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SECTION 01 11 01.00 28

SUPPLEMENTARY REQUIREMENTS

PART 1 GENERAL

The work covered by this section of the specifications consists of work common to more than one section of these TECHNICAL SPECIFICATIONS.

1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 Safety and Occupational Health Requirements

Comply with the current edition and all changes posted on the web as of the effective date of this solicitation.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals having an "I" designation are for information only. Designation following the "G" or "I" designation identifies the office that will review the submittal for the Government. Submit in accordance with SECTION 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment List; I, C

Project Schedule; G, C

1.3 DEFINITIONS

a. Qualified Person.

As defined in EM 385-1-1; "DEFINITIONS", unless otherwise specified.

1.4 FIELD VERIFICATION OF SITE CONDITIONS

Field verify all elevations, dimensions, and coordinates of existing features indicated on the contract drawings that affect new fabrication and transformer delivery. Any variations must be updated as per SECTION 01 78 00.00 28, CLOSEOUT SUBMITTALS, paragraphs WORKING AS-BUILT DRAWINGS.

1.5 BARGE SHIPPING REQUIREMENTS

a. **Provide a minimum of 3 (three) delivery date options a minimum of 45 days prior to the earliest proposed delivery date.** The Government will coordinate Transformers delivery with other river users and notify the Contractor of the final delivery date a minimum of 30

(thirty) calendar days prior to delivery.

b. All deliveries and Contractor arrival to the Project site must occur within typical Government work hours. See SECTION 01 14 00.10 28 PROJECT SITE RESTRICTIONS, paragraph "Government's Work Schedule" for additional information.

c. The Navigation Lock will be closed to river traffic between 0700 and 1700 on the day of delivery. All barge delivery tasks requiring use of the Navigation Lock must be completed during this time. Additional time will **NOT** be allowed, unless approved in advance by the Contracting Officer. Due to requirements of other river users, the Government cannot guarantee additional time will be available. The Contractor's barge will only be allowed to moor at the Project site during this coordinated Navigation Lock Closure. All Contractor barges and other equipment must be cleared from the Navigation Channel prior to the end of this outage. **NOTE: Navigation Lock closure start time may vary up to an hour to accommodate river vessels in transit. Anticipate total duration of Lock closure to remain the same as identified above.**

d. Contractor is solely responsible for off-loading the Transformers and other items from the barge, moving them to the storage location, and positioning Transformers for storage as shown and specified. Provide all personnel, equipment, supplies, and other items needed for delivery tasks. Government personnel, equipment and property is **NOT** available for Contractor use.

e. The Transformers must **NOT** be set on the ground during off-loading and storage activities. If the transformers must be placed on the ground during off-loading, provide hardwood timber mats comprised of 12-inch square oak timbers, secured together with steel rods for transformer support.

f. The Contractor is responsible for obtaining information about the intended Navigation Lock moorage location to ensure damage does not occur to the transformers, equipment, or Government property.

g. Additional shipping and delivery requirements are located in SECTION 48 20 00.04 26 TRANSFORMER SHIPMENT, HAULING AND SITE ASSEMBLY.

1.5.1 Required Final Transformers Delivery Location

a. Deliver the Transformers to the Little Goose Lock & Dam "Storage Yard".

b. Demobilize from the "Storage Yard" no later than 7 calendar days following Government acceptance of the Transformers.

c. See Volume 1 and Volume 2 on Sheet G-001, and G-006 for delivery to the storage yard location.

1.6 DOCUMENT SUBMITTALS

In addition to other specified submittal requirements, a copy of all documents submitted as part of work on this contract, must be e-mailed to the Contracting Officer Representative (COR) and submitted in Resident Management System Contractor Mode (RMS CM). Include project contract number, title, and e-mail topic in all e-mail subject lines.

1.7 SUPPLEMENTAL DRAWINGS

a) A “Supplemental Drawings” packet is provided as part of this contract for information only and is not part of Contract work. These drawings are not available in CAD. These drawings depict the best estimate of existing components and equipment. The Government does not guarantee the accuracy of Supplemental Drawings.

b) Contractor shall verify accuracy of these drawings prior to use. Any errors or deficiencies arising from use of these drawings shall be the responsibility of the Contractor and corrected at no additional cost to the Government.

1.8 EQUIPMENT LIST

Furnish a complete list of all equipment to be used on the Project 30 days prior to commencement of on-site work. Submit a revised list in the event of change of equipment. Lists includes rented equipment as well as lease-purchase or sale-leaseback equipment. The initial list and the revised lists shall indicate dates equipment is assigned to or removed from the Project and adequate identification or description of each item of equipment including manufacturer's name (abbreviated), model number, manufacturer's serial number, year of manufacture, and Contractor's assigned serial or record number.

