terminal points. 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. The wiring diagram or connection diagram must be in a form showing the physical arrangement of the devices showing interconnecting wiring by lines or indicating interconnecting wiring only by terminal designation and an address system. Tube type markers must be sized to snugly fit the wire being marked. Markers must contain legible identifications and must be durable and resistant to change due to age or contact with insulating materials. Wire identification must be as shown on the Contractor's drawings.

2.5.6 Marking

White or other light-colored plastic marking strips, fastened by screws to each terminal block, must be provided for wire designations. Marking strips for rail terminal blocks may be fastened by another means than screws. The manufacturer's wire number and the Government's wire number must both be shown for each connected terminal on the marking strips with permanent marking fluid. The marking strips must be reversible to permit marking both sides, or two marking strips must be furnished with each block, to accommodate the two sets of wire numbers.

2.6 BOXES, CABINETS, AND ENCLOSURES

2.6.1 General

All cabinets, boxes and enclosures must conform to NEMA ICS 6 of NEMA 250 unless otherwise specified. Cabinets, boxes, and enclosures with volume greater than 100 cubic inches must be in accordance with UL 50. The NEMA 250 type of enclosure and the material are specified on the drawings. Should the type and material not be indicated then all outdoor enclosures and indoor enclosures in a wet environment must be NEMA 250 Type 4X, stainless steel, all other indoor enclosures must be NEMA 250 Type 12, galvanized steel. All enclosures installed outside and exposed to the weather must be installed with drip shields.

Brackets for mounting of internal equipment must be supplied. Shop drawings submitted for special cast and sheet metal boxes and enclosures must indicate the internal volume and the Contract drawing sheet on which the individual assemblies are shown. Cabinet and enclosure type must conform to NEMA 250. Sheet steel used in cabinets, special boxes or enclosures, must be not lighter than No. 12 U.S. Standard gage, and cover fastening screws must be placed along the perimeter of a box access cover. Manufacturer's descriptive literature must be submitted for approval for all equipment.

2.6.2 Steel Cabinets and Boxes

Steel cabinets, junction, splice and pull boxes, and other steel boxes and enclosures and their doors and trim must conform to Underwriter's Laboratories, Inc., Standard UL 50 for Cabinets and Boxes except as noted below. Boxes with hinged doors must be mounted in such manner as to comply with IEEE or NEC standard (as applicable) for minimal required rotation of door. Sheet steel used in cabinets, special boxes or enclosures, must be not lighter than No. 12 U.S. Standard gage, and cover fastening screws

must be placed not more than eight inches apart along the perimeter of a box. Special steel boxes, cabinets, doors, and covers must be made of galvanized sheet steel or must be hot-dip galvanized after fabrication. Junction and pull boxes must be furnished with covers of the same gage metal as the box. Threaded hubs must be provided where required by the type of enclosure. T & B "Bullet Hub" fittings or equal are acceptable. Concentric ring knockouts will not be allowed for conduit entrances. Galvanizing damaged during fabrication or field installation or drilling must be repaired. Where standard NEMA type enclosures are not indicated on the drawings, control cabinets and other surface mounted enclosures must be NEMA Type 12 as modified herein. Holes will be permitted in NEMA Type 12 enclosures for mounting provisions and for cover mounted devices. Doors, handles, trim, panels and gutters must be furnished as specified or shown.

2.6.3 Design of Conduit Pull Boxes

a. The following simplified rules are for use with conductors covered with accepted jacket materials per Section 26 05 19.00 26 INSULATED WIRE AND CABLE and the NEC-2011. When odd sized dimensions are obtained the next larger standard size should be used. References to conduit diameter should be used as trade size.

b. Straight Pulls: The length of the box should not be less than 12 inches or six times the diameter of the largest conduit, whichever is greatest. The width should not be less than the sum of the locknut diameters plus 1/2 inch between adjacent conduits and between locknuts and box edges. The depth should not be less than 4 inches for conduits up to 2 inches in size and two times diameter for all others.

c. Angle Pulls: The length of the box should not be less than 12 inches or eight times the diameter of the largest conduit, whichever is greatest. The distance should be increased for additional conduits by the sum of the diameters of the conduits entering the same side of the box. Where conductors turn 90 degrees and parallel to the cover the box length and width should be equal and the depth should be determined the same as for straight pulls. Where the conductors turn 90 degrees in a plane perpendicular to the cover the width should be determined the same as for straight pulls and the depths should be equal to the length.

2.6.4 Doors, Covers, Cabinet Trim and Hardware

Each door must be equipped with flush or semi-concealed hinges and, if the height exceeds 36 inches, with a vault type handle and a three point catch. NEMA Type 12 enclosures must have hinged covers and must be modified to have door handles equipped with three point catches in lieu of retained fasteners. Except for panel board cabinets, double doors or doors in pairs must be provided wherever the width of a door opening exceeds 24 inches or the height of the opening exceeds 36 inches. Locks must be provided for cabinets in which 125 Volt DC, 120/208 Volt AC or 277/480 Volt AC equipment is exposed when the door is open. The locks must be master keyed using interchangeable 6-pin tumbler mechanisms in removable cores as manufactured by the Best Universal Lock Co., Inc. Two control keys for the removal of the interchangeable cores of the master key system and two master keys for the locks of each cabinet must be furnished. Identifying nameplates must be provided on the front of the doors with designations as shown in the Contract drawings.

2.6.5 Painting

Interior and exterior steel surfaces of equipment enclosures must be thoroughly cleaned and then, if not galvanized or stainless steel, must receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Interior surfaces must receive not less than one coat of paint in accordance with the manufacturer's standard practice. Exterior surfaces must be primed, filled where necessary, and given not less than two coats of quick air-drying lacquer or synthetic enamel with semi gloss finish. The paint color of the panel must match that of the new hydraulic power unit.

2.7 CONTROL, INSTRUMENT AND SELECTOR SWITCHES

2.7.1 General

All control switches must have handles on the front and the operating contact mechanisms on the rear of the panels. Contacts of all control switches must be self-aligning and must operate with a wiping action. A positive means of maintaining high pressure on closed contacts must be provided. Compression springs or pivoted joints must not be depended upon to carry current. Except as noted, all control switches must be suitable for operation on 600-volt AC or 125-volt DC circuits, must be capable of satisfactorily withstanding a life test of at least ten thousand operations with rated current flowing in the switch contacts, and must be capable of continuously carrying 10 amperes without exceeding a temperature rise of 30°C. The single-break inductive load interrupting ratings must be not less than 1.1 amperes for 125-volts DC or 6-amperes for 120-volts AC.

2.7.2 Control and Selector Switches

Control station switches must be of the panel mounted, heavy duty, 30mm oiltight construction with double break silver contacts. Contacts must have the rating designation of A600 in accordance with Table 2-125-1 of NEMA ICS 2. The type of switch furnished must be determined by the contact arrangement or as indicated. Each control switch escutcheon plate must be clearly marked to show each operating position. Switch identification numbers must be engraved on the escutcheon plates or on separate nameplates. The escutcheon and nameplate markings must be as shown.

2.7.3 Pushbuttons

Pushbuttons must be of the oil-tight type, 30mm, to NEMA ICS 2 standards. Where applicable, in enclosures rated NEMA 4X, they must be to NEMA 4 requirements. Each pushbutton must have an individual nameplate, furnished by the manufacturer, with the pushbutton function clearly indicated. All functions must be as indicated on the drawings. Contacts, rated for NEMA A600, rated at 120 volts ac, for 10 amps continuous current and with a "make" current of 60 amps and a "break" current of 6 amps must be furnished to perform the function intended and as shown on the Drawings. Contact blocks must be of the oil-tight type. All push button operators that are exposed to the weather must be installed with weather resistant boots.

2.8 INDICATING LIGHTS

Indicating lights must be 30mm, corrosion resistant NEMA 250 Type 4, full

voltage type rated 24 volts DC or 125 volts DC as applicable. Lights must be LED type, push to test, and be complete with color caps as indicated. Insofar as practicable, all color caps must be similar and interchangeable, and all lamps must be of the same type and rating. Manufacturer's descriptive literature must be submitted for approval for all indicating lights. The following colors must be used for the indicated states:

- a. Red - on, running, open, active, etc.
- b. Green - off, stopped, closed, inactive, etc.
- c. Blue - changing state,
- d. Amber - warning indication.

2.9 LEVEL SWITCH

Install level switches in accordance with the manufacturer's instructions. Switches must be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, provide a mounting bracket for connection to the inside tank wall.

Float switch assemblies for use in liquid systems must consist of wall bracket or mounting plate, galvanized steel rods, stainless steel bolts, explosion proof and corrosion resistant housing, and intrinsically safe relays. Each switch must consist of at least two contacts (or adequate contacts for the functions as shown on the drawings), encapsulated in epoxy resin. The float casing must be polypropylene. The switch cable must be oil resistant thermoplastic cable with 4 No. 18 gauge stranded copper conductors, rated for 600 Volt application.

2.10 PRESSURE INSTRUMENT

2.10.1 Pressure Switch

Sensors must be diaphragm or Bourdon tube and must be constructed of 316 stainless steel. Pressure switch must have a repetitive accuracy of plus or minus 5.0 percent of the operating range and must withstand up to 150 percent of rated pressure. Switch actuation set point must be adjustable over the operating pressure range with a differential adjustment span of 20 to 40 percent of the range of the switch. The switch must have Form C snap-action contacts rated in accordance with NEMA ICS 1.

2.10.2 Differential Pressure Switch

Each switch must be an adjustable diaphragm, or bellows operated device, with taps for sensing lines for connection of pressure fittings designed to sense fluid pressure. The adjustable differential range must be a maximum of 0.15 inches water at the low end to a minimum of 0.35 inches water at the high end. Two Form C contacts rated in accordance with NEMA ICS 1 must be provided.

2.11 POWER SUPPLIES

Power supplies for use in the control system must be din rail mounted, redundant, adjustable output (23.5-28.5VDC min), 90 percent efficiency rating, and less than 50mVpp ripple voltage. Each power supply must be

capable of providing control power to the entire butterfly valve circuit for one unit with 20 percent spare capacity minimum. Power supplies must be appropriately sized for the application.

The following DC breaker assignment have been determined:

Use breaker from circuit # 17 & 19 (currently spare) in MCC4 DC panel for Unit 4 butterfly valve controls.

Use breaker from circuit # 17 & 19 (currently spare) in MCC5 DC panel for Unit 5 butterfly valve controls.

2.12 AUXILIARY AND INTERPOSING RELAYS

Auxiliary and interposing relays must be self-resetting and must be provided with a minimum of four independent contacts easily convertible from normally open to normally closed. Relay coils must operate on 125 volt D.C. or 120 volt AC and contacts must be rated for continuous operation in 125 volt D.C. or 120 volt AC circuits as required. All relays coils must be furnished with surge suppression devices to limit surge voltages, which may be generated when the coil circuits are de-energized. Contact ratings must comply with NEMA ICS 5, Part 1 and Part 2. The single-contact inductive load interrupting capacity must be not less than N150 for 125 VDC or A150 for 120 VAC as defined in NEMA ICS 5, Section 4 CHARACTERISTICS AND RATINGS, and shown in Tables 1-4-1 and 1-4-2.

2.13 ENCLOSURE HEATER

The enclosure heater must be sized appropriately to keep the equipment in its specified environment operating range with a built-in thermostat. The heater must be rated for 115V, 60Hz, panel mounted, thermostat range of 0F to 100F, and Aluminum housing.

2.14 ESCUTCHEONS AND NAMEPLATES

Identifying nameplates must be provided and are in addition to manufacturer's nameplates and must be made of 1/16-inch thick laminated sheet plastic or of 1/32-inch thick anodized aluminum engraved to provide white letters on a black background. All nameplates must be fastened to enclosures in proper positions with black finished round-head screws. In general, each control switch must be provided with an identifying nameplate in addition to an escutcheon plate to show operating position as shown in the Contract drawings. Nameplate designations must be submitted for approval. Nameplates for cabinets must be as shown in the Contract drawings, or must use text that will be furnished by the Government when the Contractor's data is submitted for approval. Designations may be changed when shop drawings are submitted for approval.

2.15 TERMINATIONS

Preinsulated confined-crimped ring-tongue terminals or indented ring-tongue terminals must be used on all wires terminated on screw or stud terminals. Terminals must be properly sized for the wire and color coded for different size wire, for easy inspection. All screw terminals must have toothed lock washers and all stud terminals must have contact nuts and either locking nuts or lock washers.

2.16 COMBINATION REDUCED VOLTAGE STARTER WITH DISCONNECT

Combination motor controller units must contain motor circuit protectors

disconnect switch, and a magnetic contactor with thermal overload relays and reduced voltage starter where indicated on the drawings. Disconnect switches for all 480VAC motor starters are to be accessible from outside of the panel that houses the starters and disconnects and be within the line of the motors.

2.16.1 Magnetic Contactors

Magnetic contactors rating, performance and service characteristics must conform to the requirements of NEMA ICS 2 for contactors with continuous current ratings for the duty indicated. Contactors for motor control must be rated for full-voltage starting (Class A controllers). Contactors must be suitable for at least 200,000 complete operations under rated load without more than routine maintenance. The interruption arc and flame must 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, must be easily removable without removing or dismantling other parts. The contacts must be easily removable. All current-carrying contact surfaces must be silver-surfaced or of other approved material to prevent the formation of high resistance oxides. The contactor must operate without chatter or perceptible hum while energized. Coils must be suitable for continuous operation 480-volt ac circuits. Alternating-current contactors must be three-pole, except where otherwise noted, and must be insulated for 600 volts ac and of the electrically-operated, magnetically-held type.

2.16.2 Voltage Fault Protection

Where shown, starters must be provided with protection against phase imbalance, phase loss, phase reversal, undervoltage and overvoltage. Upon sensing one of these faults, the protector must de-energize the starter. The protector must use a combination of voltage and phase-angle sensing to detect phase loss even when regenerated voltages are present. The protector must be connected to the load side of the motor circuit disconnect. The protector must have an adjustable line voltage trip level, adjustable trip delay, automatic reset and manual reset by an external normally closed push-button, and Double Pull Double Throw (DPDT) output contacts. Protector operation must have repeatability of +1 percent of set point, maximum, and a dead band of 2 percent maximum.

2.17 FUSES AND FUSE HOLDERS

2.17.1 Fuses

Control power fuses must be FRN for ratings above 10 amperes and FNQ for 10 amperes and below.

2.17.2 Fuse Holders

Fuseholders must be of the same manufacturer as the terminal blocks and be disconnect type with indicator. Fuses must be rated for 150 VAC with a maximum size of 10 Amps.

2.18 CONTROL VOLTAGE CIRCUIT BREAKERS

Circuit breakers must conform to the applicable requirements of UL 489 and NEMA AB 3 and NEMA ICS 2, must be fully rated, and must have voltage ratings and interrupting ratings stated. For circuit breakers of the same ampere frame size, 3 pole and 2 pole circuit breakers must be the same

width as 3 single pole and 2 single pole circuit breakers respectively. The circuit breakers must be manually-operated and must have trip-free operating mechanisms of the quick-make, quick-break type. All poles of each breaker must be operated simultaneously by means of a common handle, and must be enclosed in a common molded plastic case. The contacts of multi-pole breakers must open simultaneously when the breaker is tripped manually or automatically. The operating handles must clearly indicate whether the breakers are in "On", "Off", or "Tripped" position. The circuit breakers must be din rail-mounted, must all be products of the same manufacturer, and must be interchangeable when of the same frame size. Each circuit breaker must be provided with mechanical pressure type terminal lugs for single-conductor stranded copper cables of the size required by the specifications or shown.

2.19 LIMIT SWITCHES

Limit switches are to be NEMA rated, accept a #12-22 wire size, 10A continuous current, 600VAC, side rotary operated, spring return, stainless steel metal operator lever, and include silver contacts. Contact arrangement is as shown on the drawings. Provide and install new limit switches and wiring for the butterfly valve similar to existing limit switches installed in the position indicator. Provide and install new limit switches and wiring for the butterfly valve mechanical locking device. Provide limit switches with adequate contacts for the functions as shown on the drawings.

2.20 MOTORS

Motors to be supplied as part of this contract must be 480 Volt AC, 3-phase, 60 Hz, TEFC. Motors supplied for the HPU must be compatible with the HPU pump unit as described in Section 35 05 40.14 26, HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES. Size motors to meet the operating requirements for the new HPU's and the bypass fill valves. Motors must conform to the applicable portions of NEMA MG 1, suitable for continuous operation.

2.20.1 480VAC POWER SUPPLY TO MOTORS

Provide new disconnecting means by way of disconnect switches located at a distance and in line of sight to meet NFPA 430 requirement for each valve motor operator and HPU pump motors under this contract. Provide disconnect switches rated at 30A, 600V for each bypass valve motors. Provide disconnect switches rated at 100A, 600V for each HPU hydraulic pump motor.

The HPU offline oil filtration pump and oil filtration system heater must be rated for and suitable for connection to an industrial 480VAC, 3 phase, 60Hz, 50A power supply.

2.21 TUNNEL DRAIN HEATING CABLE AND THERMOSTAT

Provide and install new heating cable (heat trace cable) for the new manually operated tunnel drain and isolation valves and piping. This is to prevent freezing of water pipe and associated valves. Provide heating cable suitable for exposure temperature range from -40 deg F to 200 deg F and 120VAC power supply. The power supply to the heating cable will be fed from panel PP8A. The heating cable must be capable of being wrapped around the 12" tunnel drain pipe to provide the required freeze protection. Provide freeze protection for the length of pipe as shown on M-430.

Provide new automatic ON/OFF thermostat controller suitable for exposure temperature range from -40 deg F to 200 deg F. Thermostat operating range must be 30 deg F to 110 deg F. Install the new thermostat on Contractor supplied installation bracket as shown on M-430. Contractor to ensure the temperature sensing device for the thermostat is installed per industry best practice to provide the optimum freeze protection for the pipe and valves. Provide and install new NEMA 4X terminal box for terminating the heating cable. Provide new power cable from the existing PP8A panel to the new terminal box. Remove the existing disconnect switch panel and wiring. Reuse existing conduits as practicable or provide new conduits.

2.22 MAINTENANCE

2.22.1 Spare Parts

All spare parts must be duplicates of the original parts furnished and interchangeable therewith. The spare parts must be packaged for long term protection and storage. The packaging must be legibly labeled to identify the spare parts. A list of the furnished spare parts must be included in the Operation and Maintenance Manual per specification Section 01 78 23 OPERATION AND MAINTENANCE DATA. The following spare parts for the equipment specified in this Contract Section must be provided.

- a. Two spare fuses of each type and rating used.
- b. Four spare indicating light assemblies, including lenses, of each type and color used.
- c. Ten spare lamps of each type used in indicating lights.
- d. Two spare replacement relays of each type used.
- e. One spare switch (control, instrument, selector) of each type used.
- f. One spare circuit breaker of each type used.
- g. One gallon of paint in quart containers to exactly match the finish of the new enclosure panels.
- h. Two spare power supplies of each type used.

2.22.2 Maintenance Support

During the warranty period, provide telephone on-call support for the maintenance of control system hardware and software.

PART 3 EXECUTION

3.1 DEMOLITION, INSTALLATION, AND RECONFIGURATION

Provide and submit for approval, a work plan for this job that describes in detail the sequence of tasks for all work required by this Contract. The plan must account for all work items that affect operation of the Fort Peck Powerhouse. Provide and submit for approval, drawings for all equipment showing proposed equipment layout, mounting, cable and conduit routing and wiring.

With the sequence of work, provide all pertinent details, list all power outage schedules and coordinate with the Fort Peck Project personnel for

these outages. Coordinate with the COR in scheduling preparation meetings for each stage as required. No work must begin on any stage of the plan until approval has been received.

3.2 CONTROLS AND INDICATION

3.2.1 Bypass Valve Control and Indication

3.2.1.1 Local Control and Indication at HPU Control Panel

Provide the ability to locally operate the bypass valves at the control panel (control console) located at the HPU. The local valve controls at the HPU must allow the operator to open, close, stop, and set the valve to local/remote mode. The bypass valves must have proper indication locally showing the state of the valve and if it is in local or remote mode at a minimum.

3.2.1.2 Remote Control and Indication

Provide remote indicating lights at the station service instrument control board on the turbine floor; and remote indicating lights and control at the control room for the bypass valves for each unit. The remote indication must include whether the bypass valve is open or closed. The remote control feature in the control room must have capability to open and close the bypass valve at a minimum.

3.2.2 Butterfly Valve Control

Provide two HPU's, one for unit 4, the other for unit 5, and each with its dedicated control panel. Refer to Section 35 05 40.14 26, HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES for details on the HPU design.

3.2.2.1 Local Control and Indication at HPU

Provide the built-in ability to locally operate the butterfly valves for each unit at the HPU. The local valve controls at the HPU must allow the operator to open, close, stop, lock/unlock, and set the valve to local/remote mode. The controls must be placed on the HPU so the operator can perform these actions while simultaneously viewing the HPU. The butterfly valves must have proper indication locally at the HPU control panel showing whether the valve is open, closed, in transition/travel, and the locking pin status.

The wiring to the HPU control panel must reuse embedded conduit as reasonably feasible. Where new conduit is to be supplied, the Contractor must provide Shop Drawings and specifications per Section 01 33 00, SUBMITTAL PROCEDURES.

3.2.2.2 Remote Control and Indication

Provide remote control and indication at the control room, and remote indication at the unit switchboard for the butterfly valves. The remote indication must include whether the valves are open, closed or moving. The remote control switches must be replaced with new. The wiring to the switch and indicating lights must be replaced on this Contract.

3.2.2.3 Butterfly Valve Pump Motor Control

- a. The butterfly valve HPU pump system must be designed for one pump

operation. Lead/lag pump operation criteria will not be required for HPU operation.

b. Provide the ability to switch the designation of primary and secondary operation between the two pumps at the control panel. The system must also provide means of automatic and manual operation at the control panel. Indication of pump operation must also be included at the HPU control panel. The Contractor must submit for approval wiring and schematic diagrams for the new motor controls in accordance with Section 01 33 00, SUBMITTAL PROCEDURES for approval.

3.2.3 Alarms

Provide visual indication on the HPU control panel for excessive pressure drops across filters, and provide local indications and alarms if hydraulic pressure drops or a pump failure, initiates a secondary pump operation or other abnormal indication.

3.3 ELECTRIC SOLENOID OPERATED VALVES

Solenoid valves for each butterfly valve must be installed to provide hydraulic fluid to open and close the butterfly valve. These solenoids must operate at the voltage shown on the drawings for each solenoid valve.

3.4 ESCUTCHEONS AND NAMEPLATES

All nameplates must be fastened to enclosures in proper positions with black finished round-head screws. The escutcheon and nameplate drawings, for cabinets, showing all pertinent data and designations must be submitted in accordance with Section 01 33 00, SUBMITTALS for approval.

3.5 CONDUIT SYSTEMS

3.5.1 Installation

All leads from devices and accessories must be run in rigid galvanized conduit and connected to terminal blocks in each cabinet or junction box. All conduit runs installed must be terminated at devices or connection boxes and at the terminal cabinet in standard pipe-threaded couplings. Similar pipe-threaded connections must be provided on the terminal cabinet for attaching incoming conduit. Other conduit connections must be made with cast metal boxes and outlet fittings having threaded outlets and gasketed covers. No running threads on conduit will be permitted. Clamp-backs must be used for mounting to concrete. Conduit, fittings and accessories must be installed in accordance with details shown and as specified herein:

a. All conduit bends must have a radius of not less than six times the conduit's inside diameter.

b. No threadless fittings or running thread couplings must be used on conduit runs.

c. Metal conduits must be cut only with a tool approved for the purpose. Roller type pipe cutters must not be used on conduits. All cuts must be square and the conduit opening must not be constricted. After cutting and threading, conduit ends must be reamed to remove rough edges and burrs and the entire conduit must be thoroughly cleaned to remove all cuttings, dirt and oil from its interior.