1.9 TESTING OF EQUIPMENT

Before any machinery or mechanized equipment is put to use on the job, it must be inspected and tested by a qualified person and determined to be in safe operating condition. Cranes or derricks must be tested by the Contractor or a qualified testing agency in accordance with EM 385-1-1. Equipment must be large enough to safely handle proposed picks or tasks without exceeding the crane rating established by these tests.

1.10 PROJECT SCHEDULE

a. Furnish a cost loaded schedule for the complete project within 30 days after receipt of Notice of Award.

b. Email a digital copy of the schedule, in the original format the schedule was developed in (e.g. .xer, .xls., .mpp, etc.), to the Contracting Officer's Representative (COR). See SECTION 01 33 00 SUBMITTAL PROCEDURES paragraph "Digital Copies" for email address.

1.11 PROTECTION AND RESTORATION OF EXISTING FACILITIES

Reference FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements (Apr 1984).

1.12 CONTRACTOR RESPONSIBILITY FOR CONTRACT WORK

The Contractor is responsible for correcting all damage and defects to work covered by this contract, until final acceptance by the Government.

1.13 DISCONNECTED OIL LINES

Anytime an oil line is disconnected by the Contractor due to work performed under this contract it is the Contractors responsibility to cap

the line. Oil line cap must be rated at 125 percent of the pressure in the line. Notify the Contracting Officer when an oil line has been disconnected. Document with the Contracting Officer when the disconnected oil line has been sealed to ensure no transfer of oil or water, from or into the sealed line.

1.14 FINAL INSPECTION AND GOVERNMENT ACCEPTANCE

a. Final acceptance of the spare transformers will occur at Little Goose Lock and Dam storage yard upon delivery. After off-loading spare transformers, crating material may be removed, at the COR's discretion, to inspect all deliverables.

b. All spare transformer related items, that arrive at the Project in damaged packaging will be further inspected at the Project Site. The Contractor is responsible for correcting all damage that occurred during shipping, prior to Government acceptance, at no additional cost to the Government.

c. A complete final spare transformer inspection will be conducted during the offloading process as indicated in above paragraph "SPARE TRANSFORMER DELIVERY REQUIREMENTS".

d. Final payment for each spare transformers will not made until the "Transformer Field Test Report" submittal according to SECTION 48 20 00.04 26, TRANSFORMER SHIPMENT, HAULING AND SITE ASSEMBLY has been completed and approved by the Government.

1.15 POST AWARD MEETINGS

1.15.1 Pre-Work/Pre-Fabrication

Within 15 calendar days after receipt of Notice of Award, attend a Pre-Work/Pre-Fabrication Meeting. Pre-work/Pre-Fabrication meeting may be in person or via conference call. Senior Level members of the Contractor's staff involved with this contract shall participate in this meeting to discuss the overall contract requirements. The Government will lead the Pre-Work portion of the meeting, and take the meeting minutes.

1.15.2 Pre-Fabrication

For the Pre-Fabrication part of the meeting, the Project Superintendent shall lead the meeting and discuss the Contractor's plan on executing the work at the work site, schedule, and plan for implementing quality control.

1.15.2.1 Minutes

The Contractor is responsible for taking the meeting minutes and must send them electronically within 48 hours of the meeting to the Government's Project Engineer, Quality Assurance Representative, and Resident Engineer. Include project name and meeting topic in e-mail subject line.

1.15.3 RMS Orientation Meeting

a. Upon the Contractor's request, an RMS (Resident Management System) Orientation Meeting will be held after receipt of Notice of Award. See SECTION 01 45 01.00 28 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM) for additional information. The Orientation Meeting will be held at NWW District Headquarters, and may occur in conjunction with, but

not at the same time as, the Pre-Work Meeting. The Orientation Meeting can also occur via video conference. Coordinate meeting date and time with the Contracting Officer a minimum of 7 calendar days prior to the meeting.

b. At a minimum, the Contractor's RMS-CM Administrator and QC system manager must attend the RMS Orientation meeting. A Government Representative will lead the orientation. Anticipate the following at the meeting:

1. Allow for a maximum 4 hour duration.

2. Cover the following topics, at a minimum, in RMS Contractor Mode (CM):

i. Contractor use of RMS (CM) system.

ii. Contractor Data.

iii. Quality Control Reports.

iv. Submittals.

v. RFIs.

vi. Payment.

3. Receive a follow-up handout/guide for reference on the above items.

c. Contractor employees shall bring a computer with Wi-Fi capability (to gain access to the Internet), with RMS pre-loaded.

d. The RMS Orientation Meeting is required for Contractors with no prior RMS experience. The RMS Orientation Meeting, is optional, but may be requested, for all other Contractors.

e. The purpose of the RMS Orientation Meeting is to facilitate Contractor's use of RMS (CM). It does not relieve the Contractor of the requirement to use RMS (CM) in accordance with the Contract. See SECTION 01 45 01.00 28 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM), paragraph RMS SOFTWARE for information related to required download and installation deadlines.