Threads must be clean cut. Threaded joints in metal conduit and terminations in cast boxes must have the threads coated with a joint compound, and must be screwed tight to make the joint watertight and to provide electrical continuity of a given conduit system. Suitable watertight conduit hubs and bushings must be provided where conduit terminates within a box, terminal cabinet or accessory that has no threaded hub or fitting to receive threaded conduit.

d. All new conduit must be installed in such a manner as to insure against trouble from the collection of trapped condensation and all runs must be arranged to avoid traps wherever possible. Existing embedded conduits abandoned in place must have the conduit stub capped to prevent dirt and water entry. Each abandoned conduit must be labeled at both ends indicating it being abandoned and the location of the other end.

e. Pull boxes must be furnished and installed, complete with covers, in conduit runs as required by the NEC and good practice in the trade, and per this Section regardless of whether the boxes are specified on the drawings.

f. Conduit must be installed with a minimum of bending and cutting. Conduits not dimensioned as to location must be installed approximately where shown with limited adjustment to avoid interference with other work. Conduit must be rigidly attached with approved supports and anchors to the surface over which it is run. The maximum spacing of supports for the exposed conduit must be 10 feet, and within 3 feet of any enclosure or box. Supports for exposed conduit on concrete surfaces must be fastened securely to the concrete with approved anchors.

g. The entire metallic conduit system installed by the Contractor must be electrically continuous and thoroughly grounded. No welding or brazing of the grounding conductor to the conduit will be allowed. All grounding connections to the conduit must be made by means of grounding bushings or by an approved pressure type connector.

h. Conduits terminating in cast boxes must be made up in approved threaded hubs unless otherwise indicated. Cast boxes and enclosures with threaded hubs must be provided with proper size hubs to fit conduit being installed. Threaded reducers will not be permitted.

i. Use liquid-tight flexible metal conduit where practicable. Liquid-tight flexible metal conduit must be made from steel strip that is zinc-coated by the hot-dip galvanizing method with an integral or separate bonding wire or and water-proof extruded PVC cover and conforming to UL 360.

3.5.2 Special Boxes, Cabinets, and Enclosures

All boxes, cabinets, and enclosures must be straight and true with horizontal or vertical structural lines. The final installation must not be out of plumb more than 1/4 inch over the full length nor be deformed more than 1/16 inch per linear foot nor more than a total of 1/4 inch in any surface. Exposed cabinets on concrete surfaces must be fastened with anchors near each corner. All boxes and cabinets must be cleaned of concrete and grout after the forms are removed and boxes with gasketed covers must be closed immediately. The gaskets must be treated with graphite or other approved paste at the time the cover is fastened to the

box.

3.6 WIRE AND CABLE

3.6.1 General

For the purposes of this Contract, the term "internal wiring" must be used to designate the Contractor's factory installed wiring in equipment furnished for installation, and the term "external wiring" must be used to designate the Contractor's field installed wiring. Conduit and cable schedules are shown in the Contract drawings, and indicate information on conduit and cable numbers, sizes and estimated lengths, number and insulation ratings of conductors, the function and operating voltage of circuits, and the terminations of conduits and cables. Although estimated cable lengths are indicated on the cable schedule, the Contractor must be responsible for determining the actual cable length required to make an installation of all new cables. Splicing of cable runs must not be allowed. Reference Section 26 05 19.00 26 INSULATED WIRE AND CABLE and this Section.

3.6.2 External Wiring

All external wire and cable must conform to Section 26 05 19.00 26 INSULATED WIRE AND CABLE, of these specifications. All wire and cable must be installed in accordance with National Electrical Code requirements. All necessary materials, tools and equipment required for proper handling and installation of wire and cable in conduits and elsewhere must be furnished. Except for spares, each wire and cable must be connected to the associated equipment at both ends, and must be continuous and without splices between the equipment termination points. Wire and cable must be pulled in a manner which will preclude damage to the conductor, insulation or jacket. Any cable damaged during installation must be removed and replaced. Installation of wire and cable must include installation of all supporting devices and all terminations required to complete the circuits as required. Wire and cable must not be pulled into conduit runs until the conduit has been checked and determined to be clean and dry by pulling a clean, dry, tight fitting rag through each run (this includes existing conduits as well as new conduits). Only approved lubricants may be used to facilitate pulling of conductors. Cables must be placed straight and parallel in the trays.

3.6.3 Internal Wiring

All enclosures and devices must be completely wired to designated terminal blocks for connection to external devices. The Contractor's standard cables and methods of cable terminations may be used for wiring and terminations performed at the factory. Any wiring extending beyond the equipment cubicles must be terminated at 600-volt terminal blocks. Special attention must be given to terminal wiring arrangements on the terminal blocks to permit individual conductors of each external cable to be terminated on adjacent terminal points.

3.6.4 Terminations

All cable and wire connections must be made at terminal blocks or terminal studs with ring-tongue indented terminals. The shield and shield insulating jacket of shielded signal cables and conductors, if applicable, must be maintained to a point as close to the terminals as possible. The shield insulating jacket must not be stripped from the shield except where

necessary to make the ground connection. All signal cable shields must be grounded at one end only. Each connected terminal of each block must have the circuit designation or wire number placed on the marking strip with permanent marking fluid. Terminal block wire designations must be made with white or other light-colored plastic marking strips, fastened by screws. For each connected terminal, the manufacturer's wire number and Government's wire number must both be shown on the marking strips with permanent marking fluid. Two marking strips must be furnished with each block, to accommodate the two sets of wire numbers. Except for motor leads, the conductors must be either terminated on screw or stud terminals or a separate adjacent terminal block must be provided as indicated on the drawings. Either locking nuts or lock washers must be used on all stud terminals. Where not otherwise indicated, phasing must be A-B-C from left to right, from top to bottom and from front to back when facing the front of the equipment. Where control and signal cables cannot be immediately terminated at both ends, the end of each cable not terminated must be capped or taped so that conductors are insulated from each other, the equipment, and ground until connections to the associated equipment can be made.

3.6.5 Identification

All multiple-conductor cables must be clearly identified with the cable designation by either embossed one-inch diameter brass tags or by embossed aluminum band markers. Tags or band markers must be securely fastened to the cables at each termination, junction or pull box, and as required at other points of access. Wires and individual conductors of control and power cables must be identified with non-metallic tube-type markers at each termination. Tube-type markers must be suitable for contact with rubber or neoprene or plastic. Tubing must be sized to fit the wire being marked and must have black marking on a light colored background. Where individual conductors are run in cable trays, markers must be securely fastened to the conductors every fifty feet, and must be sized to fit the wire being marked and must have black marking on a light colored background. Installed markers must be uniform in position on the wire and legends must be visible when wires are terminated on terminal blocks or equipment. Identification on each tag and marker must include both the source and destination location as shown in the Contract drawings or as directed.

3.7 GROUNDING

3.7.1 General

Ground connections to the existing grounding system must be made complete to all equipment installed under this Contract whether or not specifically shown or detailed on the drawings. Where required to make conduits and other metallic runs electrically continuous, approved copper jumpers or bonding must be provided.

3.7.2 Ground Conductors

All new branch circuits and feeders must have a ground conductor, sized in accordance with NFPA 70 Article 250 whether or not specifically shown or detailed on the drawings. Ground conductors must be installed as continuous pieces of copper cable. Exposed ground cable runs must be supported to follow conduit, equipment or concrete wall contours. Support clamps or clips must be of corrosion resistant metal and existing equipment bolts or screws must be used where possible for fastening.

Drilling of equipment housings or frames will be permitted only when approved. Concrete anchors must be used for wall fastening.

3.7.3 Ground Connections

All exposed connections and taps must be made with approved bolted or compression connectors unless otherwise shown on the drawings. Soldered, brazed, or welded type connections will not be permitted. If any ground connections are to be embedded, the connection must be of the molded powdered metal weld.

3.8 PAINTING

3.8.1 New Equipment

Interior and exterior steel surfaces of the housings, special boxes, cabinets, enclosures and new control panel sections must be thoroughly cleaned and then, if not galvanized or constructed of stainless steel, receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces must be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces must receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces must be primed, filled where necessary, and given not less than two coats of quick air-drying lacquer or synthetic enamel with semigloss finish. Lead-based paints must not be used. Spare paint must be furnished to repair any damage in the exterior finish after the equipment has been installed.

3.8.2 Existing Equipment

Any paint damaged during modifications to existing equipment must be repaired, by degreasing, sanding, feather-edging, priming, and finishing with an approved paint of matching color. Tiny nicks and other similar damage may, if approved, be repaired with matching finish color alone.

3.9 FACTORY TEST

3.9.1 General

The control panels must be factory assembled and shop tested. Shop testing must occur at the HPU factory, with wiring connections to be same as final installation onsite. Permissive interlock and circuit feedback signals from external devices may be duplicated for test purposes only by approved means. The shop testing must be in the presence of the Government Quality Assurance Representative in accordance with the shop test plan. The Contractor must notify the Government Quality Assurance Representative (GQAR) fourteen days prior to conducting tests. The Contractor must furnish all materials, labor, and equipment necessary to conduct tests. The Contractor must perform all tests and inspections recommended by the manufacturer unless specifically waived by the Government Quality Assurance Representative. The Contractor must maintain a written record of all tests that includes date, test performed, personnel involved, devices tested, serial number, name of test equipment and test results. All test reports will be signed and dated by the Contractor. All testing must be performed at the panel fabricator's shop.

3.9.2 Factory Test Plan

Provide a shop test plan 30 days prior to conducting tests. Coordinate the

panels testing schedule with the Construction Schedule. As a minimum, the test plan must include procedures and test sheets for the following:

- a. The entire assembled panels must be meggered and tested to be free from grounds and shorts.
- b. Simulate input signals to verify operation of control and monitoring circuits.
- c. Circuits and interlocks must be tested to assure that they function correctly before the panel is shipped. Each device and control loop must be tested and demonstrated to function properly.
- d. Correct, replace, or repair panel wiring, and/or components until testing demonstrates proper operation. Do not ship panels to the site until testing has demonstrated satisfactory operation of the panels.
- e. Attention of the Contractor is directed to the fact that more than one shop test and/or review of the panel wiring/drawings may be required. If the first shop test is not satisfactory, or results in the need to make revisions to the panel and/or 'as-shipped' drawings that cannot be effected during the course of the shop test, then a repeat shop test and/or review of the drawings against the construction will be required. The presence of the Owner's Representative at up to two shop tests/reviews will be without cost to the Contractor. If more than two shop tests/reviews are required, then the Contractor must be required to reimburse the Owner for the Owner's Representative costs for the third and each subsequent shop test/review.

3.9.3 Factory Test Reports

The Contractor's written records of testing must be submitted in the form of a formal shop test reports. Test report must be submitted 10 days after completion of shop testing.

3.9.4 As-Shipped Drawings

Provide updated and complete as-shipped drawings at the time of final testing. The Owner's Representative must review the drawings against the panel construction at the time of final testing. Drawings which do not reflect the actual construction of the panel will need to be revised and reviewed again by the Owner's Representative against the actual construction prior to shipment of the panel to the job site. 'As shipped' drawings which require revisions must be submitted to the Owner's Representative for review prior to the actual field review of these drawings against the panel construction. This process of revision and review of the drawings will be repeated as necessary to produce drawings which reflect the actual construction of the panel at the time of shipment. Do not ship panels to the site until the 'as-shipped' drawings are updated, complete, and reflect the actual 'as-shipped' status of the panels as approved by the Owner's Representative.

3.9.5 As-Constructed Drawings

Revise all drawings after project commissioning to show "as-constructed" status of the panels at time of project acceptance.

3.10 FIELD TESTING AND COMMISSIONING

3.10.1 General

After completion of the installation of the equipment and accessories, perform field testing and commissioning to ensure proper installation and verify proper operation. Submit a field testing and commissioning plan for approval, listing the routine and operational tests to be conducted. Coordinate the field testing and commissioning plan requirements of this Section with the requirements of Section 35 05 40.14 26, HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES paragraph FIELD TESTS AND INSPECTIONS, and Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING paragraph FIELD OPERATIONAL TESTS. The tests must be witnessed by a Contracting Officer's Representative.

3.10.2 Conductor and Cable Test

Perform continuity and insulation resistance tests for wiring installed post factory installation. Reference Section 26 05 19.00 26 INSULATED WIRE AND CABLE.

3.10.3 Operating Test

After the field testing is performed, conduct operating tests for approval. Demonstrate the ability to operate in accordance with the specified requirements.

3.10.4 Field Test Reports

Submit field test reports for approval. Include in the test reports, the test equipment manufacturer, serial number, range and test equipment calibration certificate. Record the exact test voltage, current, etc. and results. Test data must include the name of the test engineer and the date the tests were performed.

3.11 ACCEPTANCE

Final acceptance of the equipment will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

3.12 DRAWINGS AND PRODUCT DATA

The Contract and reference drawings are intended as guidelines and for information only, respectively. Any omissions from the Contract drawings must be corrected and added to the Contract drawings by the Contractor, and the Government must be notified as such. If departures from the Contract drawings are deemed necessary by the Contractor, details of such departures, including changes in related portions of the project and the reasons therefore, must be submitted as part of each System/Routing Design. As-built drawings must be submitted.

3.13 DISPOSAL OF REMOVED EQUIPMENT

All removed equipment which is not reutilized or specifically addressed in the Contract drawings or specifications as being delivered to the Government, must become the property of the Contractor.

3.14 DELIVERY, STORAGE, AND HANDLING

Equipment must be packaged for shipment to and for the convenience of handling and storage at The Fort Peck Project. The equipment must be shipped as completely assembled and wired as feasible so as to require a minimum of installation work. Any instrument, relay, meter, or other device which cannot withstand the hazards of shipment when mounted in place must be carefully packed and shipped separately. These devices must be marked with identification where they are to be mounted and must be clearly identified so that they can be readily remounted and reconnected. Each shipping package must be provided with removable lifting channels with eye bolts for attachment of crane slings to facilitate lifting and handling. Finished painted surfaces and metal work must be wrapped suitably or otherwise adequately protected from damage during shipment. Parts must be prepared for shipment so that slings for handling may be attached readily while the parts are in the railway car or truck. Equipment crated for shipment must be of such size, including crates, that will pass through an existing hatch opening. The Contractor must investigate and verify openings and routing through which equipment and packaging must pass at the storage and installation sites. Equipment shipping container sizes and proposed routing must be submitted to the COR for approval. The shipment must be transported and handled as packaged by the manufacturer. Crating and other packing must not be removed until the equipment is adjacent to and ready to be mounted in its permanent location. Equipment Crate Size, Storage Location and Proposed Routing at Site must be submitted for approval.

3.15 WARRANTY

Equipment, material and installation of items provided in this Section must be guaranteed for a minimum period of two years from the date of acceptance. A written warranty must be provided. The warranty must include defective materials, design and workmanship. Upon receipt of notice from the Government of failure of the systems covered in this Section, repairs must be made or new replacements parts must be furnished and installed at no additional cost to the Government.

3.16 ONSITE TRAINING

Training must cover the complete operation of the butterfly and bypass valve electrical controls, all new equipment installed, and guidance on operations and maintenance of the system. The field-training course and training materials details for all the systems and components detailed and associated with this Section must be included in and meet the requirements of the Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING as an integrated training for operation and maintenance of the refurbished penstock butterfly valves, and associated systems and components.

3.16.1 Operation and Maintenance Instructions Manual

Submit operation and maintenance instruction manual following requirements in Section 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING.

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SECTION 26 05 19.00 26

INSULATED WIRE AND CABLE

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

All wire and cable used for power and control systems must be provided by the Contractor and must conform to the requirements specified herein for Fort Peck Penstock Butterfly Valves Rehab contract.

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.

ASTM INTERNATIONAL (ASTM)

| | |
|----------|---|
| ASTM B3 | (2013) Standard Specification for Soft or Annealed Copper Wire |
| ASTM B33 | (2010; R 2014) Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes |
| ASTM B8 | (2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft |

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

| | |
|-----------|--|
| IEEE 1202 | (2006) Flame-Propagation Testing of Wire and Cable |
|-----------|--|

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

| | |
|--------------------------|---|
| NEMA WC 57/ICEA S-73-532 | (2004) Control, Thermocouple Extension, and Instrumentation Cables |
| NEMA WC 70/ICEA S-95-658 | (2009) Non-Shielded Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy |

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

| | |
|----------|--|
| NETA ATS | (2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems |
|----------|--|

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---------|--|
| NFPA 70 | (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA |
|---------|--|

20-1; TIA 20-2; TIA 20-3; TIA 20-4)
National Electrical Code

UNDERWRITERS LABORATORIES (UL)

| | |
|---------|--|
| UL 44 | (2014; Reprint Feb 2015) Thermoset-Insulated Wires and Cables |
| UL 1685 | (2000) Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber 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. The following must be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit within 100 calendar days after Notice To Proceed:

Insulated Wire and Cable; G HDC
Signal and Communications Cable; G HDC
Cable Supports; G HDC
Control Panel Shop Wiring; G HDC
Switchboard Wire; G HDC
Ground Conductors
Wire Marking
Terminations

SD-06 Test Reports

Submit three certified copies within 10 days after completion of tests:

Factory Inspection and Tests; G HDC
Insulation Resistance Test; G HDC
Shield Resistance Test; G HDC

1.4 DELIVERY, STORAGE, AND HANDLING

Furnish wire and cable one length to a reel or coil. Each length, 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. Cables for exclusively DC applications must be identified as such. Reels must remain the property of the Contractor. Cables on reels must be stored in an area reserved for that purpose and

protected from damage. Reels must be stored with the axis hole parallel to the horizontal plane. Cables on reels stored laying flat on the side of the reel will not be accepted. Reels must be rolled only in the direction indicated by the manufacturer. cables must be unreeled or uncoiled slowly to prevent damage to the sheath by sudden bending. Unreeling or uncoiling must be stopped if kinks appear and must not proceed until kinks have been removed. Kinked wire and cable will be rejected. Improperly handled wire and cable may be rejected.

1.5 INSPECTION AND TESTS

1.5.1 General

Inspection and tests of wire and cable furnished under these specifications must be made by and at the plant of the manufacturer. Testing in general must comply with Section 6 of NEMA WC 57/ICEA S-73-532 or Section 6 of NEMA WC 70/ICEA S-95-658 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. In addition to the manufacturer's routine sample testing, each reel provided must have passed an insulation resistance test and a shield continuity test. No wire or cable may be shipped until after the manufacturer's test reports have been submitted and approved.

1.5.2 Flame Tests

All multiple-conductor and single-conductor cable assemblies must pass IEEE 1202 flame tests (formerly under IEEE 383) or UL 1685 flame tests. Single-conductor cables and individual conductors of multiple-conductor cables must pass the flame test of Section 6.16 of NEMA WC 57/ICEA S-73-532 or Section 7.3 of NEMA WC 70/ICEA S-95-658 as applicable. 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.

1.5.3 Independent Tests

The Government may at any time make visual inspections, continuity or resistance checks, insulation resistance readings, partial discharge tests, dissipation 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.

PART 2 PRODUCTS

2.1 INSULATED WIRE AND CABLE

2.1.1 General

All wire and cable must be provided by the Contractor and must conform to the requirements specified herein. Characteristics, including conductor size, stranding, number of conductors, rated circuit voltage, cabling, and other requirements for each type of service, must be as indicated on the drawings, or as specified under the detailed requirements of these specifications for the particular construction or use, unless otherwise

stated.

2.1.2 Wire and Cable Schedule

Wire and cable must be furnished in accordance with the requirements of the Conduit and Cable Schedules, and as indicated on the drawings. Estimated quantities listed in the Conduit and Cable Schedules are approximate for bidding purposes and must be verified by the Contractor.

2.1.3 Governing Standards

Materials, construction and tests, unless otherwise specified, must conform to the applicable requirements of NEMA WC 57/ICEA S-73-532 and NEMA WC 70/ICEA S-95-658 as applicable.

2.2 MATERIALS

2.2.1 Submittal Requirements

The Contractor must submit catalog data to the Contracting Officer for review and/or approval as indicated in the submittal register. Data must demonstrate compliance with the specifications requirements for all wire and cable types to be provided.

2.2.2 Rated Circuit Voltages

All wire and cable must have minimum 600 volt rated circuit voltages in accordance with NEMA WC 70/ICEA S-95-658.

2.2.3 Conductors

2.2.3.1 Material for Conductors

Conductors must conform to all the applicable requirements of Section 2 of NEMA WC 70/ICEA S-95-658 and must be annealed copper wire conforming to ASTM B3. Copper conductors may be bare, or tin- or lead-alloy-coated, if required by the type of insulation used. Tin-coated copper conductors must conform to ASTM B33. Conductors must be solid or stranded as required by subparagraph entitled Stranding. Aluminum conductors will not be accepted.

2.2.3.2 Wire Size

Minimum wire size must be No. 12 AWG for power and lighting circuits; No. 10 AWG for current transformer secondary circuits; No. 12 AWG for potential transformer circuits; No. 14 AWG for relaying, control, and annunciation circuits; and No. 16 AWG for RTD, RTU, and PLC circuits. No. 18 AWG may be submitted as a variance for PLC module interconnection wiring if required by terminal size limitations, but must not be run outside the PLC enclosure. The submittal must include the reason for the variance request.

2.2.3.3 Stranding

Conductor stranding classes cited herein must be as defined in Appendix G of NEMA WC 70/ICEA S-95-658. Conductors No. 10 AWG and smaller must be solid for 120 volt lighting and receptacles, and for all other uses must have Class B or Class C stranding as defined in Table 1 of ASTM B8. Any conductors used between stationary and moving devices, such as hinged

doors or panels, must be Class H or K stranding. All other conductors must have class B stranding.

2.2.4 Insulation

2.2.4.1 Insulation Voltage Rating and Insulation Level

The rated voltage of the insulation must be 600 volts for all circuits operating below 2,000 volts, with 100 percent insulation level.

2.2.4.2 Insulation Material

Except as otherwise specified under paragraph SPECIAL WIRE AND CABLE, insulation must be cross-linked thermosetting polyethylene (XLPE) type or an ethylene-propylene rubber (EPR) type meeting the requirements of Section 3 of NEMA WC 70/ICEA S-95-658. Cables accepted as a variance for No. 18 under paragraph WIRE SIZE may have a non-PVC thermoplastic insulation and must be UL Listed. Polyvinyl Chloride (PVC) insulation will not be accepted.

2.2.4.3 Insulation Thickness

The insulation thickness for each conductor must be based on its insulation material.

a. Single-Conductor Cables - The insulation thickness for single-conductor cables must be as required by NEMA WC 70/ICEA S-95-658 Section 3.3 Tables for Insulation Classes R, X, and E.

b. Multiple-Conductor Control Cables - The insulation thickness of the individual conductors of multiple-conductor (multiconductor) cables must be as required by NEMA WC 70/ICEA S-95-658 Section 3.3 Tables for Insulation Classes R, X, or E for cables used for power, or NEMA WC 57/ICEA S-73-532 Section 3.3 Tables for insulations XLPE, ER, SR, CSPE, or EP composites for cables used for control and related purposes.

2.2.4.4 Insulation Shielding

Shielding, where specified for control cables, must conform to the requirements of Section 4.1 of NEMA WC 57/ICEA S-73-532.

2.2.5 Jackets

All cables must have jackets meeting the requirements of Section 4.2 of NEMA WC 57/ICEA S-73-532 or Section 4.1 of NEMA WC 70/ICEA S-95-658, and as specified herein. Individual insulated conductors listed in UL 44 Table 19 as optional or none for jacket type need not be jacketed. 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.

2.2.5.1 Jacket Material

The jacket must be one of the materials listed below, in accordance with the applicable paragraphs of NEMA WC 70/ICEA S-95-658. Polyvinyl chloride compounds will not be permitted. 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.