1.16 WEEKLY PRODUCTION MEETINGS

1.16.1 Production Briefings

During all fabrication, hold a weekly production meeting to brief the Government on the status of the project.

a. Use the attached "Weekly Meeting Agenda" and discuss all elements of this agenda.

b. Provide a two (2) week 'look ahead'.

1. Describe all planned fabrication activities over the next two (2) weeks.

2. ENSURE these activities align to the overall fabrication SCHEDULE submitted under PROJECT SCHEDULE.

3. RECORD any changes to the Project Schedule AND INCLUDE IN the next scheduled update.

c. Key members of the Contractor's staff including the Quality Control System Manager must attend.

d. The Quality Control System Manager shall discuss all QC aspects outlined in SECTION 01 45 00.01 28 CONTRACTOR QUALITY CONTROL.

e. The Government reserves the right to require any person from the Contractor's staff such as the Project Manager, Engineer, Scheduler or Key Subcontractor Personnel to attend the meeting.

1.16.2 Fabrication Progress Photos

a. During fabrication activities, record fabrication progress by submitting weekly progress photographs. Provide photos of fabrication activities and progress to the Government for unrestricted use by the Government.

1. Submit photos at the end of each work week.

2. Furnish digital photographs, Utilize JPEG file format for all photograph and image files.

3. Provide full-color photos with photo resolution of not less than 4 megapixels and not more than 12 megapixels showing the sequence and progress of work.

4. Take a minimum of 20 digital photographs each week throughout the entire project.

5. Submit weekly digital photographs at weekly production meetings.

b. Ensure that the photographs are digitally dated. A log must be furnished for each photograph that records the following information:

1. Photograph number (the specific format should be tied to the filename of the digital photograph).

2. Date the photograph was taken.

3. A brief description of the location, what the photograph depicts, and the orientation of the view.

1.16.3 Minutes

The Contractor is responsible for taking the meeting minutes and shall send them electronically within 24 hours of the meeting to the Government's Project Engineer, Quality Assurance Representative, and Resident Engineer. Include project name and meeting topic in e-mail subject line.

1.17 ADDITIONAL MEETINGS

Record the minutes of all meetings, including all conference calls, that

occur between the Contractor and Government. Send minutes electronically within 24 hours of the meeting to the Contracting Officer for concurrence. E-mail subject line shall include project name and meeting topic.

1.18 GOVERNMENT QUALITY ASSURANCE SURVEILLANCE PLAN (QASP)

1. The Government will monitor the Contractor's performance under this contract using quality assurance procedures developed by the Government. Typical procedures might include random sampling, checklists, customer complaints, and observations.

2. The Government reserves the right to inspect and test all services called for by the contract, to the extent practicable at all times and places during the term of the contract. The Government will perform inspections and tests in a manner that will not unduly delay the work.

3. If any of the services do not conform to contract requirements, the Government will request the Contractor to perform the services again, where appropriate, in conformity with contract requirements, at no increase in contract amount. When the defects in services cannot be corrected by re-performance, the Government may (1) require the Contractor to take necessary action to ensure future performance conforms to contract requirements and (2) reduce the contract price to reflect the reduced value of the services performed.

4. If the Contractor fails to promptly re-perform the services or to take the necessary action to ensure future performance in conformity with contract requirements, the Government may by contract, or otherwise (1) perform the services and charge to the Contractor any cost incurred by the Government that is directly related to the performance of such service or (2) terminate the contract in whole or in part.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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INTEGRATING ANTITERRORISM (AT) AND OPERATIONS SECURITY (OPSEC)

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1.7 ESCORTING IN CLASSIFIED AND/OR SENSITIVE AREAS
1.8 PRE-SCREEN CANDIDATES USING E-VERIFY PROGRAM

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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SECTION 01 14 00.90 28

INTEGRATING ANTITERRORISM (AT) AND OPERATIONS SECURITY (OPSEC)

PART 1 GENERAL

The work covered by this section of the specifications consists of work common to more than one section of these TECHNICAL SPECIFICATIONS. This contract does not require access to or handling of classified material. This contract does not require access to secured and restricted areas, sensitive information, or equipment. Secured area is considered any location where on-site work is performed by contractor personnel. The restricted areas, sensitive information, or equipment consists of everything inside the security fence at the project.

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.

FEDERAL ACQUISITION REGULATIONS (FAR)

FAR 52.222-54	Employment Eligibility Verification
FAR 22.18	Employment Eligibility Verification
FAR 22.102-1	Federal and State labor requirements

Website for Federal Acquisition Regulation Supplement:
https://www.acquisition.gov/browse/index/far

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals having an "I" designation are for information only. The designation following the "G" or "I" 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

Suspicious Activity Reporting; G, C

Pre-Screen Candidates Using E-Verify Program; G, C

1.3 RESOURCES

The following resources are accessible from the Walla Walla District (NWW) Public Website:

https://www.nww.usace.army.mil/Business-With-Us/Contracting/AT-OPSEC-for-Contractors/

a. E-Verify Program.

b. Suspicious Activity Reporting Training (e.g. iWATCH, CorpsWatch,

or See Something, Say Something).

1.4 GENERAL SECURITY REQUIREMENTS AND GUIDANCE

a. The security requirements described in this SECTION apply to **all** contractor personnel supporting the performance requirements of this contract. Contractor personnel includes employees of the prime Contractor ("Contractor") and all subcontractor employees. The Contractor is responsible for compliance with these security requirements. Questions regarding security matters must be addressed to the Contracting Officer (KO).

b. The Department of Defense (DoD) and Army security training requirements specified in this SECTION, are performance requirements. All contractor personnel shall complete initial training within 30 calendar days of contract Notice of Award, or the date new contractor personnel begin performance on the contract. Within five business days from the completion of training, the Contractor shall submit written documentation of completed training to the KO. **The documentation shall include the names of contractor 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 KO.

c. Contractor personnel and vehicles are subject to search when entering federal installations. Additionally, all contractor personnel shall comply with Force Protection Condition (FPCON) measures, Random Antiterrorism Measures (commonly referred to as "RAMs"), and Health Protection Condition (HPCON) measures.

d. The Contractor is responsible for meeting performance requirements during elevated FPCON and/or HPCON levels in accordance with applicable Walla Walla District (NWW) plans and procedures. This includes identifying mission essential and non-mission essential personnel.

e. 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 contractor personnel. The Contractor shall ensure all contractor personnel are aware of their security responsibilities, including any site-specific requirements identified in local policies or procedures.

1.5 PHYSICAL SECURITY AND ACCESS CONTROL REQUIREMENTS

a. All contractor personnel requiring physical access to a federal installation or facility must comply with the access control procedures of that location.

b. Contractor 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"). Contractor personnel shall comply with all personal identity verification requirements specified in installation/facility policies and procedures.

c. **Contractor personnel who do not meet requirements for unescorted access to USACE facilities shall coordinate escorted access with the KO, as needed.** Coordinate escorted access with the KO a minimum of 14 calendar days prior to date of needed escort. Government escorts are dependent upon availability of personnel. The Government is not responsible for impacts to Contractor work due to unavailability of Government escorts.

d. Contractor 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 NWW.

1.6 SUSPICIOUS ACTIVITY REPORTING TRAINING (e.g. iWATCH, CorpsWatch, or See Something, Say Something)

Initial and annual refresher training on the local suspicious activity reporting program is required for all onsite personnel if transformers are barged upstream and off-loaded at Little Goose Lock & Dam project. This locally developed training provides contractor personnel with general information on suspicious behavior, and guidance on reporting suspicious activity to the project manager, security representative or law enforcement entity. See paragraph RESOURCES for link to training.

1.7 ESCORTING IN CLASSIFIED AND/OR SENSITIVE AREAS

In accordance with applicable regulations, all contractor personnel who do not possess the appropriate security clearance or access privileges will be escorted in areas where they may be exposed to classified information or operations, sensitive information or activities, or restricted areas.

1.8 PRE-SCREEN CANDIDATES USING E-VERIFY PROGRAM

a. Contractors must comply with the requirements set forth in FAR 52.222-54 Employment Eligibility Verification and FAR 22.18 in using the E-Verify Program 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. See paragraph RESOURCES for link to the E-Verify website.

b. An initial list of verified/eligible candidates shall be provided to the KO no later than three business days after receipt of Notice of Award. Submit pre-screening results to the KO via email as a password protected pdf file.

c. Submit updates to list of verified/eligible candidates within three business days of new verifications. The Contractor shall maintain a current list of verified/eligible employees as part of their contract files and provide copies to the KO upon request.

d. 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.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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GOVERNMENTAL SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ANSI/ASSP)