- a. Heavy-duty black neoprene (CR).
- b. Heavy-duty chlorosulfonated polyethylene (CSPE).
- c. Heavy-duty cross-linked (thermoset) chlorinated polyethylene (XL-CPE).

Cables accepted as a variance for No. 18 under paragraph WIRE SIZE may have a thermoplastic jacket if it is UL listed and is rated for low smoke and/or zero halogen. PVC jackets will not be accepted.

2.2.5.2 Jacket Thickness

The minimum thickness of the jackets at any point must be not less than 80 percent of the respective nominal thicknesses specified below:

- a. Thickness of the jackets of the individual conductors of multiple-conductor cables must be as required by Section 4.1 of NEMA WC 70/ICEA S-95-658, and must be in addition to the conductor insulation thickness for the insulation used. Thickness of the outer jackets or sheaths of the assembled multiple-conductor cables must be as required by Section 4.1 of NEMA WC 70/ICEA S-95-658.
- b. Single conductor cables, if nonshielded, must have a jacket thickness as specified in Section 4.1 of NEMA WC 70/ICEA S-95-658. If shielded, the jacket thickness must be in accordance with the requirements of Section 4.1 of NEMA WC 70/ICEA S-95-658.

2.2.6 Cabling

Individual conductors of multiple-conductor cables must be assembled with flame-and moisture-resistant fillers, binders, and a lay conforming to Section 5 of NEMA WC 57/ICEA S-73-532 or Section 5 of NEMA WC 70/ICEA S-95-658 as applicable, except that flat twin cables will not be permitted. 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.

2.2.7 Dimensional Tolerance

The outside diameters of single-conductor cables and of multiple-conductor cables must not vary more than 5 percent and 10 percent, respectively, from the manufacturer's published catalog data.

2.2.8 Color-Coding

Only one color-code method must be used for each cable construction type. Colored braids will not be permitted. Control cable color-coding must be in accordance with Table E-2 of NEMA WC 57/ICEA S-73-532. Power cable color-coding for 208/120 volt systems must be black for Phase A, red for Phase B, blue for Phase C, and white for grounded neutral. Color coding for 480/277 volt systems must be brown for Phase A, orange for Phase B, yellow for Phase C, and gray for grounded neutral. Green must be used only for grounding conductors if insulated.

2.3 SPECIAL WIRE AND CABLE

2.3.1 Control Panel Shop Wiring

Wiring for factory assembled control panels or factory assemblies of electrical components for miscellaneous equipment must conform to NEMA WC 57/ICEA S-73-532, and NEMA WC 70/ICEA S-95-658, as applicable. All wire must be single conductor stranded copper in accordance with Part 2 of NEMA WC 57/ICEA S-73-532. Insulation must be rated for 600 volts with thickness in accordance with Section 3 of NEMA WC 70/ICEA S-95-658. Conductors must be Class C stranding, except hinge wire must be Class D or Class K stranding as defined in Appendix G of NEMA WC 70/ICEA S-95-658. Conductor size must be No. 16 AWG minimum. The completed installation must conform to all requirements of NFPA 70.

2.3.2 Switchboard Wire

Control wiring provided in the switchboards must be single conductor 600-volt, Type SIS, or approved equal meeting the requirements of UL 44. Stranding must be Class K as defined in Appendix G of NEMA WC 70/ICEA S-95-658.

2.3.3 Signal and Communications Cable

The cable must conform to the applicable requirements of UL 44 and NEMA WC 57/ICEA S-73-532. Conductors must be tinned copper conforming to Section 2.3 of NEMA WC 57/ICEA S-73-532 with Class C or Class K stranding as defined in Appendix G of NEMA WC 70/ICEA S-95-658. Minimum conductor size must be No. 16 AWG. Conductors must be insulated for 600 volts with a thermoset insulation conforming to NEMA WC 57/ICEA S-73-532 Section 3.3 Tables for insulations XLPE, ER, SR, CSPE, or EP composites. Overall shielding must be provided by aluminum-Mylar tape to provide 100 percent coverage. A drain wire in continuous contact with the shield must be provided as described in NEMA WC 57/ICEA S-73-532 Section 4.1 for metal thickness of 0.001 inch or less. Overall shields must be provided for multiple-shielded pair or triplet cables. A thermoset jacket must also be provided over shielded pairs or triplets of multiple-grouped cables in accordance with Section 4.2 and Table 4-1 of NEMA WC 57/ICEA S-73-532 for equivalent diameter of single conductor cables. Individual conductors of shielded and jacketed twisted pairs and triplets and jackets over paired or tripled conductors must be color coded in accordance with Appendix E of NEMA WC 57/ICEA S-73-532. Polyvinyl chloride (PVC) insulation or jacketing will not be accepted. Individual conductors and cable assemblies must pass the flame tests described in paragraph FLAME TESTS.

2.3.4 Ground Conductors

Ground conductors must be bare, soft-drawn, Class A or B stranded copper

cables sized in accordance with NFPA 70. Ground conductors size No. 10 and smaller must be solid. Ground conductors size No. 6 and larger must be Class A stranded.

2.4 TERMINATIONS

Terminals and lugs must be approved for connection to copper conductors. Long barrel, NEMA two-hole or four-hole compression-type terminals must be furnished for terminating cables No. 2 AWG and larger.

PART 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

3.1.1 General

For the purposes of this contract, the term "internal wiring" must be used to designate the Contractor's factory installed wiring furnished with the furnished equipment, and the term "external wiring" must be used to designate field installed wiring. Schedules of external wire and cable are as shown in the drawings, showing information on cable numbers, sizes and estimated lengths, number of conductors, the function, and origins and terminations. Although estimated cable lengths are shown on the schedule for bidding purposes, the Contractor must be responsible for determining the actual cable length required to make an installation of all new cables without splices. Different voltages must not be run within the same multiconductor cable. The Contractor must submit the manufacturer's installation instructions.

3.1.2 External Wiring

All external wire and cable must conform to paragraph INSULATED WIRE AND CABLE. All wire and cable must be installed in accordance with NFPA 70 requirements. All necessary materials, tools and equipment required for proper handling and installation of wire and cable in conduits, cable trays, and elsewhere must be furnished by the Contractor. Except for spares, each wire and cable must be connected to the associated equipment at both ends, and new cable must be continuous and without splices between the equipment termination points. Spares must have exposed ends taped over and labeled as "spare". Any cable damaged during installation must be removed and replaced. Installation of wire and cable must include installation of all supporting devices and all terminations required to complete the circuits as required.

3.1.3 Phasing

All terminal connections for power cables and conductors must be made in such manner that the phasing will be as marked on the equipment, or indicated on the approved shop drawings. The Contractor must verify phasing on existing wiring before disconnecting and removing. The Contractor is also responsible for verifying that the phasing on new wiring is the same rotation as presently existing wiring. Normal phasing for existing equipment is A-B-C from left to right, from top to bottom and from front to back when facing the front of the equipment but contractor to verify. After cables have been terminated and the connection torqued, insulate all exposed parts to the cable's voltage rating.

3.1.4 Cable Pulling Requirements

Wire and cable must be pulled in a manner which will preclude damage to the conductor, insulation or jacket. Wire and cable must be pulled by the conductor and not by the insulation, jacket, or sheath. Pulling tension must not exceed the manufacturer's recommended maximum. Strain gages must be used when pulling cable if any kind of mechanical pulling device is required for installation. Caution should be used to avoid exceeding the side wall rating of the cable. Any cable or conductor damaged during installation must be removed and replaced with equivalent cable or conductor. Installation of wire and cable must include installation of all supporting devices and all terminations and identifications required to complete the circuits as shown on the drawings and as required.

3.1.5 Installation in Conduit

Cable must not be pulled into conduit runs until the conduit has been checked and determined to be clean and dry by pulling a clean, dry, tight fitting rag through each run. Where existing conduits are being reused, the conduit must be cleaned with a tight-fitting wire brush mandrel. Only approved lubricants may be used to facilitate pulling of conductors.

3.1.6 Installation in Cable Trays

Cable pulling sheaves of adequate size must be used where necessary to prevent damage to the cable. Cables must be placed straight and parallel in the trays. There must be minimum crossing of cables in trays. Cables must be fastened in the cable tray at intervals not to exceed 6 feet. If two or more single conductors comprising a circuit to and from electrical equipment are routed in a cable tray, they must be bundled together at intervals not to exceed six feet with approved cable ties. Identification markers must be installed on each tied bundle at intervals not to exceed 18 feet. After all work in the area containing new cables is complete, the trays must be thoroughly cleaned of all dirt and trash generated by the new cable installation. Cable moved in the cleaning process must be repositioned and final cable positions in the trays checked and corrected if necessary.

3.1.7 Bends

The minimum radius to which an insulated conductor or a multiconductor cable may be bent, without specific approval, whether permanently or temporarily during installation, must be 12 times the overall diameter of the completed cable for tape shielded cables and 10 times the overall diameter for other cables. In these instances where this radius is not possible, approval will be required for minimum radii as specified in NFPA 70. For multiconductor cable, follow manufacturer's recommendation for type of cable involved.

3.1.8 Cable Supports

3.1.8.1 Cable Clamps

Clamps for protecting and supporting the weight of cables installed in vertical wireways must be as required per NFPA 70 for adequate support. The size of each clamp must be in accordance with the manufacturer's recommendations for each diameter and weight of cable to be supported or protected.

3.1.8.2 Support Grips

Heavy duty galvanized steel wire mesh support grips must be used to support the weight of cables installed in vertical wireways and cable shafts for adequate support as required per NFPA 70 Table 300.19(A). Size each support grip in accordance with the manufacturer's recommendations for each diameter and weight of cable to be supported or protected. Closed mesh type support grips must be used except where the dynamics of the cable installation require open mesh, in which case this should be annotated on the submittal.

3.1.9 Splices

Splices will be permitted only with written approval. All splices must be made in accessible cabinets, boxes or outlets. No splices will be allowed inside conduits.

3.1.10 Terminations

All wire and cable connections must be made at terminal blocks or lugs using ring tongue terminals. The shield and shield insulating jacket of shielded signal cables and conductors, if applicable, must be maintained to a point as close to the terminals as possible. The shield insulating jacket must not be stripped from the shield except where necessary to make the ground connection. All signal cable shields must be grounded at one end only. Spare conductors must be terminated on an available unused terminal of a terminal block and labeled as SPARE at both ends, or if left unterminated must have the exposed ends wrapped in insulating tape and labeled as SPARE at both ends.

3.1.11 Wire Marking

All wires and cables must be identified on both ends by the designations as shown on the Contract drawings or as otherwise shown on approved shop drawings. All wires and cables must be clearly identified with the cable designation by either embossed 1-inch diameter brass tags, by embossed aluminum band markers, by tube-type markers as described in subparagraph Marking, or by 1-inch phenolic tags marked as described in subparagraph Marking. Tags or band markers must be securely fastened to the cables at each termination, junction or pull box, where cables enter or leave cable trays, and as required at other points of access. Wires, cables and individual conductors of multiconductor cables must be identified with markers at each termination. Installed markers must be uniform in position on the wire and cable, and legends must be visible when conductors are terminated at the equipment.

3.1.11.1 Marking

Tubing must be sized to fit the wire being marked and must have black marking on a light colored background. Tube-type markers must be suitable for contact with the type of insulation material used. Tubing must have permanent black marking on a light-colored background. The markers must have been tested by an independent testing laboratory or by the manufacturer to indicate that the markers will not stain or discolor when subjected to an accelerated aging test while in contact with wire insulating materials and ultraviolet light exposure.

Wire marker labeling must follow the following format: WWWW/XXXX-YY(ZZ) where WWWW is the wire number, XXXX is the destination device name, YY is

the terminal number on the destination device, and ZZ is the location of the destination device if not in the same enclosure. For example, PC1/TB5-10(BV) would represent wire number PC1 going to terminal 10 on terminal block TB5 located in enclosure BV.

3.1.12 Ground Conductors

A ground conductor must be run for all circuits. If not an integral part of a multiple conductor cable, a separate ground conductor must be provided. Ground conductors must be installed as continuous pieces of copper cable whenever possible. Exposed ground cable runs must be supported to follow conduit, equipment or concrete wall contours. Support clamps or clips must be of corrosion resistant metal and existing equipment bolts or screws must be used where possible for fastening. Drilling of equipment housings or frames will be permitted only when approved. Concrete anchors must be used for wall fastening.

3.2 FIELD ACCEPTANCE TESTING

3.2.1 Testing

Testing must be per NETA ATS recommended procedures.

- a. Submit Test Reports in accordance with referenced standards in this section.
- b. After completion of the installation and prior to energizing the conductors, perform wire and cable continuity and insulation tests as herein specified before the conductors are energized.
- c. Contractor must provide all necessary test equipment, labor, and personnel to perform the tests, as herein specified.
- d. Field Acceptance Testing and submittals must be performed as described herein. Any damages to existing or new electrical equipment resulting from contractor mis-wiring will be repaired and re-verified at contractor's expense. All repairs must be approved by the Government Quality Assurance Representative (GQAR) prior to acceptance of the repair.
- e. Isolate completely all wire and cable from all extraneous electrical connections at cable terminations and joints. Substation and switchboard feeder breakers, disconnects in combination motor starters, circuit breakers in panel boards, and other disconnecting devices must be used to isolate the circuits under test.
- f. Suitable records must be kept of all tests, indicating the insulation-resistance tests, high voltage tests, continuity tests, and conductor identification markings. A duplicate record of all tests must be furnished to the Contracting Officer. Prior to testing, the wire and cable test record form must be submitted for approval. Test reports must provide room for the Contracting Officer's signature. After installation, but just prior to terminal connection, each conductor must be tested as follows:
 - (1) Perform a Conductor Continuity Test on each wire and each individual conductor of a multiconductor cable to insure correct connections end-to-end.

- (2) Perform a Shield Continuity Test on each cable shield.
- (3) Perform a Shield Resistance Test on each cable shield. Shield resistance must be less than 10 ohms per 1000 feet of cable.
- (4) Perform an Insulation Resistance Test on each field-installed conductor with respect to ground and adjacent conductors. Applied potential must be 1000 volts DC. Take readings after 1 minute and until the reading is constant for 15 seconds. Minimum insulation-resistance values must not be less than 100 Megohms.
- (5) Tests must be witnessed by the Contracting Officer and the wire and cable installation test reports must be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

3.2.2 Acceptance

Final acceptance will depend upon the successful performance of wire and cable under test. Conductor must not be energized until the final test reports are reviewed and approved by the Contracting Officer.

-- End of Section --

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SECTION 35 05 40.14 26

HYDRAULIC POWER SYSTEMS FOR CIVIL WORKS STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

a. The work covered by this Section of the specifications consists of requirements to design and provide new butterfly valve (BFV) operators with integral mechanical locking device, hydraulic power units (HPU) and associated plumbing for two penstock BFVs of Powerhouse 2 at Fort Peck Dam. The specifications include detailed requirements for the removal of existing equipment and design, fabrication and manufacturing, factory testing, installation, and field testing of new equipment and systems, as specified and shown. This includes but is not limited to the list below:

(1) Design and provide two BFV operators (quarter-turn hydraulic cylinder actuators) with integral mechanical locking device:

- (a) Remove existing BFV operator and associated plumbing;
- (b) Install new BFV operator with integral mechanical locking device;

(2) Design and provide two BFV HPUs with controls and offline oil filtration system:

- (a) Remove existing BFV HPU and associated plumbing;
- (b) Install new BFV HPU and associated plumbing;

b. The new BFV operators, HPUs, and associated systems must be identical and interchangeable.

c. The work specified includes but is not limited to all appurtenances required for a complete, fully functional installed system (e.g. piping, hoses, fittings, valves, controls, alarms, warning signs, nameplates and mounting systems). Design and installation in accordance with the provisions of these specifications, complete and fully operational, in direct correlation with SECTION 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING, SECTION 26 05 19.00 26 INSULATED WIRE AND CABLE and SECTION 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT.

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 WATER WORKS ASSOCIATION (AWWA)

AWWA C541

(2016) Hydraulic and Pneumatic Cylinder
and Vane-Type Actuators for Valves and
Slide Gates

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B16.11 (2016; Errata 2017) Forged Fittings, Socket-Welding and Threaded

ASME B31.1 (2018; R 2020) Power Piping

ASME B36.19M (2004; R 2015) Stainless Steel Pipe

ASME B40.100 (2013) Pressure Gauges and Gauge Attachments

ASME BPVC SEC IX (2021) BPVC Section IX-Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding Brazing, and Fusing Operators

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A182/A182M (2020) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

ASTM A193/A193M (2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications

ASTM A194/A194M (2020a) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both

ASTM A240/A240M (2020) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A269/A269M (2015a; R 2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM A312/A312M (2019) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

ASTM A325 (2014) Standard Specification for Structural Bolts, Steel, Heat Treated,

| | |
|-------------------|---|
| | 120/105 ksi Minimum Tensile Strength |
| ASTM A354 | (2017; E 2017; E 2018) Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners |
| ASTM A519/A519M | (2017) Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing |
| ASTM A536 | (1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings |
| ASTM A572/A572M | (2018) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel |
| ASTM A576 | (2017) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality |
| ASTM A789/A789M | (2020) Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service |
| ASTM B117 | (2019) Standard Practice for Operating Salt Spray (Fog) Apparatus |
| ASTM D3951 | (2015) Commercial Packaging |
| ASTM D4057 | (2012; R 2018) Standard Practice for Manual Sampling of Petroleum and Petroleum Products |
| ASTM F844 | (2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use |
| ASTM F3125/F3125M | (2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength |

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

| | |
|------------|--|
| ISO 1219-1 | (2012; Amd 1 2016) Fluid Power Systems and Components Graphic Symbols and Circuit Diagrams - Part 1: Graphic Symbols for Conventional Use and Data-Processing Applications |
| ISO 1219-2 | (2012) Fluid Power Systems and Components Graphic Symbols and Circuit Diagrams - Part 2: Circuit Diagrams |
| ISO 16889 | (2008) Hydraulic Fluid Power - Multi-Pass Method for Evaluating Filtration Performance of a Filter Element |

- ISO 4021 (1992) Hydraulic Fluid Power - Particulate Contamination Analysis - Extraction of Fluid Samples from Lines of an Operating System
- ISO 4406 (2017) Hydraulic Fluid Power - Fluids - Method for Coding the Level of Contamination by Solid Particles
- ISO 4407 (2002) Hydraulic Fluid Power - Fluid Contamination - Determination of Particulate Contamination by the Counting Method Using an Optical Microscope

DEFENSE CONTRACT MANAGEMENT AGENCY - DEPARTMENT OF DEFENSE

- MIL-STD-2073-1E (2019) Standard Practice for Military Packaging - Packaging and Marking Guide for DoD

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

- MSS SP-58 (2018) Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA MG 1 (2018) Motors and Generators

NATIONAL FLUID POWER ASSOCIATION (NFLPA)

- NFLPA T2.13.1 (2007; 5th Ed) Recommended Practice - Hydraulic Fluid Power - Use Of Fire Resistant Fluids In Industrial Systems

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

- SAE AS598A (2018) Aerospace Microscopic Sizing and Counting of Particulate Contamination for Fluid Power Systems
- SAE J514 (2012) Hydraulic Tube Fittings
- SAE J518-1 (2013) Hydraulic Flanged Tube, Pipe, and Hose Connections, 4-Screw Flange Connection Part 1: 3.5 MPa to 35 MPa (Code 61)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR 1910.219 Mechanical Power Transmission Apparatus

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. Unless otherwise stated, submit the following submittals within 100 calendar days after receiving Notice to Proceed and at least 45 calendar days prior to any construction or manufacturing. Unless otherwise stated, all durations specified as "days" shall be considered "calendar days". Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Registered Professional Engineer Credentials; G HDC

Submit within 30 days after receiving Notice to Proceed.

Designer Resumes; G HDC

Submit within 30 days after receiving Notice to Proceed.

Assembler Resumes; G HDC

Submit at least 60 days prior to any on-site construction or manufacturing.

Erection Engineer; G HDC

Submit at least 60 days prior to any on-site construction or manufacturing.

Early On-site Inspection Procedure; G HDC

Submit at least 60 days prior to the early on-site inspections.

Early On-site Inspection Report; G HDC

Submit within 30 days after completing inspections and field measurements.

Packaging, Preservation, Dunnage, And Shipping Plan; G HDC

Submit at least 60 days prior to shipping.

BFV Operators Shop Assembly Plan; G HDC

BFV Operators Shop Testing Plan; G, HDC

HPU Shop Assembly Plan; G, HDC

HPU Shop Testing Plan; G, HDC

HPU Reservoir Shop Testing Plan; G, HDC

Procedure for Shop Cleaning and Flushing; G HDC

Existing Equipment Removal Procedure; G HDC

Submit at least 100 days prior to any on-site construction.

HPU System Installation Procedures; G HDC

Submit at least 100 days prior to any on-site construction.

BFV Operators Installation Procedures; G HDC

Submit at least 100 days prior to any on-site construction.

Hydraulic Plumbing - Routing and Mounting Locations; G HDC

Submit at least 100 days prior to any on-site construction.

Plan and Procedure for Documentation of Accessible Areas of BFV Operator Assemblies; G, HDC

Submit at least 60 days prior to any on-site construction.

Plans and Instructions for The Removal and Installation of the BFV Operator Assemblies; G, HDC

Submit at least 60 days prior to any on-site construction.

Plan for Determination of the Dimensions of BFV Operator Assembly Components to be Provided; G, HDC

Submit at least 60 days prior to any on-site construction.

Initial Shop Inspection Plan for Each Furnished BFV Operator Assembly Component; G, HDC

Submit at least 60 days prior to any on-site construction.

Revised Shop Inspection Plan for Each Furnished BFV Operator Assembly Component; G, HDC

Submit at least 7 days prior to Final Machining of BFV Operator Assembly Components.

Revised Plans and Instructions for The Removal and Installation of the BFV Operator Assemblies; G, HDC

Submit at least 7 days Prior to Removal of BFV Operator Assembly Components.

Hydraulic Fluid Sampling Plan; G HDC

Procedure for On-site Cleaning and Flushing of the HPU Systems and BFV Operators; G HDC

Submit at least 90 days prior to any on-site construction.

HPU Systems Field Testing Procedure; G, HDC

Submit at least 90 days prior to any on-site construction.

BFV Operators Field Testing Procedure; G HDC

Submit at least 90 days prior to any on-site construction.

Fully Operational Penstock Butterfly Valve Open and Closure System Field Testing Procedure; G HDC

Submit at least 90 days prior to any on-site construction.

SD-02 Shop Drawings

HPU System Schematics and Drawings; G, HDC

BFV Operators Drawings; G, HDC

Drawings of Rough or Partially Machined Parts for BFV Operator Assemblies; G, HDC

Submit at least 30 days prior to any construction or manufacturing; submit together with Initial BFV Operator Assembly Dimensional Analysis.

Initial Drawings of Final Parts for BFV Operator Assemblies; G, HDC

Submit at least 30 days prior to any construction or manufacturing; submit together with Drawings of Rough or Partially Machined Parts for BFV Operator Assemblies.

Revised Drawings of Final Parts for Unit 4 BFV Operator Assemblies; G, HDC

Submit no more than 7 days after Existing BFV Operator Assembly Component Inspection, and 7 days before final machining of components.

Revised Drawings of Final Parts for Unit 5 BFV Operator Assemblies; G, HDC

Submit no more than 7 days after Existing BFV Operator Assembly Component Inspection, and 7 days before final machining of components.

As-Built Drawings; G, HDC

SD-03 Product Data

Manufacturers Data, General Equipment; G HDC

Valve List; G HDC

Valve Data; G HDC

HPU System Product Data; G HDC

BFV Operators Product Data; G HDC

SD-05 Design Data

HPU System Design; G HDC

BFV Operator Design; G HDC

Initial BFV Operator Assembly Dimensional Analysis; G HDC

Submit at least 30 days prior to any construction or manufacturing.

Revised BFV Operator Assembly Dimensional Analysis for Unit 4; G HDC

Submit no more than 7 days after Existing BFV Operator Assembly Component Inspection and with Revised Drawings of Final Parts for BFV Operator Assemblies.

Revised BFV Operator Assembly Dimensional Analysis for Unit 5; G HDC

Submit no more than 7 days after Existing BFV Operator Assembly Component Inspection and with Revised Drawings of Final Parts for BFV Operator Assemblies.

Spare Parts; G HDC

Submit at least 60 days prior to mobilization, a complete list of spare parts for the HPU System Design and the BFV Operators. Update list with any changes within 30 days after demobilization.

SD-06 Test Reports

BFV Operators Shop Test Reports; G HDC

Submit within 10 days of completing shop test.

HPU Shop Test Reports; G HDC

Submit within 10 days of completing shop test.

HPU Reservoir Shop Test Reports; G HDC

Submit within 10 days of completing shop test.

Shop Test Hydraulic Fluid Sampling Results; G HDC

Submit within 10 days of collecting hydraulic fluid samples.

Shop Cleaning And Flushing Report; G, HDC

Submit within 10 days of completing shop cleaning and flushing.

On-site Cleaning and Flushing Report for the HPU Systems and BFV Operators; G HDC

Submit within 10 days of completing on-site cleaning and flushing, and include the hydraulic fluid sampling test results for each unit.

Documentation of Accessible Areas Associated with The BFV Operator Assemblies Report for Unit 4; G HDC

Submit no later than 14 days after completion of disassembly of

unit, and no later than with the submittal of the Revised BFV Operator Assembly Dimensional Analysis for Unit 4.

Documentation of Accessible Areas Associated with The BFV Operator Assemblies Report for Unit 5; G HDC

Submit no later than 14 days after completion of disassembly of unit, and no later than with the submittal of the Revised BFV Operator Assembly Dimensional Analysis for Unit 5.

Furnished BFV Operator Assembly Component Initial Shop Inspection Report; G, HDC

Submit no later than 7 days after completion of the shop inspection.

Existing BFV Operator Assembly Component Inspection Report; G, HDC

Submit no later than 7 days after completion of each unit's inspection.

Revised Shop Inspection Report for Each Furnished BFV Operator Assembly Component; G, HDC

Submit no later than 7 days after completion of the shop inspection and 7 days prior to component installation.

HPU Systems Field Test Report; G HDC

Submit within 14 days of completing field test.

BFV Operators Field Test Report; G HDC

Submit within 14 days of completing field test.

Fully Operational Penstock Butterfly Valve Open and Closure System Field Test Report; G HDC

Submit within 14 days of completing field test.

New Hydraulic Fluid Test Results; G, HDC

Submit within 10 days prior to filling the HPU system.

Field Test Hydraulic Fluid Sampling Results; G, HDC

Submit within 14 days of completing field test.

Bulk Hydraulic Fluid Sampling Test Results; G, HDC

Submit within 5 days of completing testing.

SD-07 Certificates

Inspection and Test Notification; G HDC

Notifications of date and location of all inspections and tests. Submit at least 14 days prior to the inspection or test within the

United States and 60 days prior to the inspection or test outside of the United States. Unless otherwise specified herein in which case the earlier notification deadline governs.

Materials and Equipment Certificates; G HDC

Proof of compliance to codes and standards; at least 30 days prior to use.

BFV Operator Assembly Component Material Certifications; G HDC

Submit at least 45 days prior to use.

SD-10 Operation and Maintenance Data

Training Manuals; G, NWO

Submit at least 21 days prior to scheduled class.

Draft Operation and Maintenance Manual; G, HDC

Submit at least 45 days prior to field testing or on-site training.

Revised Draft Operation and Maintenance Manual; G, HDC

Submit within 14 days of completion of on-site training session.

SD-11 Closeout Submittals

Final Operation and Maintenance Manual; G HDC

O&M Manual with details for all systems associated with, modified, removed, tested, and installed for this Contract must be submitted within 14 days following approval of the Revised Draft Operation and Maintenance Manual submittal.

As-Constructed Drawings; G HDC

As-Constructed drawings for all systems associated with, modified, removed, and installed for this Contract must be submitted within 30 days following installation.

1.4 GENERAL REQUIREMENTS

1.4.1 Designer Qualifications

a. Personnel responsible for design of the butterfly valve operator, HPU, and ancillary equipment must have a minimum working experience performing similar design tasks for at least five years over the past ten years. Similar tasks are defined as the design of systems that have similar features and function as the quarter-turn butterfly valve operator shown, large custom hydraulic cylinders with minimum operating pressure of 2500 psi, hydraulic power systems with redundant hydraulic pumps, offline oil filtration system with an in-line heater, and HPU controls. Personnel design experience must include experience designing to applicable codes and standards, industry standard practice, and similar performance requirements specified in this

Section.

b. The Registered Professional Engineer(s) is(are) responsible for ensuring all components (whether custom designed for this project, or commercial and off-the-shelf items) and systems selected for use are appropriately sized, integrated, and capable of performing the intended functions as they pertain to this project. Submit for approval, Designer Resumes and Registered Professional Engineer Credentials for the engineer(s) approving and stamping design calculations, drawings, and associated system design submittals for each System/Routing Design.

1.4.2 Assembler Qualifications

The supervising personnel overseeing all assembly work of the butterfly valve operators, HPUs, and all ancillary equipment must have a minimum work experience of three consecutive calendar years performing similar assembly tasks as required by this effort (inclusive of intricate electrical wiring). Similar tasks are defined as assembly of systems that have similar features and function as the quarter-turn butterfly valve operator shown, large custom hydraulic cylinders with minimum operating pressure of 2500 psi, hydraulic power systems with redundant hydraulic pumps, offline oil filtration system with an in-line heater, and HPU controls. Submit for approval, Assembler Resumes.

1.4.3 Early On-Site Inspections (Verification of Dimensions)

a. Field verify existing dimensions and conditions as part of the development of the System/Routing Designs (design data) specified in paragraph 1.7 SYSTEM/ROUTING DESIGNS, and the development of the plans and procedures specified in paragraph 1.3 SUBMITTALS SD-01 Preconstruction Submittals. Submit Early On-Site Inspection Procedure for approval.

b. Field verification inspections and measurements performed outside the penstock (i.e. outside the water passage) can be performed anytime after approval of the "Early On-Site Inspection Procedure" and must be coordinated with the Contracting Officer. It is not permitted to disassemble existing equipment for early on-site work window verification of dimensions and inspection.

c. The Contractor must become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy, through submission of an Early On-Site Inspection Report, before finalizing any design work of replacement equipment. The Contractor is responsible for correcting the design and installation to remedy any discrepancies to the satisfaction of the Government. As part of the Contractor's verification of dimensions and inspection report, include at a minimum the following:

(1) Verification of all work areas and working clearances surrounding the equipment specified in this Section for refurbishment, replacement, demolition, installation, and modification.

(2) Verification of all access points and dimensions for equipment removal and installation, including but not limited to powerhouse 2 surge tank structure service door, freight elevator, and hatch covers at EL 2070.0 and 2052.0.

(3) Inspection and verification of connection details of butterfly valve operator to valve body.

(4) Note the close clearances between the butterfly valve operator and the hatch covers and support beams at EL 2052.0, inclusive of all clearances to the hatch opening and butterfly valve maintenance platforms and access ladder.

(5) Measure dimensions of existing location of HPU and surrounding equipment, electrical panels, piping and electrical conduit. The maximum dimensions and the installation location of the new HPU Skid is shown on Contract Drawing M-420 and is based on these approximated dimensions.

(6) Inspect the condition of existing hydraulic routing concrete anchors to determine if routing and mounting of replacement anchors can be in the same location.

(7) Verification of ancillary equipment needing to be removed to gain access to systems being replaced.

1.4.4 Equipment and Piping Arrangement

Arrange equipment and piping substantially as existing, unless otherwise shown differently on contract drawings. Detailed drawings of proposed departures due to actual field conditions or other causes must be submitted for approval. Properly install, completely interconnect, and place in working order all equipment. Use products of the same manufacturer where two or more items of the same type of equipment are required.

1.4.5 Protection of Existing Work

Take precautions to ensure against damage to existing work before beginning any dismantling, drilling, cutting, removal, or other modification of existing work. Any damage to such work must be repaired or replaced as directed by the Contracting Officer at the Contractor's expense.

1.4.6 Coordination

a. Piping and other system components must be installed in the most direct and workmanlike manner so that interference between other piping, ducts, conduit, mechanical, electrical and structural features are avoided. Install overhead piping and supports to maximize the space available for overhead clearance, in particular at the work platforms in the valve pit. Examine previously installed work prior to developing layout and installation plans for piping, valves, ducting, and accessories to determine that installation can be made without interference with other work. In case interference does develop, the Government will decide which work must be relocated regardless of which work was first installed. The rerouting must be made without additional cost to the Government. Do not cut or weaken structural portions of the powerhouse to install piping and accessories, except where indicated.

b. Notify the Government prior to inspections and tests as specified. Testing of each butterfly valve operator, valve locking device, and

HPU assembly with integral offline oil filtration system with control consoles and components or subassemblies shall be witnessed by the Contracting Officer and a representative of the Hydroelectric Design Center (HDC) unless otherwise approved in writing. Submit Inspection and Test Notification within the timeline specified in paragraph SUBMITTALS SD-07. Clearly identify the dates of notifications and test start dates in the overall work schedule for this job.

1.4.7 Avoidance of Electrical Equipment

Avoid placement of hydraulic system routing directly above cable trays and other electrical or water-sensitive devices or equipment to the extent practicable.

1.5 SYSTEM DESCRIPTION

The work covered by this Section of the specifications consists of detailed requirements for the design, fabrication, shop assembly, testing, delivery, and installation of new HPU systems and BFV operators which must operate with penstock butterfly valve integrated open and closure systems as specified and as shown. Requirements for new butterfly valve grease lubrication systems, new electro-mechanical valves for the equalizing line (BFV bypass system), and new spiral case and tunnel drain valves are specified in SECTION 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING.

1.6 DESIGN AND PERFORMANCE REQUIREMENTS

The contract drawings indicate the general arrangement of the hydraulic power systems for operation of the butterfly valves, clearances necessitated by the structure or other equipment, maximum overall dimensions, and other pertinent features. Furnish the detailed design in conformity with the following design criteria. Identify design and dimensional changes necessary to satisfy the principal design parameters identified in the paragraph DESIGN PARAMETERS (below) as variations in the submittals (follow instructions on Engineering Form 4025 for identification of each VARIATION). Dimensions submitted that differ from those indicated and not otherwise constrained by the Design Parameters and physical limitations of installation are subject to approval by the Government.

1.6.1 Design Parameters

The principal design parameters for the hydraulic power systems (HPU and BFV Operator) are as follows:

- a. Design capable of fully opening and fully closing a unit's butterfly valve.
- b. Designed to fully close the valve in not less than two minutes and not greater than five minutes (adjustable) without exceeding the design stresses under a 213 feet head and 3900 cfs condition. Existing valve closure time is 5 minutes - the system must be adjusted to this timing and verified during on-site testing.
- c. Designed for emergency closure of the valve in not less than two minutes and not greater than five minutes without exceeding one-half the yield stress when operating at 3900 cfs and a maximum head condition of 213 feet.

d. Designed to fully open the valve in not less than two minutes and not greater than five minutes (adjustable) without exceeding the design stresses under a 213 feet head, equalized water pressure between the upstream/downstream sides of the valve, and zero flow condition. Existing valve opening time is 4.5 minutes - the system must be adjusted to this timing and verified during on-site testing.

e. Utilize a hydraulic system operating pressure of 2000 psi. If higher operating pressure is necessary to maintain equivalent opening and closing forces as existing BFV Operator, Contractor to submit for approval.

f. Designed to prevent the butterfly valve from slamming shut upon closing sequence, and to hold the valve in the fully open position during normal unit operation with the turbine generator running at rated load at rated head.

g. Comply with the component and system requirements of Section 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT.

h. Design must be capable of fully closing the valve under complete loss of power by means of manual hydraulic hand pump and manually operable control valves.

i. Overall design sized by the Contractor to meet the space limitations shown on the Contract Drawings.

1.6.2 Allowable Stresses

1.6.2.1 Structural Items

Design any new structural items associated with the hydraulic power systems, such as support beams, to withstand the maximum force exerted by the BFV operators plus any dead loads with a factor of safety of three based on the yield strength of the materials involved. In addition, the design of the HPU must meet the requirements detailed in Section 13 48 00.00 26, SEISMIC RESTRAINT FOR MECHANICAL AND ELECTRICAL EQUIPMENT.

1.6.2.2 BFV Operator - Hydraulic Cylinder Actuator

Design BFV operator hydraulic cylinder actuators to withstand the resulting forces from maximum operating pressure in the system with a factor of safety of five, based on the ultimate strength of the material, or three if based on the yield strength of the material. Apply a factor of safety of three to the compression load when designing the BFV operators to resist buckling.

1.6.2.3 Stress Concentration Factors

Use stress concentration factors where applicable. Reduction of allowable stresses to compensate for repeated cycles of loading is not required.

1.6.3 Connections

1.6.3.1 Pinned Connections

Design pinned connections for BFV operator for field assembly as shown.

1.6.3.2 Shop Connections

Design shop connections for assembly by means of welding or by bolting.

1.6.3.3 Welded Connections

Design welded connections for all structural components in accordance with the applicable provisions of AWS D1.1/D1.1M and the requirements as detailed in Section 05 05 23.17 26, WELDING (STEEL), FABRICATION, AND MACHINE WORK. Design welded connection for all hydraulic plumbing and pressurized equipment, as defined by the scope of ASME BPVC SEC IX, to the requirements of ASME B31.1 and the requirements as detailed in Section 05 05 23.18 26, BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION. Apply the welder's or welding operator's assigned symbol near each weld made as a permanent record.

1.6.3.4 Structural Bolted Connections

Make structural bolted connections carrying primary loads with ASTM F3125/F3125M Grade A325 bolts. Additionally, design structural bolted connections in accordance with the provisions set forth in Section 05 05 23.17 26, STRUCTURAL STEEL WELDING AND FABRICATION.

1.7 SYSTEM/ROUTING DESIGNS

1.7.1 General

a. The Contractor is responsible for coordination and compliance of the new penstock BFV HPU System Design and new penstock BFV Operator Design with the requirements of the other Contract Sections, as well as each of the installed systems with applicable codes and standards, industry standard practice, and performance requirements of this Section.

b. Mechanical components and systems must be reviewed by a mechanical engineer, and the other systems by their respective disciplines. Submit for approval the Designer Resumes and the Registered Professional Engineer Credentials for each installed system per the requirements of paragraph DESIGNER QUALIFICATIONS.

1.7.2 Design Data

Submit for approval complete system designs which detail how each will meet all of the requirements within this Section, other applicable sections of this contract, and as shown on contract drawings. Include design calculations and documentation for each system to be refurbished, replaced, designed and provided new, and/or serviced showing how the equipment and/or approach adheres to the design requirements of these specifications and the operating conditions for which it will experience in conjunction with any existing equipment.

System/Routing Designs to be submitted:

- a. HPU System Design
- b. BFV Operator Design

1.7.2.1 Design Calculations

Submit design calculations for all components provided as per this Contract for approval. Submit design calculations for new components (or system of components) concurrent with the drawings and product data specific to the designed component (or system of components). Include within the calculations a list of assumptions made, a list of all codes and standards referenced, equations, specified efficiencies, limits, factors of safety, component ratings, sources of values used, free body diagrams or sketches of each load case, and reference to the applicable Contractor shop drawings. Clearly define all equations, constants, and variables in the calculations with sources cited. Calculations must show that the systems clearly meet the requirements as detailed within these Contract specifications.

1.7.2.2 Finite Element Analysis (FEA)

When FEA data is submitted, it must be submitted in addition to, not instead of, the design calculations defined in paragraph DESIGN CALCULATIONS above. Present FEA in a report format. FEA report is to include clear indication of all load scenarios, visual and narrative description of load location and application, boundary conditions/fixtures, contact settings between components, global mesh attributes, detailed mesh attributes where mesh refinement is required, reasoning for mesh refinement, verification that actual material is consistent with material used in the model, narrative explanation of any peak stresses noted, and narrative explanation of any peak deflections noted. Submit electronic files for any FEA performed (in the FEA software file type). Post-processing FEA data, such as graphics output, submitted alone will be cause for rejection.

1.7.3 Product Data

Submit complete descriptive literature and specifications of each product or system of products with original, legible manufacturer's cut sheets and data sheets to clearly indicate physical construction, operation, mechanical and structural characteristics and associated hardware, electrical characteristics, equipment class, options, design ratings including temperatures, pressures and compatible fluids, any associated code numbers, material properties, testing results, as applicable. For sheets with extraneous data, clearly indicate which data applies by crossing out other models, circling the correct options, etc. Include manufacturer's catalog numbers and designations, and clearly cross-reference with shop drawings as appropriate. Product data submitted for approval must clearly show conformance with these specifications, including but not limited to product manufacturers' declarations of conformance to applicable technical standards. Product data must be approved prior to procurement of associated materials and equipment. Indicate if the material or component is a direct replacement to the OEM conditions or a requested alternative.

Product Data to be submitted with each system and component design:

- a. Manufacturers Data, General Equipment. Include performance data and curves for pumps and motors. Provide catalog cuts and outline dimensions for the pumps, motors, filters, heaters, thermostats, temperature gauges, float switches, pressure switches, breathers, and all valves, valve controls, and other accessories. Submit electrical equipment and HPU control console (control panel) manufacturers data

and product data per requirements in Section 26 00 00.00 26, MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT. The submittal is to include, but not be limited to the Manufacturer's Catalog Data for each new or modified piece of equipment proposed for use in each system. Data must indicate the name of the manufacturer of each item of equipment. In addition, submit a complete equipment list which includes equipment description, model number and quantity; submit together with each System/Routing Design.

b. HPU System Product Data The manufacturer's Catalog Data must be submitted for any standard catalog component used in this system. Data must indicate the name of the manufacturer, with data highlighted to indicate type, construction, class, size and materials. Any non-applicable data must be clearly annotated as not applicable. In addition, description of component location and any associated code numbers, design ratings including temperatures and pressures.

c. BFV Operators Product Data The manufacturer's Catalog Data must be submitted for any standard catalog component used in this system. Data must indicate the name of the manufacturer, with data highlighted to indicate type, construction, class, size and materials. Any non-applicable data must be clearly annotated as not applicable. In addition, description of component location and any associated code numbers, design ratings including temperatures and pressures.

1.8 SCHEMATIC AND DRAWINGS

a. Submit HPU System Schematics and Drawings. Detailed system drawings in both hardcopy and electronic (MicroStation *.dgn and Adobe PDF) format of the proposed systems/routing illustrating mechanical operation of the systems, clearly differentiating between new and existing components installed at Fort Peck. Submit together with each system/routing designs and the HPUs drawing requirements outlined in HYDRAULIC POWER UNIT DRAWINGS (below).

b. Submit BFV Operators Drawings. Detailed system drawings in both hardcopy and electronic (MicroStation *.dgn and Adobe PDF) format of the proposed systems/routing illustrating mechanical operation of the systems, clearly differentiating between new and existing components installed at Fort Peck. Submit together with each system/routing designs and the BFV operator drawing requirements outlined in BUTTERFLY VALVE OPERATOR DRAWINGS (below).

1.8.1 Bill of Materials and Schedule of Equipment

Include bill of materials or parts lists on the drawings, consisting of total quantity, manufacturer, manufacturer's part number, material type, size, and weight of item or equipment; or bill of materials drawings that are part of the drawing set, having a title block, border, and sheet number compatible with the drawing set. For the bill of materials, provide a cross reference between manufacturer data and shop drawings.

1.8.2 Shop Drawings

Include fabrication, shop assembly, delivery, and field installation drawings in the detailed shop drawings. Detail any component part of fabricated items omitted on the shop drawings. If departures from the contract drawings are deemed necessary by the Contractor, submit details of such departures, including changes in related portions of the project

and reasons thereof, with the shop drawings.

1.8.3 Component Detailed Drawings

Provide fully defined detailed drawings for all components, including fabrication details for all mechanical and structural parts or components, except those which are of standard manufacture. The drawings must fully define the components showing complete details of materials, dimensions, tolerances, machined surface finishes, connections, and proposed welding sequences which differentiate shop welds and field welds. Provide dimensional details of standard manufacture items in the form of product data sheets to include sufficient information to confirm connectivity and installation with related items. Provide detailed drawings of the drilled passages for the manifolds, if applicable.

1.8.4 Hydraulic Power Unit Drawings

Provide drawings for the HPU's showing general arrangement of components and outline dimensions. Identify all components on the drawings and provide sufficient information to determine whether the components proposed conform to the specifications. Provide with Shop Drawings and Component Detailed Drawings.

1.8.5 Butterfly Valve Operator Drawings

Provide drawings for the BFV operator with quarter-turn cylinder actuator, integral mechanical locking device, operator housing, lever (crank), link, pins, bushings, and crosshead, showing general arrangement of components and outline dimensions. Identify all components on the drawings and provide sufficient information to determine whether the components proposed conform to the specifications. Provide with Shop Drawings and Component Detailed Drawings.

a. The Drawings of Rough or Partially Machined Parts for BFV Operator Assemblies are to address the components that will be initially supplied in an unfinished state in order to reduce the lead time in producing the final components for the BFV operator assemblies. This includes but is not limited to the operator housing, lever (crank). Identify dimensions that are to be final and those that include additional material for final sizing.

b. The Initial Drawings of Final Parts for BFV Operator Assemblies are to include all those components that are being supplied and finalized for each BFV operator assembly. Any dimensions to be established from examination of existing components of the BFV operator assemblies must be identified and the draft dimension from initial analysis of the government provided drawings detailed. Submitted drawings must include assembly drawings for each of the BFV operator assemblies, including bill of materials with part numbers, quantities, and materials where applicable.

1.8.6 Revised Butterfly Valve Operator Drawings

After completion of the Revised BFV Operator Assembly Dimensional Analysis and Existing BFV Operator Assembly Component Inspection Report, submit for the BFV operator assemblies for the two penstock butterfly valves the Revised Drawings of Final Parts for Unit 4 BFV Operator Assemblies and Revised Drawings of Final Parts for Unit 5 BFV Operator Assemblies. All features detailed in drawings and related to the existing installed

components are to be recreated or modified as determined by the design requirements for the new components unless approved by the government. All features and dimensions on supplied drawings must be finalized and identify if it is an existing or an added feature. Detail in each drawing the features, including dimensions, that are applicable to both Unit 4 and 5, and any of those specific to either unit.

1.8.7 Manifold Drawings

Provide fully defined and detailed fabrication drawings for all manifolds, dimensioning and identifying all features, even if said manifolds are of standard manufacture. The drawings must include at minimum the general arrangement, drilling passages and identify all port configurations and connections. Identify all components on the drawings and provide sufficient information to determine whether the components proposed conform to the specifications.

1.8.8 Piping Drawings

Provide piping drawings fully defining and showing the complete hydraulic systems in schematic format identifying all items of equipment incorporated in the system. Include details of all setpoints and size parameters for each component, and all pipe supports including those for manifolds and on the hydraulic power units. Ensure drawings show details of new piping connecting up with existing pipe where necessary.

1.8.9 Electrical Drawings

Provide electrical drawings of all electrical equipment, schematics and connection diagrams, setpoints, etc., per Section 26 00 00.00 26, MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT.

1.8.10 Shop Assembly Drawings

Provide shop assembly drawings with details for connecting the adjoining fabricated components in the shop to ensure satisfactory field installation.