ANSI/ASSP A10.8	(2019) Scaffolding Safety Requirements
ANSI/ASSP A10.34	(2021) Protection of the Public on or Adjacent to Construction Sites
ANSI/ASSP Z244.1	(2016) The Control of Hazardous Energy Lockout, Tagout and Alternative Methods
ANSI/ASSP Z359.0	(2018) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ANSI/ASSP Z359.1	(2020) The Fall Protection Code
ANSI/ASSP Z359.2	(2017) Minimum Requirements for a Comprehensive Managed Fall Protection Program
ANSI/ASSP Z359.3	(2019) Safety Requirements for Lanyards and Positioning Lanyards
ANSI/ASSP Z359.4	(2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
ANSI/ASSP Z359.6	(2016) Specifications and Design Requirements for Active Fall Protection Systems
ANSI/ASSP Z359.7	(2019) Qualification and Verification Testing of Fall Protection Products
ANSI/ASSP Z359.11	(2021) Safety Requirements for Full Body Harnesses
ANSI/ASSP Z359.12	(2019) Connecting Components for Personal Fall Arrest Systems
ANSI/ASSP Z359.13	(2013) Personal Energy Absorbers and Energy Absorbing Lanyards
ANSI/ASSP Z359.14	(2021) Safety Requirements for Self-Retracting Devices for Personal Fall

	Arrest and Rescue Systems
ANSI/ASSP Z359.15	(2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.20	(2018) Below-the-Hook Lifting Devices
ASME B30.22	(2023) Articulating Boom Cranes
ASME B30.26	(2015; R 2020) Rigging Hardware
ASME B30.5	(2021) Mobile and Locomotive Cranes
ASME B30.8	(2020) Floating Cranes and Floating Derricks
ASME B30.9	(2018) Slings

ASTM INTERNATIONAL (ASTM)

ASTM F855	(2020) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1048	(2016) Guide for Protective Grounding of Power Lines
IEEE C2	(2023) National Electrical Safety Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z89.1	(2014; R 2019) American National Standard for Industrial Head Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2022; ERTA 1 2021) Standard for Portable Fire Extinguishers
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 51B	(2024) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2023; ERTA 1 2024; TIA 24-1) National Electrical Code
NFPA 70E	(2024) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

NWWP 385-1-20	Safe Clearance Program for the Control of Hazardous Energy
EM 385-1-1	Safety and Occupational Health Requirements

Comply with the current edition and all changes posted on the web as of the effective date of this solicitation.

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
29 CFR 1926.1400	Cranes and Derricks in Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals having an "I" designation are for information only. A designation following the "G" or "I" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with SECTION 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, C

Activity Hazard Analysis (AHA); G, C

Safe Clearance; I, C

Authorized Individuals; I, C

Standard Lift Plan; G, C

Critical Lift Plan; G, C

Crane Wheel And Outrigger Loading Diagram And Deck Protection For Outriggers; G, ST

Competent Person Qualifications; G, C

Confined Space Entry Permit; G, C

Site Safety And Health Officer (SSHO) Designation Letter; G, C

Eng Form 6277 Energized Electrical Work Permit; G, C

Master or Journeyman Electrician; I, C

SD-06 Test Reports

Accident Reports; I, C

LHE Inspection Reports; I, C

Accident, Mishap, and Near Miss Investigation and Reporting; I, C

SD-07 Certificates

Crane Operators/Riggers; I, C

Hot Work Permit; I, C

Certificate of Compliance; I, C

Competent Person Trainer; G, C

Naval Architecture Analysis; I, C

1.3 ENGINEER FORMS

All Engineer Forms (ENG FORM) referenced in this SECTION are available online at the following location:

https://www.publications.usace.army.mil/USACE-Publications/Engineer-Forms/

NOTE: If Forms produce a "Please Wait" screen, click on the "Download" tab and download the file to your computer. Open the file in Adobe and click the "Enable All Features" tab.

1.4 DEFINITIONS

1.4.1 Accident

Any unplanned event or series of events that results in death, injury, or illness to personnel, or damage to or loss of equipment or property. Within the context of EM 385-1-1, accident is synonymous with mishap.

1.4.2 Competent Person (CP)

a. CP is a person meeting the requirements as defined in EM 385-1-1, in addition to the following requirements:

1. Be designated in writing to be responsible for the immediate supervision, implementation and monitoring of the program.

2. Through training, knowledge and experience be able to correctly identify, evaluate and address existing and potential hazards.

3. Has the authority to take prompt corrective measures with regard to specified hazards.

b. CP's are required for the following:

1. Confined Space 29 CFR 1926.1200, EM 385-1-1 Chapter 34 Confined Spaces in Ships and Vessels (CPCSSV).

2. Cranes and Rigging ASME B30, EM 385-1-1 Chapter 16.

3. Fall Protection EM 385-1-1 Chapter 21.

4. Scaffolding 29 CFR 1926 Subpart L, EM 385-1-1 Chapter 22.

See Competent Person Roles and Responsibilities in EM 385-1-1 for additional information.

1.4.3 Load Handling Equipment (LHE)

Load Handling Equipment(LHE) is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including excavators or forklifts, used with rigging to hoist and move a load).

1.4.4 Medical Treatment

Medical Treatment is treatment administered by a physician, or registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.4.5 Mishap

Within the context of EM 385-1-1, mishap is synonymous with accident. See above paragraph "accident" in this SECTION for definition.

1.4.6 Near Miss

A potentially serious accident that could have resulted in personal injury, death, or property damage, damage to the environment, or illness; but did not occur due to one or more factors (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).

1.4.7 Operating Envelope

The area surrounding any crane. Inside this "envelope" is the crane, the 360-degree area up to the crane's maximum working radius, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load, and the crane's supporting structure (for example, ground, rail).

1.4.8 Qualified Person (QP)

A QP is a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

1.4.9 Recordable Accident

A reportable accident that meets the minimum criteria stated in EM 385-1-1.

1.4.10 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.

1.4.11 Reportable Accident

All occurrences that cause injury, occupational illness, or property damage of any kind.

1.4.12 Site Safety and Health Officer (SSHO)

A Contractor Employee that is responsible for overseeing and ensuring implementation of the prime Contractor's Safety and Occupational Health (SOH) program according to the Contract, EM 385-1-1, applicable federal, state, and local requirements.

1.4.12.1 Level 1 SSHO

A designated employee with Level 1 full-time SOH responsibility that meets and follows the requirements of EM 385-1-1.

1.4.12.2 Level 2 SSHO

A designated employee with Level 2 SSHO responsibility that meets and follows the requirements of EM 385-1-1. Level 2 SSHOs cannot be assigned to projects that have a residual Risk Assessment Code (RAC) of high or extremely high.

1.4.12.3 Level 3 SSHO

A designated Qualified Person or Competent Person with SOH responsibility that meets and follows the requirements of EM 385-1-1. Level 3 SSHOs cannot be assigned to projects that have a residual RAC of high or extremely high.

1.4.12.4 Alternate SSHO

An employee that meets the definition of the contract-required level SSHO, but is not the primary SSHO.

1.4.13 USACE Property and Equipment

Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

1.4.14 Load Handling Equipment (LHE) Accident or Load Handling Equipment Mishap

Accidents, mishaps, and near misses that involve Load Handling Equipment (LHE) as defined in EM 385-1-1 Chapter 16 that occur during operation, including operation during maintenance or testing, resulting in personal

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 if no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, or 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).

Report load handling equipment accidents, mishaps, and near misses in accordance with EM 385-1-1 Table 2-1.

1.5 MONTHLY EXPOSURE REPORTS

When submitting each monthly billing request enter Contractor and sub-contractor hours of work in the Resident Management System (RMS).

This report is a compilation of employee-hours worked each month for all site workers.

Failure to submit the Exposure Hours report may result in retention of up to 10 percent of Contractor payment.

1.6 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 all federal, state, and local laws.

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.

1.7 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

1.7.1 Personnel Qualifications

1.7.1.1 Site Safety and Health Officer (SSHO)

Employ a minimum of one Level 1 Site Safety and Health Officer (SSHO) at each project site, in accordance with EM 385-1-1 Chapter 2-8, to function as the primary SSHO. The primary SSHO is responsible for ensuring all site personnel are implementing SOH requirements according to this contract, the EM 385-1-1, applicable federal, state, and local requirements to include specific responsibilities outlined in EM 385-1-1 Chapter 2-4. The SSHO must be employed by the Prime Contractor. **The SSHO can be assigned as the Project Superintendent on this project**.

a. A Designation Letter is required for all levels of onsite SSHOs. Designate in writing all SSHOs on mandatory ENG Form 6282 (Site Safety and Health Officer Designation Letter). Both the Contractor Corporate Safety Official and the SSHO are to sign the form and submit it to the Contracting Officer for acceptance.

b. If a new or additional SSHO is assigned to perform SOH duties onsite, the Contractor must submit a new Designation Letter. Work is prohibited from being conducted until the Contracting Officer accepts ENG Form 6282 (Site Safety and Health Officer (SSHO) Designation Letter). Maintain a copy of the accepted form at the site of work.

c. All onsite SSHOs are required to meet the qualification and training requirements commensurate with the SSHO level, as established in this contract, and in accordance with EM 385-1-1 Chapter 2-3, and ENG Form 6282.

d. A designated SSHO is required to be at the site of work whenever work is performed and located so that they have full mobility and reasonable access to all major work operations occurring during the shift.

e. If the SSHO has to temporarily (that is, up to 24 hours/one day) leave the site of work due to unforeseen or emergency situations, a Level 1, 2, or 3 SSHO may be used in the interim and is to be on the site of work at all times when work is being performed.

f. If the SSHO is off-site for a period longer than 24 hours/one day, an additional/alternate SSHO of equivalent training and experience is required at the site of work to fulfill the same roles and responsibilities when work is performed.