1.8.11 Hydraulic Schematic

Provide a complete hydraulic schematic in accordance with ISO 1219-1 and ISO 1219-2. Show all hydraulic components including but not limited to all valves, motors, pumps, manifolds, pressure switches, level switches, heaters, breathers and filters on the schematic, and indicate all setpoints, test points and size parameters for each component and include data such as pump pressure on/off setting, designed temperature setting for heater, pressure relief setting, counter balance valve setting, gallons per minute that include flow direction for open and close, and provide open, close and emergency closure times. Submit together with the Shop Drawings, Piping Drawings, Hydraulic Power Unit Drawings, Component Detailed Drawings and Shop Assembly Drawings.

1.8.12 Delivery Drawings

Provide delivery drawings with descriptions of methods of delivering components to the site and to their final operating locations, including details for supporting fabricated components during shipping to prevent distortion or other damage.

1.8.13 Nameplate Drawings

Provide drawings of nameplates that show location and lists details on each for all equipment and components required to have nameplates as identified in these Contract specifications.

1.9 DELIVERY, STORAGE, AND HANDLING

1.9.1 General Packaging, Shipping, Preservation, and Storage

Submit Packaging, Preservation, Dunnage, and Shipping Plan for preparation of packaging, shipping, and storing all major components and spare parts specified in this Section and all other Sections specified in these contract specification. Include dunnage, blocks, and supports used for protecting and securing all transported components, and types of preservative coating and protective transparent wrapping for shipping and storage and in accordance with ASTM D3951 and MIL-STD-2073-1E including specified method used, unless otherwise approved by the Contracting Officer. Include complete details on how each HPU and BFV operator will be delivered to Fort Peck Dam Powerhouse 2 by means of freight elevator, hatches or other.

1.9.2 Packaging

a. Do not prepare the hydraulic power systems for shipment until they have been inspected and accepted for shipment at origin by the Contracting Officer, unless inspection has been waived in writing by the Government. Ship each hydraulic power system or subassembly completely assembled. The subassemblies are defined as the following:

- (1) Hydraulic power units
- (2) Piping assemblies
- (3) Control consoles
- (4) BFV Operators

b. Provide the subassemblies with adequate protective pads, dunnage, supports, and blocking and securely restrained to prevent distortion or damage to any painted and machined surfaces in transit. Any loss or damage during shipment, including damage to the painted or machined surfaces, is the Contractor's responsibility; replace or repair without cost to the Government. Pack all accessories and spare parts separately in containers plainly marked "ACCESSORIES ONLY," or "SPARE PARTS ONLY." Place a packing list, listing the contents of each container, in a moisture-proof envelope and securely fasten to the outside of the container. Standard commercial packaging for items intended for immediate use in accordance with ASTM D3951 will be acceptable except where a different method or standard of packaging is specified. Package all components intended for long term storage in accordance with MIL-STD-2073-1E inside containers constructed of wood material and built for long term storage, preservative coated to protect unfinished metal surfaces and wrapped with transparent greaseproof wrapping material when applicable, and protected by cushioning or dunnage material, unless approved by the Contracting Officer.

1.9.3 Shipping, Preservation, and Storage

Packing, crating, cradles, etc., necessary to ensure safe shipment are the responsibility of the Contractor and become the property of the Government upon final acceptance of field testing and final acceptance tests of the equipment. The BFV operators - hydraulic cylinders must be filled with the specified hydraulic fluid, and make provisions to account for expansion and contraction of the oil during shipping and storage by installation of a bladder type accumulator to the rod end bleed port. Securely cap remaining ports on the BFV operators - hydraulic cylinders with blank flanges to prevent the entrance of foreign matter. Adequately protect machined surfaces from corrosion and physical damage. Protect equipment delivered and placed in storage from the weather, humidity, temperature variation, dirt and dust, or other contaminants.

1.10 WARRANTY

All equipment must be guaranteed for a period of 2 years from the date of acceptance. Guarantee replacement parts for 2 years from date of replacement. Provide Warranty in writing against defective materials, design, and workmanship. In cases where the equipment manufacturer's advertised minimum guarantee is in excess of 2 years, it remains in force for its full period. Upon receipt of notice from the Government of failure of any of the parts during the warranty period, provide new replacement parts promptly at no additional cost to the Government.

1.11 QUALITY CONTROL

Establish and maintain quality control for operations under this section to assure compliance with contract requirements and maintain records of quality control for all materials, fabricated parts, equipment, and construction operations. In addition, establish and maintain surveillance for quality control over sub-contractors, suppliers, or manufacturers. The quality control must include a minimum of two shop inspections during manufacture and assembly of the BFV operator assemblies, and hydraulic power units and manifolds. All shop inspections are subject to be witnessed by the Government. The quality control includes but is not limited to the following:

- a. Materials and workmanship.
- b. Manufacture and installation of the piping, BFV operator assemblies, hydraulic power units and manifolds.
- c. Cleaning and flushing.
- d. Shop assembly and tests.
- e. Field erection and tests.
- f. Damage and defects.
- g. Foreign material exclusion.

Furnish a copy of these records and tests, as well as the records of corrective action taken, to the Government.

PART 2 PRODUCTS

2.1 MATERIALS AND MECHANICAL EQUIPMENT

2.1.1 General

a. Provide materials and mechanical equipment that conform to the requirements indicated or specified, and if not specified, furnish materials and mechanical equipment of the best commercial grade quality suited to the intended use and as approved by the Government. All electric motors, hydraulic pumps, valves and similar items and/or accessories, of the same type and size, must be the products of the same manufacturer, unless otherwise approved by the Government. Submit Materials and Equipment Certificates of compliance, where materials or equipment are specified to comply with specific standards organization requirements, at least 30 calendar days prior to use. Permanently display the manufacturer's name, address, and catalog number on a nameplate securely attached to each major item of equipment.

b. Materials and equipment must be the products of manufacturers regularly engaged in the manufacture of such products. Items of equipment must essentially duplicate equipment that has been in satisfactory use at least two years prior to bid opening. Materials differing in minor respect from that specified may be proposed, provided such differences are clearly stated. Any materials required which are not covered in the piping material schedule, on the drawings, or these specifications must conform to applicable specifications. The Contractor must furnish the highest commercial grade quality of material or product available in cases where material is not covered by one of the listed specification groups. Give particular attention to the marking of valves to indicate body and trim material and pressure rating.

c. Submit data specifications and assembly drawings showing sizes, ratings, parts and material lists, overall dimensions, and mounting dimensions with the product data.

2.1.2 Standard Products

Where items are referred to hereinafter as "similar and equal to" a particular manufacturer's product, such references have been made merely as a convenient method of indicating the type of material or equipment required, with no intention of asserting superiority thereof. The standard product of any reputable manufacturer regularly engaged in the commercial production for at least 2 years prior to this solicitation of the type and quality of material or equipment referred to will not be excluded on the basis of minor differences, provided essential requirements of the specifications relative to materials, capacity, and performance are met. Furnish performance capacities and other pertinent information concerning the manufacturer's "equal to" standard products intended for incorporation in the work. "Equal to" standard products installed or used without such approval are at the risk of subsequent rejection.

2.1.3 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, Class, model and serial number, pressure rating, flow rating, and/or voltage and current rating as applicable, and catalog number, on a corrosion-resistant steel plate permanently affixed to the

equipment with corrosion-resistant fastener materials. Lettering on nameplates must be machine engraved or metal stamped with a black background. Plates must be mounted in a location easily visible without use of a mirror or removal of any components.

2.1.4 Prevention of Corrosion

Provide fasteners of corrosion-resistant materials. Surfaces of products such as pumps, cylinders, fluid motors, and similar components, of ferrous metal, where not otherwise specified, must be given a corrosion-protective coating at the factory. Manufacturers' standard coatings are acceptable, provided that coatings for interior use can withstand continuous exposure to salt spray for 120 hours and coatings for exterior use for 504 hours. The fog test must conform to ASTM B117. Immediately after completion of the test, coating must show no signs of wrinkling, cracking, or loss of adherence, and the specimen must show no signs of corrosion creepage beyond 1/8 inch on either side of the scratch mark made as specified. If coated samples have successfully withstood the salt spray test within the preceding two years, certificates will be acceptable in lieu of testing.

2.1.5 Butterfly Valve Operators

a. Provide new BFV operators consisting of quarter-turn cylinder actuator with integral mechanical locking device for each butterfly valve, conforming to the requirements as detailed in AWWA C541 and as specified herein. Design the BFV operators to safely and properly function with refurbished butterfly valves, to provide the required torque to properly actuate the butterfly valve under all conditions of the hydraulic power system design parameters as detailed in paragraph DESIGN PARAMETERS of this Section, and paragraph BUTTERFLY VALVE DESIGN PARAMETERS of Section 22 00 00.00 26, BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING.

b. The BFV operator cylinder actuator must use hydraulic fluid pressure acting on a piston within a cylinder to restrain or move the valve closure member. Design BFV operator to operate quarter-turn butterfly valves and include an intermediate mechanism designed to convert a hydraulic cylinder's linear thrust output to rotary motion using levers, linkages, pins, and associated components. Include means to prevent side load forces on the rod (i.e. crosshead with greaseless bearing components, similar as existing) and threaded rod end for field adjustment of butterfly valve in the closed and squeezed position, with minimum 1/2" gap between piston and cylinder head in the closed/squeezed position. The primary components of the BFV operator include but will not be limited to the following:

- (1) Hydraulic cylinder
- (2) Operator housing
- (3) Crank (similar to WISCO P/N 4701)
- (4) Link (similar to WISCO P/N 4502)
- (5) Pins (similar to WISCO P/N 4303)
- (6) Bushings (similar to WISCO P/N 4504)
- (7) Crosshead (similar to WISCO P/N 4501)

(8) Mechanical locking device

(9) and all mounting hardware

c. The dimensional constraints of the new hydraulic cylinder and its overall length limitations and clearance requirements shown on drawing M-420 will be a determining factor for the final design and connection details to the new operator housing. The manufacturing of the valve operator assembly must occur prior to the Fort Peck units being taken out of service for valve rehab work, except the final machining of the connection points to the valve disc stem and valve body must not be completed until the existing valve operator for each unit is removed, inspected, and measured.

2.1.5.1 Hydraulic Cylinder

Provide hydraulic cylinders of the tie rod or welded construction design. The pressure rating of the cylinder must not be less than the maximum system pressure indicated. Provide evidence that each cylinder was hydrostatically tested to 200 percent of the most severe service rating and that the dynamic seals are suitable for both frequent and infrequent operation and are capable of not less than 500,000 cycles of operation in a properly maintained system. Provide the hydraulic cylinder with adjustable cushions on both ends. Cushions must have free reverse flow check valves. Provide the cylinders as double acting with single end rod, and the piping ports must be SAE straight thread o-ring type.

2.1.5.1.1 Cylinder Tubes

Machine the cylinder tube from ASTM A519/A519M, Grade 1018, heavy wall seamless steel tubing with the bore honed to a surface finish compatible with the seals being used so as to result in zero leakage past the seals.

2.1.5.1.2 Cylinder Heads and Caps

Fabricate the cylinder head and cap from ASTM A576, Grade 1018, steel bar stock and machine finished on all surfaces. Equip the cylinder head with a rod seal and external dirt wiper and have a rod bushing piloted into the head to ensure concentricity. Make the rod bushings, seals, and wipers removable and replaceable without the use of special tools and without removing the tie rods or cylinder head. Attachment of the cylinder tube to the head and cap must be by ASTM A193/A193M Grade B7 threaded rods having a minimum yield strength of 100,000 psi and with ASTM A194/A194M Grade 2H nuts. Removable attachments must have the cylinder tube end seals arranged to seal with pressure and be designed to prevent shearing and extrusion and to provide axial metal backup.

2.1.5.1.3 Pistons

Design and fabricate the pistons to be precision fitted to the cylinder body bore. The piston is to be designed and equipped with zero leakage cup-type seals. The design must protect the piston rings from blow-out and oversqueezing. Cup-type seals must be self-regulating and automatically compensate for wear. In case of threaded piston to rod connection, provide means for permanently securing the connection.

2.1.5.1.4 Piston Rods

Make the piston rods of 90,000 to 110,000 psi high tensile strength steel using ASTM A108, Type C 1045, for rods 5/8 to 2 1/2 inches in diameter, and ASTM A108, Type CR 4140, for rods 3 to 10 inches in diameter. Case harden the rod to 50-54 Rockwell C, polished to a 10 microinch RMS surface finish or better, and nickel and hard-chrome plated to 0.003 inch minimum thickness.

2.1.5.2 Operator Housing

a. Design the operator housing for the following loading scenarios:

- (1) maximum operating system pressure with butterfly valve closed and pushing towards squeeze.
- (2) maximum operating system pressure with butterfly valve open, and all intermediate positions.
- (3) loads resulting from hydraulic actuator movement with mechanical locking device engaged, and mechanical locking device partially engaged.

b. New operator housing must occupy the same space as the existing housing as shown; and similar to Willamette Iron and Steel Company (WISCO) P/N 4101 and 4201 as shown on WISCO drawings H-4078, H-4079 and H-4080. Make the housing from ASTM A36/A36M or ASTM A572/A572M welded steel construction, and machine finish all mating surfaces. Provide removable bolt-on inspection hatch(es) that allows full access to all components within the operator housing. Provide viewing window to visually verify when pin is engaged, disengaged, including intermediate positions to allow inspection of locking pin mating surfaces. Do not final machine the surfaces of the housing that interface and mate with the butterfly valve until the existing BFV operators are removed and the butterfly valves and operators are inspected and measured as specified in paragraph GENERAL REMOVAL OF EXISTING EQUIPMENT.

2.1.5.3 Link, Lever (Crank), Pins, and Crosshead

Design the link, lever (crank), pins, and crosshead in accordance with these specifications. Make the link, lever (crank), pins, and crosshead from materials of equal or better than existing, as shown and detailed on the WISCO drawings.

2.1.5.4 BFV Operator Assembly Components

Provide all of the components for each BFV operator assembly substantially sized to OEM conditions, dimensions, and tolerances, except where modifications are required, specified, and shown. Where the design requires deviation to comply with these specifications, identify such in the BFV Operator Design of the system/routing design submittals and submit for approval. Do not final machine the bore of the lever (crank), or the mounting interfaces of the housing that mate with the butterfly valve until the existing BFV operators are removed and all details are inspected and measured as specified in paragraph GENERAL REMOVAL OF EXISTING EQUIPMENT, paragraph BFV OPERATOR ASSEMBLY PARTS AND PLANNING DOCUMENTS, and paragraph BFV OPERATORS REMOVAL AND INSTALLATION.

a. See WISCO reference drawings for existing details - field inspect, measure, and verify. Manufacture components that connected to the butterfly valve to a partially finished condition for both valves prior to Units 4 and 5 being taken out of service. Perform an Initial BFV Operator Assembly Dimensional Analysis using the drawings and knowledge of the components for each BFV operator assembly to determine the base dimension and their tolerances to set for the partially finished conditions. Determine which features of the components need adequate margin for adjustment to account for potential variation with existing components of Units 4 and 5, and detail what margin has been incorporated. Submit that analysis with the component drawings. Determine and identify which features are to be produced in the shop and which are to be produced in the field.

b. Materials must be in accordance with these specifications. If an equivalent material specification or type is to be used, then a formal request must be made to the government detailing the change in specification and why the change is needed and recommended. Any replacement or alternate piece due to obsolete or other must be clearly identified as such in all submitted materials. Submit BFV Operator Assembly Component Material Certifications for each new assembly component of the BFV operator assemblies.

2.1.5.5 Finished BFV Operator Assembly Components

The procured components of the BFV operator assemblies for both Penstock Butterfly Valves are to be finished to a ready to install condition. The BFV operator assembly dimensional analysis shall be performed in accordance with approved plans using the Existing BFV Operator Assembly Component Inspection results to determine the final dimensions of the components that were not previously to a ready to install condition. Submit the Revised BFV Operator Assembly Dimensional Analysis for Unit 4 and Revised BFV Operator Assembly Dimensional Analysis for Unit 5 with the unit's revised component drawings. In addition, new component features resulting from the Existing BFV Operator Assembly Component Inspection are to be generated on any of the applicable BFV operator components, provided the government has formally approved the feature.

2.1.5.6 Mechanical Locking Device

Design a mechanical locking device that is integral to the BFV operator to secure and lock the butterfly valve in the closed position, to protect personnel from accidental opening of the valve. Access to the mechanical locking device for operation, maintenance, and inspection must be from new BFV maintenance platform landing, as shown on M-420. Design must include the following:

a. The locking device must be capable of withstanding all forces obtainable from the hydraulic operator. Any inadvertent operation of the actuator with the mechanical locking device engaged must be a fully recoverable situation (e.g. the entire operator, the locking device, the hydraulic cylinder, the housing, mechanical connections, etc. cannot be damaged). This must be included in the design calculations.

b. Design the pin and pin collar with sufficient clearance to allow smooth operation of the locking pin, without binding, but not too loose that results in relaxing of the butterfly valve when closed and on squeeze. Diametric clearance must not exceed 1/8" unless otherwise

required by contractor design and submitted for approval.

c. Connect mechanical locking device as shown on M-420 and M-601, and include provisions to field adjust alignment of mechanical locking device to achieve optimal position with butterfly valve closed and on squeeze. This will be verified during the alignment check of butterfly valve disc bronze leaf seals (contact bluing check) specified in SECTION 22 00 00.00 26 BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING.

d. Mechanical locking device must be manually operated, with an operator lever as conceptually shown. Force to manually operate the locking pin must not exceed 40 pounds. Provide all operator lever linkages with bushings.

e. To lock the butterfly valve in the open position will require a similar method as the existing, by closing lockable plug valves ("bubble tight" block valve) to hydraulically lock the cylinder, as shown on M-601 and as described on reference drawing H-4066 Operating and Wiring Diagrams and Instructions.

f. Provide a limit switch for electrical indication of mechanical lock "engaged". Provide a second limit switch for electrical indication of mechanical lock "disengaged". Design the BFV controls such that with the BFV closed and the locking device engaged, the limit switch activated by the locking device must prevent any HPU operation of the butterfly valve. Provide mounting brackets for limit switches that are field adjustable.

2.1.6 Hydraulic Power Units

Provide self-contained hydraulic power units, packaged units designed by the Contractor to operate the quarter-turn hydraulic cylinder actuators (BFV operators) in accordance with the criteria stated in paragraph DESIGN PARAMETERS of this Section. Design the power units to meet the space limitations shown and configure essentially as indicated. The structure of the units both internally and externally must be adequate for the units to be free standing and capable of being lifted or moved without structural damage. Securely attach all components including piping, motors, pumps, manifolds, control console (control panel), and offline oil filtration system with heater to the power units in a manner to be free of damaging vibration during operation. Mount the control console on the HPU such that the center of the panel door is 65 inches from the floor, and account for the height of the secondary oil containment the HPU is mounted on. Design and provide each unit with forklift tubes and lifting eyes to facilitate lifting or moving the units, including the reservoir when full of oil. All structural designs, manufacture, and fabrication of the HPU skid is to be in accordance with the provisions of Section 05 05 23.17 26, WELDING (STEEL), FABRICATION, AND MACHINE WORK and Section 05 50 04.00 26, METALS: MISCELLANEOUS, STANDARD ARTICLES, SHOP FABRICATED ITEMS. Affix steel nameplates that identify all major components to the HPUs and provide SAE threaded sample ports, test ports, and padlock lockable ball valves where noted on drawings.

2.1.6.1 Secondary Oil Containment

The entire hydraulic power unit, including the reservoir, pumps, offline oil filtration system, all piping, valves, and routing each must be within an oil containment skid. Said containment skid must be capable of holding

1.5 times the total system volume without loss of fluid. Provide threaded fittings for drainage with manual ball valve and plug installed. Design oil containment skid to provide minimum 12 inch clearance between floor and underside of skid for access to oil piping fittings at floor penetrations.

2.1.7 Hydraulic Power Unit Reservoirs

a. Size each oil reservoir to meet the space limitations indicated and to accommodate 125 percent of the fluid needed for proper pressurization and actuation of the butterfly valve operator, drainage of all system components, and level monitoring. Size each oil reservoir such that normal operating oil level does not fluctuate more than one-half inch between butterfly valve open position versus butterfly valve closed (i.e. due to unbalanced cylinder oil volume differences). Make the reservoir of steel with welded joints and conform to the requirements as shown. Manufacture and fabrication of the HPU reservoir is to be in accordance with the provisions of Contract specification Section 05 05 23.18 26, BOILER PRESSURE VESSEL CODE WELDING AND FABRICATION. The HPU reservoir need not be certified per ASME BPVC as a pressure vessel, however, the fabrication details (weld detailing) as well as the certification of welders are to be in accordance with the provisions of Section 05 05 23.18 26. The HPU reservoir structure must be capable of handling a minimum of 5-psi internal gauge pressure.

b. Provide each reservoir with a drain with shut-off valve; a magnetic trap; low oil float level switches; and other appurtenances as indicated and as specified herein. Clean interior surfaces of the reservoir down to bright metal and coated per Section 09 97 02.00 26, PAINTS AND COATINGS, or with an approved alternate that is compatible with oil and water. Until final installation of the hydraulic equipment, seal all openings with plastic closures.

c. In addition to the requirements detailed above, provide each hydraulic reservoir with the minimum requirements:

(1) Foot valve or check suction lines must provide flooded inlets to the pumps.

(2) Shape and slope the bottom of the reservoir to facilitate emptying and cleaning.

(3) Provide each side of the reservoir with a cleanout opening of not less than 400 square inches clearance with a bolted, gasketed cover.

(4) Equip the reservoir with a single, continuous, non-breakable external sight gauge for fluid level indications. Size the external sight gauge to accommodate all reservoir fluid levels with enough resolution to distinguish fluid levels accurate up to two gallons.

(5) Equip the reservoir with a filler that has a built-in strainer in which the strainer can be inspected and removable without requiring draining of the reservoir. Locate the reservoir filler discharge such that it is no more than 4 inches from the bottom of the reservoir.

(6) Provide a baffle between the intake and return lines to facilitate the separation of air and foreign matter from the hydraulic fluid. The connection between the chambers of the reservoir must be high enough from the bottom to form a settling chamber.

(7) Bring both the intake and return pipes (i.e. the openings) down to a distance of 1-1/2 pipe diameters above the tank bottom. Locate the offline oil filtration system intake near return lines from the solenoid operated control valves. Locate the offline oil filtration system return line near the hydraulic pump suction lines.

(8) Securely attached the reservoir to the secondary oil containment.

(9) Furnish all piping, fittings, hose, manifold blocks, fasteners and appurtenances required to connect equipment to the reservoir.

(10) Provide the hydraulic reservoir fabricated from a material that is compatible with the hydraulic fluid and acceptable for use over the full range of the system fluid temperatures without staining or distortion.

(11) Finish the welded joints of the reservoir smooth and free from irregularities. Do not grind welds to an extent that weakens the reservoir.

2.1.7.1 Offline Oil Filtration System (Oil Conditioner) with Heater

A depth-type offline oil filtration system with a heater added to the hydraulic power unit to service the oil and maintain clean and dry oil in the hydraulic power unit reservoir. This filter system must be a true offline system, capable of circulating the oil in the reservoir even if the hydraulic power unit is shutdown. This system is intended for intermittent use since butterfly valve operation is typically once per year. This system must be capable of removing solid impurities to achieve and maintain ISO 4406 Cleanliness Code of 17/15/12 or better. The system must be capable of removing all free and emulsified water from the oil. The filters in these systems must also be capable of removing varnish, wear particles and other contaminants without removing additives from the hydraulic oil. The system will be operated in a controlled environment with an ambient temperature range of 65 to 85 deg F. The heater must be capable of heating up the temperature of the oil through the filter system to 108 deg F. As part of the filter system, include a sealed drain tank that contains the fluid during filter changes and maintenance. The offline oil filtration system must comply with the following features:

- a. Flow rate approximation of 32 gallons per hour (assuming a reservoir normal operating oil level volume of 50 gallons). Design system to turn over the reservoir normal operating oil volume approximately 15-times in a 24-hour period.
- b. Use a gear type pump.
- c. A relief valve, set to prevent damage to system components, is required in the pump. Alternatively, provide a high pressure shut-down switch for the off-line pump and no relief valves in the off-line loop.

- d. Do not install any by-pass valve in or around the filter housing.
- e. The filter system must have an attached oil heater, and heater must be prior to filter in flow path, as shown.
- f. Use low watt density type oil heater elements. The kilowatt rating range must be between 1.5 to 3.0 kilowatt. Do not exceed 12 watt/square inch for the watt density of the heater. Make the oil temperature manually adjustable and thermostatically controlled, factory set at 75 degrees F. Equip the oil heater with a thermal fuse or shutdown to prevent overheating the oil in case the thermostat fails while on. Indicate shutdown status of the heating element by turning off the red light on the control panel that normally indicates the heater is on. The temperature adjustment range must be 75 to 120 deg F with +/- 2 deg F differential switch. Fit the switch with an external calibrated adjustment knob.
- g. Mount or plumb the gear type pump to the filter housing, allowing oil to flow through the filter media. Discharge clean and dry oil from the base of the filter housing. Route the suction and return lines as specified in paragraph HYDRAULIC POWER UNIT RESERVOIRS.
- h. A dual maximum indicating pressure gauge (one such as LENZ for example) with minimum 2.0" Ø dial face must be installed on the filter housing to display both the current pressure and record the maximum differential pressure reached, by means of a black indicating needle and red recording needle with reset knob. Set a separate pressure switch not to exceed maximum operating pressure of filter element and it must shut down the offline system and indicate status by means of a red light on the control panel.
- i. The filter must have an SAE threaded oil valve after the pump to enable sampling of the oil from the reservoir.
- j. The filter housing cover must be one section, having handles to allow for removal. Use 150 percent of operating pressure as the minimum and 176 deg F as the maximum temperature for design. Install an O-ring seal at the filter base, between the base and the filter housing. Equip the top of the housing with an automatic air vent, and a top nut for securing the housing.
- k. The filter elements must be depth-type cellulose material, minimum rated at Beta sub 3=75, and capable of absorbing water.
- l. The minimum dirt holding capacity of the filter system must be 0.4 gallons per filter element.
- m. The minimum degradation product (including varnish) removal capacity of these filter system must be 2.2 pounds per filter element.
- n. The total volume of dirt and degradation product captured by these filter system may include up to 50 percent water.
- o. Design the system to operate safely unattended.
- p. Install a through bolt at the base of the filter and run vertically through the filter housing. Seal the filter at the base by means of a plate and seal at the top by means of a spring housing. The top housing must have a spring inserted and a nut that compresses the

spring against the housing, thereby sealing the top of the filter and preventing bypass.

q. Mount a drain ball valve at the base of the filter housing that directs drain oil into the reservoir, consider it as a return pipe.

r. Mount on the hydraulic power unit a filter system. The overall dimensions of the filter system must be contained within the overall dimensions of the hydraulic power unit and within the secondary oil containment skid.

s. Consumables such as filter elements, along with parts such as electrical motors and gear pumps, must be readily available for replacement.

t. Paint all metal surfaces, not stainless, per Section 09 97 02.00 26 PAINTS AND COATINGS.

u. The electrical operating system on each unit must be rated for and suitable for connection to an industrial 480 volt, 3-phase, 60 Hz, 50 amp supply and be CE or UL labeled. Design the electrical operating system for each unit in accordance with Section 26 00 00.00 26, MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT.

v. Include a control panel as part of the hydraulic power units Integrated Controls and Instrument Panel with steel nameplates that identify the components and setpoints.

w. Connecting ports for plumbing to reservoir must be SAE O-ring or 37-degree JIC flare fittings.

x. A programmable timer that will allow a day and hour(s) duration setting for operation of the heating system. Factory set the timer such that the unit runs continuously, but has adjustment ability to be set on an hourly interval. Design such that heater cannot be "on" unless pump is running.

2.1.7.2 Magnetic Separators

Provide the manufacturer's standard magnetic separator inside the reservoir. The magnetic separator consists of a high-strength permanent magnet arranged for rigid mounting with the poles of the magnet exposed and fully submerged in the fluid in the reservoir. The magnet must be mounted on a removable rod assembly installed through the top of the reservoir and located near the return line pipe opening.

2.1.7.3 Low Level Float Switches

Provide each power unit with two float switches. The switches must be flanged and installed inside a 5-inch nominal diameter pipe to eliminate surge effects. The mercury type switches must have a narrow differential and be rated for 13 amp at 120 volts. Set switches to close when oil level drops below 3 inches above the centerline of the hydraulic pump suction lines, or a value recommended by the HPU designer/manufacturer and observed during operational tests. Provide a NEMA 4X junction box.

2.1.7.4 Air Breather

a. Provide the reservoir with two air breathers that removes dirt and

moisture from the incoming air and include vacuum relief valves as an additional indicator of plugged breathers. The incoming air must first pass through a desiccant bed to remove the moisture, and then pass through a filter to eliminate the solid contaminants before entering the reservoir. Outgoing air must pass directly to the atmosphere through a check valve. The breather must also provide visual indication of the desiccant and filter condition. The unit must contain approximately 1.0 lb of silica-gel desiccant and be capable of absorbing at least 6.0 fluid oz of water. The minimum airflow through the breather must be at least 15 CFM = 112 GPM.

b. Construct the breather of epoxy coated steel housing or high impact resistant ABS end caps, and clear acrylic body, containing an air filter, desiccant bag filter, and silica-gel filter. The filtration must be capable of containing particulates down to 3 micron in size and have a beta ratio equal to 75 or better. Equip the assembly with a sight glass indicator that clearly shows the need for a rebuild. Ensure the indicator shows a color change when a rebuild is necessary. The operating temperature range must be 0 to 200 deg F.

2.1.7.5 Oil Level Sight Gauge

Provide a single, continuous, non-breakable external sight gauge for fluid level indication. Provide this oil level gauge with an indicating length of not less than 12 inches on each unit and position to give a visual indication of the oil level in the tank including the "low level", "add oil", "nor. min. level", and "max. level" marks. Size the external sight gauge to accommodate all reservoir fluid levels with enough resolution to distinguish fluid levels accurate up to two gallons. After the system is operational and all tests complete, permanently mark the levels on the tank in a manner approved by the Contracting Officer.

2.1.8 Piston Pumps

Provide two identical hydraulic pumps for each HPU. Each pump must adhere to the requirements detailed below. Pump volumetric ratings, tests, type, application, and mounting provisions must be in accordance with manufacturer's instructions and tested by approved methods for conformance with performance ratings. The pump selection is determined by the Contractor, and approved by the Government via Design Data submittals, for proper butterfly valve operation as detailed in paragraph BUTTERFLY VALVE DESIGN PARAMETERS of Section 22 00 00.00 26, BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING.

a. Pumps must be electric motor-driven, pressure compensated variable flow rate, axial piston type pumps.

b. Each pump must be rated for continuous operation to deliver at least 125 percent of volumetric flow required to operate the butterfly valve operator hydraulic cylinder actuator at a discharge pressure equal to or greater than the system design pressure to perform open and close operations in accordance with the specified design parameters. The flow rating must correspond with the hydraulic fluid type and temperature range as specified herein and at the rated speed of the selected electric motor.

c. Ensure that the pumps are compatible with the hydraulic fluid as specified herein.

- d. Maximum rotating speed must be no greater than 1800 rpm.
- e. Provide flexible connections, made from flexible hose meeting the requirements of PARAGRAPH: FLEXIBLE HOSES in this Section, on the discharge ports of each pump.
- f. Provide with each pump individual case drain plumbing back to tank.
- g. Provide with each pump discharge an adjustable pressure relief component.
- h. Provide safety guards for all exposed rotating parts in accordance with 29 CFR 1910.219.
- i. Mount the pumps to the electric motors by means of C-face adapter and coupling arrangement. Magnesium alloy couplings are not allowed.
- j. Mount the motor/pump combination to the HPU skid in a manner such that the pump suction is flooded.
- k. The pump motors are specified in paragraph ELECTRICAL EQUIPMENT of this Section with additional requirements specified in Section 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT in paragraph MOTORS.

2.1.9 Manual Hand Pumps

Provide a manually operated hydraulic hand pump for each HPU, designed to operate the butterfly valve when electrical power is unavailable. Permanently mount the manual hand pump to the HPU top plate and plumb into the HPU hydraulic circuit. Manual hand pump mode must operate without electrical power (e.g. switching into hand pump mode and moving the control valve to allow for butterfly valve open/close movement must not require electrical power). Provide as large a manual hydraulic hand pump as feasibly possible to limit the total operating time to close the butterfly valve from full open to full closed.

2.1.10 HPU Filters(s)

Locate filters in the pressure line after the pumps and the return line to the reservoir. Provide the duplex type filters with a differential pressure device to indicate the need for filter element service. Provide filter housing and cover made of steel or cast iron construction. Bolt the cover to the main housing. Locate filters so that they can be changed without removal of or interference with other hydraulic system components and located outside the reservoir and with a housing that allows containment of oil when changing filter elements. Shut-off valves must be easily accessible. Equip the filter with a relief valve which protects the filter against excessive pressures. Equip the filter unit with a gauge or gauges indicating the pressure loss or a cartridge replacement indicator. Equip the filter unit with a pressure switch to signal excessive pressure loss across the filter. The filter cartridges must not remove additives from the hydraulic fluid. The filter element must have a rating of 10 microns absolute. The filter elements must have a minimum silt control rating of Beta sub two = 2 and Beta sub ten = 75 at 60 psi differential pressure in accordance with ISO 16889. The filters must be rated for use with hydraulic oil and the pressure drop should not exceed 6 psi in the clean condition. Determine the pressure and flow rating of the filters to be compatible with this design of the power units.

2.1.11 Gauges

2.1.11.1 Pressure Gauges

Conform to ASME B40.100, have a black enameled metal case, a 4-1/2 inch dial, and a stainless steel Bourdon tube. The scale range of the gauge must be approximately 150 percent of the maximum pressure of the line in which installed. Provide safety type gauges with solid fronts and blowout backs. Provide each gauge with a pressure snubber. Mount each gauge as indicated. Panel mount the pressure gauges and make them readable from the front of the power unit after opening the doors of the enclosure and provide steel nameplates with setpoints included. Bottom tap gauges and gauge lines in horizontal pressure lines.

2.1.11.2 Thermometer

Provide a direct indicating thermometer (temperature gauge) to indicate fluid temperature in the reservoir. Do not use Mercury in thermometers. Provide a remote reading, capillary tube-and-bulb type thermometer, panel mounted. The thermometer must have a minimum 3 inch dial with black markings on a white background, with scale range of 20 to 240 degrees F. Provide a corrosion resistant case and stem, and stainless steel wetted components. Provide thermometer wells of the separable socket type for each thermometer with a direct type bulb.

2.1.12 Manifolds

Provide pre-drilled manifold blocks for connection of control valve assemblies. Construct each manifold block of ductile iron, ASTM A536 or approved equal material. Machine ports and passages smooth and free of burrs and sharp edges. Arrange manifold block interconnecting passages and valving so as to provide the system connections and functions as indicated. Manifold block interconnecting passages and valving must be of ample proportions to minimize internal pressure losses. Machine surfaces and recesses where valving and other components are installed to the specifications of the applicable valve or component manufacturer. Make provisions for attaching the hydraulic piping to the manifolds by the use of flanges as specified in paragraph PIPE FITTINGS and as indicated. The manifold must be in accordance with the valve manufacturer's recommendations to provide for installation of valves, flanges and accessories. Make hydraulic interconnections between the manifold and piping with 4 bolt flanges (SAE Code 61 or 62) or SAE straight thread ends and Buna N o-rings fittings as detailed below in subpart PIPING. Design the manifold for a minimum operating pressure rating of not less than 3000 psi at 150 deg F except as hereafter specified. Use of NPT fittings and adapters will be cause for rejection.

2.1.13 Test Ports, Quick Disconnect Type

Provide steel quick disconnect type hydraulic test ports at the locations shown, in addition to any other locations required by the HPU designer and contractor. All test ports must have threaded dust cap with steel wired lanyard.

2.1.14 Valves

a. Valves must have a minimum pressure rating of 1.5 times the system pressure unless stated otherwise. Manifold mounted valves must be

either cartridge type or subplate mounted. Non manifold mounted valves larger than 1-1/4 inch must have socket-welded piping connections. Valves 1-1/4 inch and smaller must have SAE straight thread ends and Buna N O-rings with tube fittings. Valves must be specifically designed and rated for hydraulic system applications.

b. Submit Valve Data and Valve List. The Manufacturers Catalog Data must be submitted for each valve for use in each system. Data must indicate the name of the manufacturer, with data highlighted to indicate type, construction, class, and size and materials for body and bonnet, seating surfaces, stem, trim and hand wheels or levers. In addition, description of valve location and code number per the following paragraphs, the design pressure and temperature for the pipe in which the valve is located must be provided.

2.1.14.1 Shut-Off Valves

Provide in-line mounted, stainless steel, lever operated, ball type (except where plug type is shown on drawings). Shut-off valves at piping manifolds of each cylinder at the upstream and downstream locations for the main supply and return lines must be sized and rated for a working pressure determined by the Contractor's design, double acting type. Shut-off valves for all other lines must be ball type, match the line size, and have a maximum allowable working pressure of 3000 psi. The valve must be three piece with either socket-weld ends or SAE Code 61 flanged pipe ends. Provide a removable operating lever for each valve. Valves must be specifically designed and rated for hydraulic system applications. Provide with stainless steel valve trim including handles. The valves must have replaceable seats and be repairable without disturbing the welded connections. Provide padlock lockable valves where indicated on the contract drawings. Valve handles must have colored sleeve to match normal operating position.

2.1.14.2 Needle Valves

Make needle valves of stainless steel and design for fine flow regulation. Use Buna N stem sealing O-rings.

2.1.14.3 Manual Control Valves

2.1.14.3.1 Flow

Flow control valves must be subplate mounted for socket-welded piping. The valves must be pressure-compensating, free flowing in one direction, and adjustable. The valves must be capable of being locked in position to prevent an unintentional adjustment. The flow rating must be determined by the Contractor in accordance with the design criteria stated in paragraph DESIGN PARAMETERS of this Section.

2.1.14.3.2 Manual Four-Way Directional Control Valves

The rotary shear seal type, open or closed center and detent or spring centered as indicated. The valve must be three position, subplate mounted with socket-welded piping connections. The flow rating must be determined by the Contractor in accordance with the design criteria stated in paragraph DESIGN PARAMETERS of this Section.

2.1.14.4 Solenoid Operated Control Valves

Solenoids must be rated for continuous operation without damage or malfunction. Solenoids must operate the valves within a 10 percent fluctuation range. All moving parts and windings of the solenoids must be totally enclosed to prevent entrance of dirt and moisture. Pilot fluid supply must be internally supplied and externally drained from the power circuit. Vent both end cap chambers as necessary to achieve spring centering. Equip the valve with manual lever weather protected overrides.

2.1.14.4.1 Solenoid-Controlled, Spring Return, Four-Way Directional Valves

Provide three position, no-detents, spring return to closed center, four-way directional, solenoid-controlled directional valves with the capability of being manually operated in the event of power loss via a lever or push rod. The valve must be subplate mounted with socket-welded piping connections. The valve's amplifier must be of the same manufacturer as the throttle valve. Provide a power supply for the valve and amplifier. Input to the power supply must be 125 volts DC. Determine the flow rating in accordance with the design criteria stated in paragraph DESIGN PARAMETERS.

2.1.14.5 Pressure Relief Valves

Provide adjustable pressure relief valves with a body designed for a set pressure to protect the systems. Determine the flow capacity in accordance with the design criteria stated in paragraph DESIGN PARAMETERS. Provide all relief valves that are field adjustable with key-lockable adjustment handles. Final factory settings must be as indicated, unless otherwise approved in writing by the Contracting Officer.

2.1.14.6 Supply Spring Loaded Check Valves

Provide spring loaded check valves of stainless steel construction, the ball or poppet type with a body designed for high shock and system service.

2.1.14.7 Bleeder Valves

Provide 1/4 inch, stainless steel construction, wrench operated bleeder valves.

2.1.14.8 Pressure Snubbers

Provide pressure snubbers for all pressure gauges and pressure switches to protect against shock and provide more stable instrument operation. Snubbers must be of stainless steel construction.

2.1.14.9 Counterbalance Valves

Install in the oil line to the rod end port of the operator piston to balance the load being held by the cylinder. The valve must be directly operated, externally drained, and adjustable for operating over a pressure range identified by the Contractor. Design the valve for a system operating pressure required by the penstock butterfly valve operator piston. The capacity rating for the valve must be determined by the Contractor's design. The valve must permit unrestrained flow into the rod end of penstock butterfly valve operator piston and must function to retain pressure in the cylinder in the amount of the valve's pressure adjustment. The counterbalance valve must be factory set in accordance

with the settings as indicated.

2.1.14.10 Blockout Valves

Blockout valves must have a handle with a lockout feature that accommodates a standard padlock.

2.1.15 Piping

Design piping, tubing, and hose for a working pressure of 1000 psi. Use pipe when a 1 inch or larger diameter is required. Use tubing when less than 1 inch diameter is required. Provide power piping equal or exceeding the requirements of ASME B31.1, and subsequent addenda unless otherwise specified herein or indicated.

2.1.15.1 Pipe

Use seamless stainless steel conforming to ASME B36.19M and ASTM A312/A312M, Grade TP304. The piping weight class must be of a Schedule that will withstand a proof pressure of two times system pressure without deformation, and a burst pressure of four times system pressure without leakage.

2.1.15.2 Pipe Fittings

Use the socket welding type pipe fittings conforming to ASME B16.11 and made of stainless steel conforming to and ASTM A182/A182M, Grade F304. Provide pressure class a minimum of 3000 pounds. Conform flanges to ASTM A182/A182M or ASTM A240/A240M or SAE J518-1 Code 61 or Code 62 with the grade suitable for the pipe to which attached. Also conform threaded fittings to the above, but use only where absolutely necessary for the application.

2.1.15.3 Pipe and Tube Hangers and Supports

Locate all pipe support devices at intervals no greater than 6 feet between centerlines of adjacent supports, except as modified herein. Install support devices on both sides of a bend within four nominal pipe or tube diameters of the bend location. Furnish all supports, hangers, sleeves and brackets complete with compatible mounting hardware and appurtenances. Conventional pipe hangers and support must meet the applicable requirements of MSS SP-58 type as required. Provide stainless steel pipe supports and hangers. Provide special hangers and anchors as indicated. Construct tube supports of stainless steel hardware with polypropylene support halves. Furnish each tube support with all mounting hardware required to connect with the appropriate anchorage system.

2.1.15.4 Sleeves and Wall Brackets

Fabricate sleeves and wall brackets of stainless steel. Locate and mount sleeves and wall brackets in such a way that significantly matches existing equipment as to minimize the amount of new mounting holes necessary. Inform the Government, in the Hydraulic Plumbing - Routing And Mounting Locations submittal, of all proposed mounting locations for both new and existing, detailing what holes and anchor points will be reused and which ones will need to be new.

2.1.15.5 Pipe Penetration Seals

Provide modular mechanical type pipe penetration seals, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and opening. Assemble links to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Tightening of the bolts must cause the rubber sealing elements to expand and provide a watertight seal.

2.1.15.6 Unions

Provide O-ring type unions, made of stainless steel with socket-welding ends. The Contractor may at their option substitute four bolt split flanges with Buna N O-rings for the unions.

2.1.15.7 Hydraulic Tubing

Stainless steel tubing used for hydraulic circuits must meet the applicable requirements of ASTM A269/A269M for Grade TP 304, Seamless ASTM A789/A789M. Select the wall thickness to provide a safety factor of 6 based on the manufacturer's ratings for burst strength in relation to the maximum working pressure.

2.1.15.8 Tube Fittings

Provide flareless type or 37-degree JIC flare type fittings with SAE straight threads and Buna N O-ring seals. Each fitting must hold the tubing with a chucking action; the fitting must provide a firm flat grip on the tubing without penetration of the tubing wall. Fittings must not twist the tubing during assembly. Fittings must provide a leak-proof seal at the rated working pressure of the tubing. All fittings must be stainless steel. Provide fittings conforming to SAE J514.

2.1.15.9 Hose

All flexible hose must have an inside diameter to match the line size to which it is to be connected to, minimum working pressure of the hose must be rated not lower than the system operating pressure indicated with a factor of safety of 4. Provide hose that is wire-reinforced, high-pressure-type made of neoprene or Buna N. The hose must be for general industrial use in hydraulic systems with petroleum base hydraulic fluids. Design fittings specifically for use with the hose selected and as recommended by the hose manufacturer. Make fittings of stainless steel and the reusable type. Fit the hose with a nylon sleeve to protect and prevent abrasion of the hose cover. Maintain minimum bending radii. The hoses when installed must appear neat and not kink or have sharp bends and must not rub, bind or ride over one another through the entire motion of the operator. Protect the finished surfaces prior to installation of the flanges. The hoses when installed must have proper clearances such that additional stresses are not imposed on the hoses or their associated fittings due to expansion and contraction as a result of temperature or pressure changes. Maximum continuous hose runs must not be greater than three (3) feet in length. Use hoses only where absolutely necessary which includes but is not limited to vibration isolation of pump motors, connections across joints, and to dampen impact of hydraulic pressure fluctuation from pump discharge and control valves.

2.1.16 Bolts, Nuts, and Washers

2.1.16.1 Carbon Steel Bolts and Nuts

Conform to ASTM A354, Grade BC, with ASTM A194/A194M, Grade 2H nuts. Structural bolted connections carrying primary loads must be made with ASTM A325 bolts.

2.1.16.2 Stainless Steel Bolts and Nuts

Conform to ASTM A193/A193M, Grade B8M, with ASTM A194/A194M, Grade 8M nuts.

2.1.16.3 Flat Washers

Conform to ASTM F844.

2.1.17 Hydraulic Fluid

The hydraulic fluid to be used during shop testing, to fill the cylinders before shipment, flush the system after installation, and to fill the complete hydraulic system must be a hydraulic oil that is compatible with what is currently in use at Fort Peck (TELLUS Shell 32), unless approved by the Government in writing. Upon delivery of new hydraulic oil to the Project site, collect oil samples in accordance with ASTM D4057. Test samples in accordance with the requirements as detailed in paragraph CLEANING AND FLUSHING in this Section. Submit New Hydraulic Fluid Test Results within the timeline specified in paragraph SUBMITTALS SD-06. If any sample does not comply with the permissible contamination limits, the supply of hydraulic fluid must be either replaced or the cleaning and filtering process must be repeated, followed by a repeat of the samplings, inspections and testing. Notify the Government of any failure of a fluid sample to adhere to the requirements and inform them of the corrective actions taken.

2.2 ELECTRICAL EQUIPMENT

Provide electrical equipment for the hydraulic power systems as indicated and as specified. Other electrical materials and equipment required for the installation of the hydraulic power systems is specified in SECTION 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT. Furnish standard catalog item electrical equipment under regular manufacture with pre-existing catalog ratings equal to or better than the requirements of the contract drawings and specifications. Accompany request for approval of equipment other than as specified or as indicated by technical and descriptive data and specifications sufficient for the Contracting Officer to determine its adequacy. Unless otherwise specified or indicated, electrical materials and equipment must meet the standards, specifications, and tests referenced.

Submit data specifications and assembly drawings showing sizes, ratings, parts and material lists, overall dimensions, and mounting dimensions with the product data.

2.2.1 Pump Motors

The pump motors must conform to the applicable requirements of NEMA MG 1, except as hereinafter specified, and designed to withstand full voltage starting. The motor must be of totally enclosed frame, fan cooled construction. Provide a stainless steel drain-breather similar and equal

to Crouse-Hinds type "ECD Universal" and locate so that any water present can be drained from inside the motor. Provide manual or automatic control and protective or signal devices required for the operation, and any control wiring required for controls and devices but not shown on the electrical drawings. The motors must operate on 480 volt AC, 60 Hz, 3 phase power and sized to operate the pumps specified in paragraph PISTON PUMPS. Design motors to operate continuously without exceeding the temperature rise permitted by the applicable NEMA standards for the class of insulation and frame construction used.