1.7.1.2 Competent Person Qualifications

Provide Competent Persons (CP) in accordance with EM 385-1-1. Roles and Responsibilities of the Competent Person are addressed in EM 385-1-1 Chapter 2-4(c) Competent Person (CP). Competent Persons are required for confined spaces, cranes and rigging, and fall protection. The CP for these activities must be designated in writing and meet the requirements for the specific activity (e.g. Competent Person, fall protection).

The CP 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. Submit documentation of training and experience to the Contracting Officer.

1.7.1.3 Qualified Trainer Requirements

Individuals who are 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, Fall Protection, Confined Space Entry, and Scaffolds in accordance with 29 CFR 1926. Submit Certification of Competent Person training.

Instructors are required to:

a. Prepare class presentations that cover fabrication-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 (5) 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.

1.7.1.4 Crane Operators/Riggers

Provide Qualified Crane Operators meeting the requirements in EM 385-1-1, Chapter 16-3. Provide Qualified Riggers meeting the requirements in EM 385-1-1 Chapter 15-3.

The following is required for the certification and qualification of all crane operators. Contractor must use mandatory ENG Form 6209 (Certificate of Compliance for Load Handling Equipment and Rigging) to designate each operator for the equipment to be used.

a. Crane operators must be trained, tested, and certified by a nationally accredited testing organization. The Contractor is still responsible for designating in writing that the operator is qualified to operate a particular type, capacity, and configuration of equipment.

1.7.2 Meetings

1.7.2.1 Preconstruction Meeting

Refer to SECTION 01 11 01.00 28 SUPPLEMENTARY REQUIREMENT for additional requirements on the Preconstruction Meeting.

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction meeting. 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 (AHA's) 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 AHA's that must be developed and implemented during the performance of the contract. This list of proposed AHA's will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHA's 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 fabrication.

1.7.2.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed

operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen 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 a minimum of Seven (7) calendar days in advance of each meeting.

1.8 ACCIDENT PREVENTION PLAN (APP)

Prepare the APP in accordance with the format and requirements of EM 385-1-1 Chapter 2-7. A Competent Person is required to prepare the written, site-specific APP on ENG FORM 6293, Accident Prevention Plan (APP) Worksheet. The following conditions apply:

1. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.

2. 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.

3. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer **Fifteen (15) calendar days** prior to the date of the preconstruction meeting for acceptance. Contract work will not be allowed to proceed without a Contracting Officer accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract.

1. 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.

2. The SSHO must conduct on-going evaluations and updates of the APP throughout the life of the project to ensure it is up to date and site specific. Changes, revisions, and updates to the APP are to be reviewed and approved by the Contractor and submitted to the Contracting Officer for acceptance.

3. Incorporate activities not identified in the original APP as they are identified. If exposure or potential exposure to a hazard is identified, cease work in the area, secure the area, and develop a plan to mitigate and control the hazard. Notify the Contracting Officer immediately, no later than 24 hours after identification. Eliminate and remove the hazard.

4. 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 ANSI/ASSP A10.34), and the

environment.

1.8.1 Plans

Provide plans in the APP as well as required names and qualifications, in accordance with the requirements outlined in EM 385-1-1, including the following:

1.8.1.1 Standard Lift Plan (SLP)

Plan all lifts to avoid situations where the operator cannot maintain safe control of the lift. Prepare a written SLP for every lift or series of lifts (if duty cycle or routine lifts are being performed), using ENG Form 6203 (Crane Standard Lift Plan). The SLP must be developed by a Competent Person (CP) with assistance from a Qualified Person (QP) if necessary, and, reviewed, and accepted by all personnel involved in the lift. Keep a copy of the SLP on the LHE for the specific approved lift(s). Keep a copy of every SLP for a minimum of three months.

1.8.1.2 Critical Lift Plan- Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Chapter 16-7 using Load Handling Equipment Crane Operation Critical Lift Plan ENG Form 6213. Critical lifts require detailed planning and additional safety precautions. Before any critical lift, a CP or QP is required to prepare a Critical Lift Plan and submit it for approval or acceptance by the Contracting Officer thirty (30) calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1 Chapter 16.

The critical lift plan must also include the following:

a. For lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1 Chapter 16

b. When Powered Industrial Trucks (PITs)/Telehandlers and other mechanized equipment are used to hoist loads utilizing hooks, eyes, slings, chains, or other rigging, the following requirements apply:

(a) Do not use this equipment to hoist loads unless authorized by the equipment manufacturer.