2.2.2 Control Consoles and Valve and Gauge Panels

2.2.2.1 Control Console Construction

Provide control console (control panel) in accordance with SECTION 26 00 00.00 26 MISCELLANEOUS ELECTRICAL WORK AND EQUIPMENT paragraph BOXES, CABINETS, AND ENCLOSURES. Equip the console with adequate louvered panels to ventilate the interior and dissipate the heat generated within the console. Provide special equipment supports and guides as required to support the equipment and other components within the console.

2.2.2.2 Valve and Gauge Panel Construction

Construct valve and gauge panels of stainless steel plate thick enough to provide rigid support for the valves and other components mounted thereon. Terminate all piping with bulkhead type connections in a position convenient for the connection of external lines.

2.2.2.3 Nameplates and Instruction Plates

Provide nameplates for each device on the control console, valve panels, and gauge panels. Nameplates must clearly indicate the function of each device and, in the case of manually operated controls, indicate the condition established for each position of the control. Instruction plates must clearly indicate the proper procedures and sequences of operations to activate the system, to operate the system, and to secure the system after completion of operation. Machine engrave lettering on nameplates on steel plate with a black background. Mount instruction plates on a rigid backing and covered with clear, rigid plastic sheeting. Mount instruction plates in a location easily visible to an operator stationed at the console or panel.

2.3 PAINT

See Section 09 97 02.00 26 PAINTS AND COATINGS.

2.4 SPECIAL TOOLS

Provide all special tools necessary for the proper operation, maintenance, assembly and disassembly of the machinery in a location and in a manner as directed by the Contracting Officer.

2.5 SPARE PARTS

2.5.1 General

Identify all Spare Parts in a list submitted to the Government. Include approved list in the O&M Manual specified in PART 3 of this Section. Package the spare parts for long-term storage in accordance with

requirements in this Section, paragraph DELIVERY, STORAGE, AND HANDLING. Where conflicting requirements exist, the most conservative requirement governs. Package spare parts with external labeling (on both the top and side of the container) including but not limited to: the contents date packaged, storage instructions, ambient temperature requirements, and any dates of importance such as packaging expiration. For rubber seal elements, use 7 silicone compound or approved equal to treat the seals prior to packaging for storage, and then seal the package for storage in a box that prevents exposure to UV. Include in the O&M Manual detailed instruction on removal and installation of all spare parts.

2.5.2 Spare Parts List

Furnish the following spare parts with the hydraulic systems. Also provide any additional spare parts recommended by the manufacturers and not otherwise included in the listing. Each spare part must have an attached identifier listing the part number, vendor or manufacturer and a contact address and phone number. The quantity specified represents the total number of each size/type furnished.

| | |
|---|--|
| One (1) hydraulic pump | One (1) hydraulic pump motor |
| One (1) hydraulic directional control valve | Ten (10) filters |
| Two (2) hydraulic pressure relief valves | Ten (10) air breathers |
| One (1) cartridge valve | One (1) spare pressure gauge for offline oil filtration system |
| One (1) control valve | Two (2) pressure gauges for the main hydraulic pressure line |
| Two (2) shut-off valves | One (1) pressure switch |
| One (1) pressure switch | One (1) float switch |
| One (1) temperature switch | One (1) set of each seal type for the BFV operators |
| One (1) 55-gallon drum of hydraulic oil | |

PART 3 EXECUTION

3.1 EXAMINATION

After visiting the site and becoming thoroughly familiar with all details of the work and working conditions, verify dimensions in the field, and then advise the Contracting Officer of any discrepancies prior to performing any work. The Contractor is specifically responsible for the coordination and proper relation of the contracted work to the structure and work of all trades.

3.2 DRAWINGS AND PRODUCT DATA

a. The Contract and Reference Drawings are intended as guidelines and for information only, respectively. Corrections and additions of any omissions from Contract Drawings is the responsibility of the Contractor, and the Government notified when such changes are made. If departures from the Contract Drawings are deemed necessary by the

Contractor, details of such departures, including changes in related portions of the project and the reasons therefore, must be submitted as part of each System/Routing Design. Submit As-Built Drawings in accordance with Section 01 33 00, SUBMITTAL PROCEDURES and Section 01 78 39.00 24, AS-BUILT DRAWINGS.

b. Include performance data and curves for pumps, motors and valves. Provide catalog cuts and outline dimensions for the pumps, motors, filters, heaters, thermostats, float switches, pressure switches, breathers, and all valves, valve controls and other accessories. For any non-applicable data, clearly annotate as not applicable. In addition, include description of component location and any associated code numbers, design ratings including temperatures, pressures, flow rate, setpoints, and times.

3.3 TEST PROCEDURES

All test procedures are to be submitted to the Government for review as required for all preconstruction submittals under this Contract. Submit all test procedures within the timeline specified in paragraph SUBMITTALS SD-01 to ensure agreement as to personnel required and scope of the testing program. Notify the Contracting Officer within the timeline specified in paragraph COORDINATION and paragraph SUBMITTALS SD-07 'Inspection and Test Notification'. Prepare test procedures, as mentioned throughout these Contract specifications, that meet the following requirements as detailed in this subpart of the Contract specification Section. All procedures must be written to delineate between each unit tested, and include detailed step by step procedures and outline all activities to occur during the test including, but not limited to, the following:

- a. Inspection of components (verifying assembly and cleanliness).
- b. List of all equipment or supplies necessary.
- c. Details regarding method of energizing and actuating equipment.
- d. Identification of test point, and expected results of each test point.
- e. Test pressures, and methods of applying and releasing test pressures.
- f. Read and record pressures for all supply and return lines for each direction of operation.
- g. Documentation points, and identification of any hydraulic or electrical aspect being simulated with inclusions of diagrams or schematics.
- h. Check and adjust flow control valves as required to conform to the indicated operating time requirements.
- i. Adjust chokes in pilot circuits of pilot-operated valves to obtain smooth, shock-free operation.
- j. Monitor and note system and component responses.
- k. During all tests, inspect all the lines and components for evidence

of leakage.

l. Response of components to operation of applicable controls must be inspected to ensure that all connections have been made properly.

m. Correct any discrepancies at no additional expense to the Government.

3.4 TEST REPORTS

Prepare and complete test reports showing in detail the results of the applicable tests that was performed. Test reports, at a minimum, must include the detailed testing procedures used, a detailed tabulation showing values of pressures, flow rates, and all adjustments recorded during the tests, and adjustment and calibration of the entire system. Include in each test report a detailed description and timeline of all discrepancies and failures encountered during the testing including the implemented resolutions. Use photographs and graphics in the reports to support the written details. All shop and all field test reports must be submitted to the Government for review no later than 10 days following the last day of testing of the respective system, unless otherwise stated in paragraph SUBMITTALS SD-06. During each test run, at a minimum, record the following data and observations as applicable:

- a. Control operation
- b. Voltages
- c. Currents
- d. Pressures
- e. Speeds and times
- f. Flow control valve settings
- g. Alignment and operating clearances
- h. Excessive vibration, by component
- i. Temperature of motors and hydraulic fluid
- j. Pertinent observations regarding such events as unusual sounds, malfunctions or difficulties encountered, and adjustments required.
- k. Hydraulic fluid cleanliness
- l. Pressure settings

3.5 SHOP ASSEMBLY AND TESTING (FACTORY TESTS)

Where applicable, shop assemble and shop test each new system and/or system components insofar as is possible using temporary piping and wiring to determine the correctness of fabrication and the matching of component parts to ensure acceptable operation after field erection. Perform shop tests in the presence of the Contracting Officer and a representative of the Hydroelectric Design Center (HDC), unless otherwise authorized in writing. Upon satisfactory completion of the shop assembly and testing, preliminary acceptance will be made by the Contracting Officer.

3.5.1 Cleaning and Flushing

Perform shop cleaning and flushing prior to factory tests. Submit a Procedure for Shop Cleaning and Flushing that includes a complete procedure for shop cleaning, flushing, fluid sampling, and fluid testing for all HPU's and BFV Operators. During assembly, securely cover all openings to avoid the entrance of abrasives, dirt, metal chips, and other foreign materials into the hydraulic system through open ends of piping, tubing, and ports of the components. Use the same hydraulic fluid for flushing as approved for final filling. Include a detailed description of the equipment, materials, hydraulic fluid, temperatures, and duration of each phase of the flushing in the procedures. Clean the systems of particles so that the contamination level is 15/13/10 or better in accordance with ISO 4406. Take three 500 milliliter samples at approved locations according to ISO 4021. Perform particle counting on each sample in accordance with SAE AS598A by an approved independent test laboratory. Submit a Shop Test Hydraulic Fluid Sampling Results report within the timeline specified in paragraph SUBMITTALS SD-06. Water content of each sample must be below 200 ppm. Re-clean and re-inspect the system if any sample does not comply with the permissible contamination limits. When flushing is completed, drain the system and then fill with enough of the specified hydraulic fluid to protect the metal surfaces. Submit a Shop Cleaning And Flushing Report within the timeline specified in paragraph SUBMITTALS SD-06. Additionally, include all required information as outlined in subpart TEST REPORTS.

3.5.1.1 Flushing Piping

Flush all hydraulic piping before connection to the HPU's, BFV operators, and manifolds. Circulate hydraulic fluid through each and every pipe unit until returning oil meets the requirement for system cleanliness. Sequence flushing so that all piping is flushed in both directions. The flow capacity of the flushing system must produce a minimum velocity of 15 feet per second in all piping and have passed through a 5 micron filter. Clean the interior of the piping with lint free cloths. Provide means to verify the flow rate during the flushing operation.

3.5.1.2 Flushing Manifolds and Hoses

After cleaning and prior to installation, flush each valve manifold, pipe manifold, and hose by circulating hydraulic fluid through all ports until the returning fluid meets the requirement for system cleanliness.

3.5.2 BFV Operators Shop Assembly And Testing

a. Submit a BFV Operators Shop Assembly Plan that includes, at a minimum, the plan for procurement, fabrication, and assembly of each BFV operator in accordance with the Contract specifications as well as detailed plans for packaging and shipping of the operators.

b. Submit a BFV Operators Shop Testing Plan that details the shop testing procedure which meet the requirements outlined in subpart TEST PROCEDURES above. Perform shop testing of each BFV operator with the complete, fully assembled operator linkage assembly, housing, and mechanical locking device. Include a hydraulic schematic of the shop test setup detailing all items to be included and excluded from the tests, details of how the items are connected, operation for filling the hydraulic cylinder operators with the specified hydraulic fluid

filtered to 5 microns, step taken to exclude intrusion of air, details pertaining to the support structure of the BFV operator, and orientation of the BFV operators. Arrange and install test equipment of such quality that any leakage identified is not attributed to the test assembly. Shop testing of the BFV operators must also include hydrostatic tests of each cylinder at twice the system pressure for a minimum of four hours. With the rod and piston fully retracted, and the pressure applied to the rod end of the piston, observe the opposite side for leakage past the piston. Any leakage past the seals will be cause for rejection. Then cycle the cylinder rod and piston no less than five cycles while observing for leakage and smooth, even travel. Full retract to full extend and back to full retract is one cycle. Any operational problems or source of leakage to the outside of the cylinder will be cause for rejection.

c. Submit BFV Operators Shop Test Reports that includes all the results and findings of the shop testing of each BFV operator in addition to the required information as outlined in subpart TEST REPORTS. Submit within the timeline specified in paragraph SUBMITTALS SD-06. Shop test reports must be approved by the Contracting Officer prior to shipping units.

3.5.3 Hydraulic Power Units System Shop Assembly and Testing

a. Submit an HPU Shop Assembly Plan which includes at a minimum, the plan for procurement, fabrication, and assembly of each HPU in accordance with the Contract specifications as well as detailed plans for packaging and shipping each HPU.

b. Submit an HPU Shop Testing Plan that details the shop testing procedures which must meet the requirements outlined in subpart TEST PROCEDURES above. Perform shop testing of each HPU with the complete, fully assembled and fully integrated control panel built for this unit and operate the BFV operator manufactured for this application. Include in the submitted shop testing plan, details pertaining to how temperature sensors, pressure switches, and level switches will be tested. Testing of the level switches must be accomplished by physically filling and draining the reservoir; note requirements for hydraulic fluid cleanliness during all shop testing. Perform tests on all system sensors, switches and valves, inclusive of all manual overrides (this includes manual operation of each control valve). Include a hydraulic schematic of the shop test setup detailing items to be included and excluded from the tests, details regarding how the items are connected, operation for filling the reservoir and test equipment with the specified hydraulic fluid filtered to 5 microns, taking care to exclude air. Completely shop assemble and test insofar as is possible using temporary piping to each hydraulic power system to determine the correctness of fabrication and the matching of component parts to ensure acceptable operation after field erection. Test each motor-driven oil pump of the HPU in the shop as directed by the Contracting Officer. Include a hydrostatic pressure test, of the shop-fabricated power and control units and piping, at not less than 125 percent of the designed system working pressure. Valves and operators must undergo a functional test and the pumps tested to verify flow and pressure ratings. Any operational problems will be cause for rejection.

b. Submit a HPU Shop Test Reports to include all pertinent test information including the results of the test and the test

procedures. Additionally, include all required information as outlined in subpart TEST REPORTS. Submit within the timeline specified in paragraph SUBMITTALS SD-06. Shop test reports must be approved by the Contracting Officer prior to shipping units.

3.5.4 HPU Reservoir Shop Testing

a. Submit an HPU Reservoir Shop Testing Plan that details the shop testing procedures which must meet the requirements in paragraph TEST PROCEDURES above. Perform shop testing of each HPU reservoir separate from the shop testing of the HPU system. Shop testing of each HPU reservoir is to verify that the fabrication of the HPU is sufficient and capable of withstanding an internal gauge pressure of at least 5-psi. Test procedure is to include means of temporary plugging all ports in the HPU reservoir, sealing off the cleanout covers, and hydrostatically pressurizing the HPU reservoir to 5-psi gauge pressure and holding the pressure for no less than 15-minutes. Passing test criteria for the HPU reservoir is when the reservoir can contain 5-psi hydrostatic pressure for at least 15-minutes without any leakage. Include, as part of the test procedure, the plan for cleaning the HPU reservoir meeting the requirements detailed in paragraph CLEANING AND FLUSHING above.

b. Submit HPU Reservoir Shop Test Reports to include all pertinent test information including the results of the test and the test procedures. Additionally, include all required information as outlined in paragraph TEST REPORTS. Submit within the timeline specified in paragraph SUBMITTALS SD-06. Shop test reports must be approved by the Contracting Officer prior to shipping units.

3.6 GENERAL REMOVAL OF EXISTING EQUIPMENT

a. The existing equipment identified in the Contract Drawings, including but not limited to the existing penstock butterfly valve operators, hydraulic power units with reservoir, and all hydraulic tubing and hoses must be removed. All equipment not specified to be salvaged becomes the property of the Contractor, removed from the Project site, and disposed of in a legal manner. Materials that cannot be removed daily may be temporarily stored on-site at an approved area. Do not sell salvaged materials on the project site.

b. Submit an Existing Equipment Removal Procedure detailing the sequence and procedures for all systems and components to be removed or affected by the removal. Submit the equipment removal procedure together with each approved system design and applicable Installation Procedure. Procedure is to include but not be limited to a detailing of:

- (1) Items to be removed.
- (2) Temporary arrangement or storage of items.
- (3) Special containment and disposal procedures.
- (4) Protection procedures for open routing.
- (5) Spill prevention measures.
- (6) Lifting and laydown plans.

(7) Procedures for existing BFV operator inspection and field measurement (mounting and connection details).

3.6.1 Removal of Existing Hydraulic Oil

The Contractor is responsible for the extraction, containment, transportation, and disposal of all existing hydraulic fluid in the penstock butterfly valve operators, system routings, HPU components, and the HPU reservoirs. Details of the Contractor's plan and procedure are to be included in the submitted Existing Equipment Removal Procedure.

3.6.2 Existing BFV Operator Measurements

The existing BFV operators must be removed and all bolted connection points and mating surfaces to the existing BFV body, the valve stub shaft, and any other connection points between the new BFV operator to the existing equipment must be inspected and field measured. Use measurements to verify final connection details of new BFV operator, update drawings, and final machine each BFV operator housing and lever (crank) before shipping to Fort Peck. Perform in accordance with paragraph BFV OPERATOR ASSEMBLY PARTS AND PLANNING DOCUMENTS, and paragraph BFV OPERATORS REMOVAL AND INSTALLATION.

3.7 ERECTION ENGINEER

Obtain the services of experienced erection engineers who are regularly employed by the BFV operator manufacturer, and the HPU manufacturer, to supervise the installation, start-up, adjustment and operation, and testing of the equipment provided. They must be present for the entire duration of initial installation, start-up, adjustment and operation, and Government witness field testing, inspections, and final acceptance tests. Each erection engineer must furnish a signed statement stating that the final installation and start-up of the hydraulic power systems have been inspected, witnessed, and complies fully with the manufacturer's warranty requirements for the system design. Following completion of the work the erection engineers must instruct representatives of the Government in the operation and maintenance of the systems. These field instructions must cover all items contained in the bound instructions. Do not conduct instruction until Operation and Maintenance Manuals are approved by the Government.

3.8 INSTALLATION

Install the equipment specified and as shown on the drawings to complete the hydraulic power systems for operation of the butterfly valves. Install hydraulic components in accordance with the manufacturer's written instructions and under the direction of the erection engineer (i.e. BFV operator manufacturer's representative and HPU manufacturer's representative). Install complete units or assemblies without disassembly. Provide necessary supports for all appurtenances, pumps, motors, and other equipment or components as indicated. Anchor floor-mounted equipment to concrete pads by anchor bolts or expansion anchors as shown.

3.8.1 General

3.8.1.1 Contractor Responsibilities

The Contractor is responsible for any damage to the material, equipment, or structures caused by the Contractor's failure to properly clean and keep clean the hydraulic systems. Repair all such damages at no additional cost to the Government. Use new materials for repairs to piping.

3.8.1.2 Repair of Existing Work

Carefully lay out the work in advance. If cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work must be carefully done. Any damage to building, piping, or equipment must be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

3.8.1.3 Accessibility of Equipment

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible, including all valve and diffuser handles. Install any concealed valve, expansion joints, controls, dampers and equipment requiring access in locations freely accessible through access doors. Orient all displays of meters to be readily accessible for ease of viewing.

3.8.1.4 Hydraulic Fluid

The hydraulic fluid to be used during shop testing, to fill the cylinders before shipment, flush the systems after installation, and to fill the complete hydraulic systems must be ISO viscosity grade 32 or equal and all units must use the same oil. Formulate the oil to separate quickly from water to prevent formation of emulsions. Provide hydraulic fluid certified by the manufacturer as fire resistant in conformance with NFLPA T2.13.1. Filter fresh hydraulic fluid through a 5 micron filter with a minimum Beta Ratio equal to 75 or better before it is added to the system or any subcomponents.

3.8.1.5 Hydraulic Fluid Sampling and Testing

a. Hydraulic fluid sampling must be in accordance with the approved sampling plan for the system or subcomponent. The samples must be tested for cleanliness as outlined above for particles and water. The Contractor is responsible for any corrective action for any non-compliant hydraulic fluid sample results.

b. Take samples at approved locations according to ASTM D4057. Detail the locations and procedures in the Hydraulic Fluid Sampling Plan submittal, and submit in accordance with the timeline specified in paragraph SUBMITTALS SD-01. The plan must include but not be limited to the following:

(1) The hydraulic power units components and assembled systems, including but not limited to the reservoirs,

i. in the shop

- ii. on-site, after cleaning and flushing
 - iii. on-site, after field-testing
- (2) The BFV Operators,
- i. in the shop
 - ii. on-site, after cleaning and flushing
 - iii. on-site, after field-testing
- (3) Bulk Hydraulic Fluid Supply, per paragraph below.

Collect two samples at each location, one sample will be provided to the Government in properly sealed and labeled containers as control samples, and the other samples are to be used for testing. All hydraulic fluid must be tested for cleanliness prior to use. The contamination level must be 15/13/10 or better in accordance with ISO 4406 by an approved independent test laboratory. Water content of each sample must be below 200 ppm. If any sample does not comply with the permissible contamination limits, the supply of hydraulic fluid must be either replaced or the cleaning and filtering process must be repeated, followed by a repeat of the samplings, inspections and testing. Notify the Government of any failure of a fluid sample to adhere to the requirements and inform them of the corrective actions taken. Formally submit to the Government a Bulk Hydraulic Fluid Sampling Test Results within the timeline specified in paragraph SUBMITTALS SD-06.

3.8.1.6 Bulk Hydraulic Fluid Supply Sampling and Testing

Each supply of bulk hydraulic oil shall be sampled and tested for both cleanliness, as outlined above, and adherence to the manufacturer's properties of the fluid prior to introduction into any hydraulic system or its subcomponents, for flushing or operational purposes. A direct comparison between manufacturer's product cut sheets or other supplier data, including physical and chemical properties, shall be performed and the results detailed as part of the sampling test results. Sampling shall be in accordance with ASTM D4057, cleanliness testing stated above, and the approved sampling plan. If the fluid will be supplied on-site from a vehicle, then the samples shall be from the vehicle and not just the parent supply. The Contractor is responsible for removal and replacement of any non-compliant supply of hydraulic fluid, and corrective action necessary.

3.8.2 BFV Operators and Hydraulic Power Units Installation

- a. Deliver the new penstock BFV operators and HPU systems in subassembled units ready for installation on the job site.
- b. Install the equipment specified and as shown on the drawings to complete the hydraulic power unit systems for operation of the penstock butterfly valves. Installation of hydraulic components must be in accordance with the manufacturer's written instructions and under the direction of the erection engineer. Install complete units or assemblies without disassembly. Necessary supports for all appurtenances, pumps, motors, and other equipment or components must

be provided in accordance with Section 13 48 00.00 26 SEISMIC RESTRAINT FOR MECHANICAL AND ELECTRICAL EQUIPMENT. Anchor floor-mounted equipment in accordance with Section 13 48 00.00 26 SEISMIC RESTRAINT FOR MECHANICAL AND ELECTRICAL EQUIPMENT.

3.8.2.1 Workmanship

a. Workmanship must be of the best quality throughout and in accordance with the best standard practice for the type of systems installed, notwithstanding any omissions in the drawings or specifications.

b. Run piping parallel with the lines of the building, unless otherwise distinctly shown or noted on the drawings. For pipe, cut accurately to measurements established at the structure by the Contractor. Remove burrs from pipes by reaming and cut into proper lengths by the use of a wheel type mechanical cutting tool or other approved device. Piping and hoses must be installed without inducing stress into valves or fittings. Keep piping, hose, valves, and fittings at a sufficient distance from other work and other services to permit not less than 1/2-inch between finished coverings on the different services. Use fittings for changes in direction. Install unions or flanges, as applicable, at valves and other equipment unless otherwise indicated. Align pipe and hose such that there will be no perceptible bends or kinks. Misalignment will be cause for rejection, and rework of the piping sections involved will be required. All equipment must be securely and neatly supported such that it cannot be damaged by equipment vibration. Install anchors and branches with due consideration for pipe temperature and future expansion. Install system components in locations that are protected from mechanical or chemical damage. Install materials in accordance with the manufacturer's recommendations.

3.8.2.2 Protection of Pipe, Hose, and Related Materials

Prior to and during installation, the pipe, valves, fittings, hose, ducting, and related materials must be kept clean and handled to prevent injury to these materials as well as the finished materials. Store materials and equipment in an approved area with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants. Openings on pipe, valves and related materials must be tightly covered with caps or plugs during installation to prevent entry of foreign material.

3.8.2.3 Cleaning

a. The interior and ends of new and existing piping affected by the Contractor's operations shall be kept thoroughly cleaned of water and foreign matter. Piping systems shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

b. A stainless steel wire brush shall be pulled through the pipe several times followed by clean cloths treated with a non-combustible metal cleaner designed for the purpose. Valves, and fittings, which have not been sealed at the factory, shall be thoroughly cleaned with a solvent-soaked cloth or pipe brush prior to installation. Piping, valves, ducting and fittings shall be inspected for water, foreign

matter or other loose material before placing into position.

3.8.2.4 Piping in Exposed Areas

Install exposed piping so as not to reduce exit access widths, corridors or equipment access. Install exposed horizontal piping, including drain piping, to provide maximum headroom. Locate piping and pipe penetrations to reduce the amount of piping routed along the floor and to prevent tripping hazards in primary walkways.

3.8.2.5 Expansion and Contraction of Piping

a. Allowance must be made throughout for expansion and contraction of the pipe. Horizontal runs of pipe over 50 feet in length must be anchored to the wall or the supporting construction approximately midway on the run to force expansion, evenly divided, toward the ends, and supported at intervals specified in paragraph POWER PIPING. Sufficient flexibility must be provided on branch run-outs from mains and risers to provide for expansion and Contraction of piping. Provide flexibility by installing one or more turns in the line such that piping has sufficient spring to allow for expansion without developing excessive stress.

b. Fabricated expansion joints may be permitted where space limitations restrict pipe bends. Submit manufacturer's data on expansion joint, including type, dimensions, material, maximum pressure, temperature rating, end connections, and installation instructions as per paragraph SUBMITTALS.

3.8.2.6 Reducers

Make changes in pipe sizes with one-piece concentric reducing fittings. The use of grooved end or rubber-gasket reducing couplings is not permitted. Use of bushings is not permitted.

3.8.3 Field Installation Procedures

Provide field installation drawings with a detailed description of the field installation procedures for the HPU systems, BFV operators, and hydraulic plumbing - routing and mounting locations. Include the locations and method of support of installation and handling equipment, the provisions to be taken to protect concrete and other work during installation, the method of maintaining components in correct alignment, and the methods for installing other appurtenant items. Include dates and schedule of work. Submit the following submittals in accordance with the timeline specified in paragraph SUBMITTALS SD-01.

a. HPU System Installation Procedures

b. BFV Operators Installation Procedures

c. Hydraulic Plumbing - Routing and Mounting Locations

3.8.4 BFV Operator Assembly Parts and Planning Documents

Provide the components for the BFV Operator Assemblies for Units 4 and 5 penstock butterfly valves as detailed in PART 2 and below. Submit the planning documents as detailed below. All plans and procedures are to detail where (at project or offsite location) and how each activity will

be accomplished and with what equipment. Include diagrams and drawings of assemblies and arrangements to explain the activities and steps of the plans and procedures. Detail if features are existing, temporarily new, or permanently new. Explain any modifications to equipment or components, referencing the applicable drawings that detail either the work, or the before and after conditions with instructional notes.

3.8.4.1 Removal and Installation Plans

a. Submit Plans and Instructions for The Removal and Installation of the BFV Operator Assemblies. The plans and instructions are to address all aspects of the removal and installation of the Unit 4 and 5's BFV operator assemblies, including removal of existing and installation of new BFV operator. Detail any adjustments that will need to be made for the valve operator after installation. Detail how alignments will be obtained, and how components will be separated and how they will be assembled. Detail how surfaces such as the valve shaft will be protected during the entire process. Detail fits and tolerances for any temporary blocking or similar. Include removal drawings, installation drawings, diagrams and images to explain processes and arrangements. Include all steps involving rework of interfacing surfaces such as the shaft of the valve discs and the valve body. Plan must detail how and where features identified in provided government drawings, and WISCO reference drawings, and clearly define all interface and all connection details between the BFV operator and the butterfly valve body and valve shaft. Including but not limited to:

(1) The interface and connection details of the BFV operator lever (crank) to the valve shaft, dowel pins, and assembly reamed dowel holes.

(2) The interface and connection details of the BFV operator housing to the valve body.

b. Facilitate a walk-through of the examination plans and the removal and installation plans and instructions with the Government prior to outage of the units. Any changes identified during the walk-through must be incorporated into the plans and instructions and submitted to the government as Revised Plans and Instructions for The Removal and Installation of the BFV Operator Assemblies. Walk-through must allow for virtual attendance in which both audio and visual connection is utilized.

3.8.4.2 Documentation of Accessible Areas Associated with BFV Operators

a. Prior to start of work on either BFV, submit Plan and Procedure for Documentation of Accessible Areas of BFV Operator Assemblies. Detail in the plan what areas will be examined, when they will be examined, with what instruments, and what documentation will be generated from the examination of accessible BFV operator assembly areas visible in the field starting when unit refurbishment work first commences, and during each step of the removal process, installation process, as detailed in the submitted removal and installation plans. Photographs of the areas are to be obtained during each step of the process, including any component examinations. Plan and procedure can reference information detailed in the Plan for Determination of the Dimensions of BFV Operator Assembly Components to be Provided.

b. Results of performing the plan and procedure to be submitted as

Documentation of Accessible Areas Associated with The BFV Operator Assemblies Report for Unit 4 and Documentation of Accessible Areas Associated with The BFV Operator Assemblies Report for Unit 5.

3.8.4.3 Plan to Determine BFV Operator Assembly Dimensions

Submit Plan for Determination of the Dimensions of BFV Operator Assembly Components to be Provided. Detail the plan and processes for determination of the dimensions of the BFV operator assembly components to be provided including tolerances - emphasis on component envelope dimensions and all interfacing connection details and dimensions, fits, and tolerances. Include a formal Existing BFV Operator Assembly Component Inspection Plan to determine final dimensions, surface finishes, and features for existing components of both units. Inspection to include not only the BFV operator assembly components but also areas of the valve body and valve disc shafts that interface with the BFV operator assemblies. Include draft dimensional recording instruction and forms. Component inner and outer diameters are to be measured a minimum of 3 times, 45 degrees apart at a minimum of 3 equally spaced elevations. If there is any tapering or steps in the item being measured, then additional elevations must be measured to address the change in dimension.

3.8.4.4 BFV Operator Assembly Components

For both Unit 4 and 5, provide the Initial BFV Operator Assembly Components as detailed in PART 2. Submit Initial Shop Inspection Plan for Each Furnished BFV Operator Assembly Component detailing the means, methods and locations to confirm components meet the requirements of this specification section and the approved component drawings. Article verification will involve 100%-dimensional and feature inspection and documentation with recording of the actual dimensions. Include any planned data record sheets to be used. Sheets to include details on the instruments used including documentation of any identifier that correlates to equipment calibration certification to be submitted. ID and ODs measured at a minimum of 3 times 45 degrees apart and three equally spaced elevations. If there is any tapering or steps in the item being measured than additional elevations must be measured to address the change in dimension. Have photos of the components taken, and any issues or modifications performed on the components due to inspection results must be documented. Furnished BFV Operator Assembly Component Initial Shop Inspection Report must be submitted for each component being provided. Report to include the complete results from the actions outlined in the approved inspection plan. Include documentation of equipment calibration certifications in report.

3.8.5 BFV Operators Removal and Installation

Perform for both Unit 4 and 5 the removal of the existing BFV operator and installation of the new BFV operator assemblies. The removal process is to be performed one unit at a time. Once the first unit's BFV operator assemblies have been removed, commencement of removal of BFV operator assembly components in accordance with approved submittals for the second unit is not to occur unless approved by the Contracting Officer.

a. Perform removal of assembly components in accordance with approved submittals.

b. Perform Documentation of Accessible Areas Associated with the BFV Operator Assemblies and Existing BFV Operator Assembly Component

Inspections per approved plans and procedures.

c. Perform approved Plan for Determination of The Dimensions of BFV Operator Assembly Components to Be Provided. Submit Existing BFV Operator Assembly Component Inspection Report, Documentation of Accessible Areas Associated with The BFV Operator Assemblies Report, and Revised BFV Operator Assembly Dimensional Analysis for each unit.

d. Generate and submit the Final Drawings of Final Parts for BFV Operator Assemblies detailed above.

e. Submit the Revised Shop Inspection Plan for Each Furnished BFV Operator Assembly Component. Plan will address the same requirements as required for the Initial Shop Inspection Plan but updated to address the revised dimensions and features resulting from the examination of the existing BFV operator assembly components for each unit.

f. Notify government of final shop inspection dates for the BFV operator assemblies a minimum of 14 days prior to inspection if to occur within continental United States, 60 days prior if outside continental United States, and Government reserves the ability to witness the inspections in person.

g. Perform BFV operator assembly component revised shop inspections in accordance with approved submittals. Submit results of inspections as Revised Shop Inspection Report for Each Furnished BFV Operator Assembly Component. Report's requirements are equivalent to those outlined for the Initial Shop Inspection Report of this specification section, including recorded dimensions and photographs.

h. In accordance with approved submittals, perform installation of the BFV operator assembly on both units, including rework of interfacing surfaces such as the shaft of the valve disc and the valve body, and any necessary reassembly.

3.9 POWER PIPING

3.9.1 Piping Installation

Install the system complete including all necessary valves, fittings and pipe accessories. All joints must be tight and successfully pass the test hereinafter specified. Provide details of pipe supports and anchors not indicated. Adequately support all lines at intervals not greater than 10 feet or as otherwise indicated. Install hangers and supports using machine bolts and masonry anchors caulked in drilled holes in the masonry or by using machine bolts and expansion shields. Ream and remove burrs from all cut ends of pipe. Remove metal particles from the reaming operations and thoroughly clean ends of pipe before proceeding with the work. Tightly plug all piping at all times except when work is being performed on a pipe. Clean the pipe sleeves, recesses and trenches of all debris and thoroughly wash before any piping is installed. Drilling, chipping or grinding of concrete in close proximity of any piping being installed is not permitted. Repeat washing out of the sleeves, recesses and trenches from time to time as necessary. Store valves in a clean, dry place and protect against moisture. Do not finally install valves in the system prior to four months before the system is to be filled with hydraulic oil. Install pipes passing through masonry in pipe sleeves as indicated. Mitering of joints for elbows and notching of straight runs of

pipe for tees is not permitted.

3.9.2 Piping Vents and Drains

Install plugged vent connections having 1/2-inch maximum size with high pressure globe or needle valves at all high points of piping. Provide plugged drain connections, with valves and 1/2-inch in size, in accessible locations at all low points of piping. Threads on valves and pipe plugs for vents and drains must be SAE Straight Thread with O-Ring seals. Provide pipe plugs and other miscellaneous fittings required for the installation of the vents and drains of the same material as the pipe on which they are installed.

3.9.3 Mounting Support for Plumbing

Provide vibration and noise dampening hangers that clamp around the full exterior diameter of the pipe being mounted. Pipe hangers must be securely and tightly fitted to the associated pipe. Provide pipe hangers of polypropylene. The pipe hangers provided are to be of the easy installation type that mount to a strut channel system. The strut channel system must utilize the existing concrete anchors already in place from the existing hydraulic piping. Use and installation of additional concrete anchors must be avoided to the greatest extent possible; proposed location for installation of new concrete anchors must be submitted to the Government for review and approval in the mounting and routing location submittal. Provide strut channels and all attachment hardware of the stainless steel type.

3.9.4 Mounting Support for Manifolds

Bolt the manifolds to a mounting base in such a manner that it can be removed by unbolting from flanges and mounting base. All bolts and hardware used in the supports must be a minimum of 3/8-inch. All items must be stainless steel.

3.9.5 Identification of Piping and Valves

Identify all pipe, tubing, valves, fittings, as required, and hydraulic power equipment, located within the trenches, machine rooms and machinery recesses. Maintain existing naming convention already in place at Fort Peck project. Use No. 20 gauge brass tags for tagging, with the proper identification symbol stamped into the metal. Use piping symbols as indicated and stamp with 3/4-inch high lettering. Attach tags to piping and valving by means of No. 12 gauge copper wire. Install pipe markers at intervals of no greater than 15 feet, except as approved by the Contracting Officer.

- a. Provide a numerical identification tag on each valve, coded such that no other valve in a connected hydraulic power system has the same number. Provide each power circuit valve with an additional tag, which indicates the valve's function.
- b. Provide manifold-mounted valves with port identification markings on a part of the valve body that remains in view after mounting.
- c. Identify all other valves at the port location, on the connecting piping.
- d. Identify manifold assemblies with a tag indicating the manifold's

function and the identity of the machine operated.

e. Identify all ball, bleed and globe valves with a "normally closed" or "normally open" legend as indicated on the Contract drawings.

f. Identify all gauge mounts and pressure switch mounts with numerical tags, as well as any working or instruction tags required for safe operation.

g. Provide a warning tag and an instruction tag, or tags as required, at each pressure and return filter assemblies to indicate the safe, approved procedures for cartridge replacement and by-pass operation.

3.10 CLEANING AND FLUSHING

Submit a detailed Procedure For On-site Cleaning and Flushing of the HPU Systems and BFV Operators within the timeline specified in paragraph SUBMITTALS SD-01. During assembly, securely cover all openings to avoid the entrance of abrasives, dirt, metal chips, and other foreign materials into the hydraulic systems through open ends of piping, tubing, and ports of the components. Use the same hydraulic fluid for flushing as approved for final filling. Include a detailed description of the equipment, materials, hydraulic fluid, temperatures, and duration of each phase of the flushing in the procedures. Clean the systems of particles so that the contamination level has a Cleanliness Code of 15/13/10 or better in accordance with ISO 4406. Take three 500 milliliter samples at approved locations according to ISO 4021. Perform particle counting on each sample in accordance with ISO 11500 or ISO 4407 by an approved independent test laboratory. Water content of each sample must be below 200 ppm. If any sample does not comply with the permissible contamination limits, re-clean, re-inspect, and re-test the system. When flushing is completed, drain the systems and then fill with the specified hydraulic fluid. Do not reuse existing hydraulic fluid. Submit an On-site Cleaning and Flushing Report for the HPU Systems and BFV Operators within the timeline specified in paragraph SUBMITTALS SD-06.

3.10.1 Flushing Hydraulic Power Unit

After cleaning and prior to shipment, flush each hydraulic power unit. Fill the hydraulic tank with hydraulic fluid as specified and actuate the oil filtration system with a 5 micron, beta ratio 75, element or better in the filter. Circulate the fluid and change filters as they become clogged. After flushing of the fluid in the tank is complete, install a by-pass loop with filter on the pressure and tank lines of the unit and run the pumps alternately until the returning oil meets the requirement for system cleanliness.

3.10.2 Flushing Piping

Flush all hydraulic piping before installation of the hydraulic power units, cylinders, and manifolds. Install by-pass loops of piping in place of cylinders, manifolds and the power units. Circulate hydraulic fluid through each and every pipe unit until returning oil meets the requirement for system cleanliness. Sequence flushing so that all piping is flushed in both directions. The flow capacity of the flushing system must produce a minimum velocity of 15 feet per second in all piping. Provide means to verify the flow during the flushing operation.

3.10.3 Flushing of Small Flow Paths and Precision Clearance

Take special care when flushing portions of assemblies and subassemblies that include solenoid valves, system components with small flow paths, and other precision clearance hydraulic mechanisms. If necessary, bypass or remove the mechanism(s) before flushing, and flush said part separately to avoid particulate build-up then perform specific port cleaning on said mechanism(s) before reconnecting to flushed system. Detail in the submitted cleaning and flushing procedure all removal and reinstallation of mechanism(s) as part of the flushing. After cleaning and prior to installation, flush each valve manifold, pipe manifold, and hose by circulating hydraulic fluid through all ports until the returning fluid meets the requirement for system cleanliness.

3.11 FILLING AND BLEEDING THE SYSTEM

With all hydraulic equipment installed, and all cleaning and flushing complete, filling of the system may begin. The cleanliness of the oil used to fill the systems must conform to the requirements for system cleanliness. Open the by-pass ball valves at the cylinders. Fill each hydraulic power unit and pump oil into the systems through a 5 micron, beta ratio equal to 75 or better, filter and keep adding oil as long as the level continues to drop. Take care to expel as much air as possible from the piping and cylinders during the initial filling. Utilize piping vents and drains as much as possible to expel air from the systems. Each power circuit pipe for the butterfly valves must have this procedure performed to fill the respective piping. Actuate cylinders by shifting spool on the four-way valve back and forth and bleeding air from ports provided on cylinders. Continue procedure for all hydraulic power units until all cylinders have been bled. Ball valves in tank lines may be closed during bleeding to prevent introduction of air into tank lines. After all the cylinders for the machinery have been filled and bled of air, fill each hydraulic power unit tank with new, unused oil that meets the Cleanliness Code of 15/13/10 or better in accordance with ISO 4406.

3.12 PAINTING

Shop prime and coat, as specified in Section 09 97 02.00 26 PAINTS AND COATINGS, exposed exterior surfaces of assemblies and equipment except stainless steel, synthetic rubber, and plastic, unless the equipment is given a standard factory finish as allowed by other paragraphs of this specification. Insofar as is practicable, the complete coating system must be applied to individual components and items before assembly to ensure complete coverage and maximum protection against corrosion. Equipment such as the pumps, which have a factory finished coating, do not need to be recoated. Repaint in the field all chips, scratches, and other damage to shop-applied painted surfaces.

3.13 FIELD TESTS AND INSPECTIONS

Field test and inspect to verify transport and installation of equipment has not compromised its operability prior to the fully integrated system testing of all new penstock butterfly valve HPUs and BFV operators. Submit a Fully Operational Penstock Butterfly Valve Open and Closure System Field Testing Procedure within the timeline specified in paragraph SUBMITTALS SD-01, and must include, at a minimum, a complete set of procedures for field testing the penstock butterfly valve open and closure systems as a whole. In addition, submit a Fully Operational Penstock Butterfly Valve Open and Closure System Field Test Report within the

timeline specified in paragraph SUBMITTALS SD-06.

3.13.1 Field Testing

Submit a HPU Systems Field Testing Procedure and a BFV Operators Field Testing Procedure within the timeline specified in paragraph SUBMITTALS SD-01. Submit procedures for field testing and proposed testing program, at least four weeks prior to the first scheduled test, to ensure agreement as to personnel required and scope of the testing program. Notify the Contracting Officer at least two weeks before any field testing is to be conducted. Conduct testing in the presence of the Contracting Officer unless waived in writing by the Government. Conduct testing under the direction of the erection engineer or manufacturer's representative. All non-permanent equipment required to perform all field testing activities is to be provided by the Contractor. Document and correct any failures during testing, corrections are to be made without any additional cost to the Government. Any cost or schedule impact due to retesting to meet satisfactory results are the sole responsibility of the Contractor. Submit a certified HPU Systems Field Test Report and a certified BFV Operators Field Test Report within the timeline specified in paragraph SUBMITTALS SD-06.

3.13.2 Final Acceptance Tests

In preparation for the final acceptance tests, and after completion of the installation and proof tests, operate each hydraulic power system to prove acceptability. Conduct preliminary tests at minimum pressures and velocities until initial adjustments have been proven safe for normal operation. Details of all operations must be constantly monitored for signs of impending trouble and corrections must be made as necessary to prevent damage to the equipment. At such time as the Contracting Officer may direct, conduct the following complete acceptance tests on each hydraulic power system for approval. Any deficiency or maladjustment disclosed by the tests must be corrected immediately and the tests repeated until satisfactory results are obtained. No subsequent tests will be permitted until all preceding tests have been completed satisfactorily. Upon completion of the final acceptance tests, furnish a written statement that each hydraulic power system has been field tested and meets all operational requirements.

3.13.2.1 Initial Start-Up

Inspect each hydraulic reservoir to ensure that the fluid is at the proper level. Test start each hydraulic pump using both the controls at the control console and the remote controls. Inspect the pumps for proper operation and discharge pressure. Read and record the discharge pressure of each pump. Adjust the pressure relief valves to limit the system pressure to the specified value. Adjust axial piston pump swash plate to exceed pressure relief setting in order to confirm proper setting of pressure relief valve. Then return swash plate adjustment to previous setting and confirm it matches design working pressure. Inspect the hydraulic lines and components which are under pressure for evidence of leakage and take corrective action as required.

3.13.2.2 Combined System Tests

After final assembly and installation of the machinery, equipment and piping, operate each assembly of operating machinery individually as nearly as practicable under its normal operating conditions for a minimum

of 5 open/close cycles; and demonstrate that each assembly is in proper working order and free from defects of materials, workmanship or alignment. Upon satisfactory completion of the individual tests, and before watering up the penstock in order to conduct final acceptance, conduct in the presence of the Contracting Officer, over-all testing through a minimum of 10 additional operating cycles, to demonstrate that all machinery has been properly installed and that all penstock butterfly valve operations can be effected without interruption. During each test operation, inspect the hydraulic lines and components for evidence of leakage. Read and record the pressure in the supply and return lines for each direction of operation. Inspect response of components to operation of applicable controls to confirm that all connections have been made properly. Check flow control valves and adjust as required to conform to indicated operating time requirements. Adjust chokes in pilot circuits of pilot-operated valves to obtain smooth, shock-free operation. Adjust relief valves and counterbalance valves to the proper pressures as indicated, unless otherwise directed by the Contracting Officer. Adjust flow control valves for the proper flows to achieve desired cylinder operating times as directed herein and may be altered by the Contracting Officer. Operating tests must cover a period of not less than 4 hours, and all tests must be conducted at such times as the Contracting Officer may direct. After final acceptance testing of each hydraulic system has been completed, install a complete set of new and unused filter cartridges.

3.13.2.3 Post Field Test Hydraulic Oil System Testing

After the completion of operational testing of each system, perform in accordance with the submitted and approved sampling plan, a system sampling. The samples must be tested for cleanliness, including water and particles as detailed above in paragraph CLEANING AND FLUSHING. Perform and document in the functional test report detailed comparison of pre and post operational test results. Notify the Government of any failure of a fluid sample to adhere to the requirements and inform them of the corrective actions taken. Submit a Field Test Hydraulic Fluid Sampling Results report within the timeline specified in paragraph SUBMITTALS SD-06.

3.14 CLEAN-UP

Keep the work areas clean during installation of the hydraulic systems and its appurtenances. Upon completion of the installation of the hydraulic systems and appurtenances, remove debris and surplus materials resulting from the work.

3.15 FINAL VERSIONS OF AS-CONSTRUCTED DRAWINGS

Upon completion of all the testing and work on-site, submit the final versions of As-Constructed Drawings for approval, incorporating any field redlines or corrective action taken during testing. All final versions of as-constructed drawings are to be submitted in MicroStation (.dgn) files as well as Adobe Acrobat (.pdf), unless otherwise approved by the Government in writing.

3.16 OPERATION AND MAINTENANCE MANUAL

Submit all O&M information for the BFV Operators and BFV HPUs with controls and offline oil filtration system in accordance with paragraph OPERATION AND MAINTENANCE MANUAL in specification Section 22 00 00.00 26, BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING. The O&M Manual submittal items covering the equipment specified in this Section

are listed below and in SD-10 and SD-11; and are included in this Section for reference. The O&M data for the equipment specified in this Section must be combined into an integrated Operation and Maintenance Manual covering all refurbished and new equipment provided under this contract, as specified in Section 22 00 00.00 26.

- a. Draft Operation and Maintenance Manual
- b. Revised Draft Operation and Maintenance Manual
- c. Final Operation and Maintenance Manual

3.17 TRAINING FOR OPERATION AND MAINTENANCE

Submit all training manuals and training material for the BFV Operators and BFV HPUs with controls and offline oil filtration system in accordance with paragraph TRAINING FOR OPERATION AND MAINTENANCE in specification Section 22 00 00.00 26, BUTTERFLY VALVE REFURBISHMENT, MECHANICAL EQUIPMENT AND PIPING.

3.18 SPARE PARTS

Deliver all spare parts prior to start of unit outage.

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