(b) Follow the procedures included in equipment manufacturer's operating manual.

(c) Equipment operators, riggers, and others involved in the hoisting operations must provide written proof of qualifications.

(d) Operators must properly use and keep onsite a copy of each manufacturer's load rating capacities or charts for the approved attachments

c. For barge mounted mobile cranes, provide a Naval Architecture Analysis and include an LHE Manufacturer's Floating Service Load Chart in accordance with the criteria from the selected standard in EM 385-1-1 Chapter 16. The Floating Service Load Chart must provide a table of rated load versus boom angle and radius. The Floating Service Load Chart must also provide the maximum allowable machine list and trim associated with the tabular loads and radii provided. If the

Manufacturer's Floating Service Load Chart is not available, a floating service load chart must be developed and provided by a qualified Registered Professional Engineer (RPE) must Develop and provide a floating service load chart that is competent in the field of floating cranes. The Load Chart must be in accordance with the criteria from the selected standard in EM 385-1-1. Provide a table of rated load versus boom angle and radius; provide the maximum allowable machine list and machine trim associated with the tabular loads and radii provided; and be stamped by a RPE qualified and competent in the field of floating cranes. The RPE, competent in the field of floating cranes must stamp and certify (sign) that the Naval Architectural Analysis (NAA) meets the requirements of EM 385-1-1.

d. Multi-purpose machines, material handling equipment, and fabrication 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. 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.

1.8.1.3 Fall Protection and Prevention (FP&P) Plan

The plan must comply with the requirements of EM 385-1-1, Chapter 21-7 and ANSI/ASSP Z359.2. Be site specific, and address all fall hazards in the workplace and during different phases of fabrication. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards 6 feet or more in height.

The FP&P plan must be developed by a CP or QP.

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 as conditions change, but at a minimum every year, reflecting any changes during the course of fabrication 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).

1.8.1.4 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Chapter 21-7, ANSI/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.

1.8.1.5 Site-Specific Energy Control Plan (SSECP)

Develop a Site-Specific Energy Control Plan (SSECP) in accordance with EM 385-1-1 Chapter 12 and NWWP 385-1-20. This is a site-specific form of

HECP required for work on or near any system that produces, uses, or stores hazardous energy. The SSECP is required to be site-specific and developed according to EM 385-1-1 figure 12-1 and ANSI/ASSP Z244.1. Include the required elements of NFPA 70E when electricity is a potential energy source. Submit this SSECP as part of the Accident Prevention Plan (APP).

When work involving hazardous energy is required to be performed at or on a USACE-operated facility, coordinate a meeting with the Contracting Officer and Project personnel, including the Project Safety Officer. The purpose of the meeting is to determine which of the scenarios in EM 385-1-1 Chapter 12-4(c) will be followed as it pertains to HEC. Document the meeting and provide copies of documentation to the Contracting Officer and Issuing Individual(s).

1.8.1.6 Emergency Action Plan (EAP)

The Contractor must ensure that all Contractor personnel at Government facilities are familiar with the Government's emergency evacuation plans and procedures specific to that facility. At the Pre-work Meeting, both the Contractor and the Government are to designate points of contact for proper coordination of the EAP and to help ensure efficient and rapid evacuation of the facility.

Prior to submitting the APP, coordinate with the point of contact for that Government facility to discuss conditions where an evacuation may be necessary, specific evacuation plans to include routes and exits, any employees to remain after evacuation notification to shut-down critical operations and/or perform other duties before evacuating, employee accounting post-evacuation, and any special equipment for employees.

Develop an EAP based upon EM 385-1-1, 29 CFR 1910.38 Emergency Action Plans, and 29 CFR 1926.35, Employee Emergency Action Plans. Include the EAP in the APP. Ensure that all Contractor and Sub-contractor personnel are trained and familiar with the EAP.

1.9 ACTIVITY HAZARD ANALYSIS (AHA)

a. See EM 385-1-1 Chapter 2-6 for AHA requirements.

Before beginning each work activity, task or Definable Feature of Work (DFOW) the Contractor(s) performing that work activity are required to prepare an AHA to ensure minimum safety requirements are adequately addressed. Use ENG FORM 6206, Activity Hazard Analysis (AHA) to complete each AHA. The following applies to all AHA's:

1. AHA's 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.

2. Develop AHA's using the Project Schedule as the basis for the activities performed. All activities listed on the Project Schedule requires an AHA to be completed.

3. AHA's must identify Competent Persons as required by EM 385-1-1.

4. AHA's must be provided to, reviewed by, and signed by all involved employees prior to starting the activity. Provide copies

of signed AHAs to Contracting Officer upon request.

5. Submit each AHA to the Contracting Officer for review at least thirty (30) calendar days prior to the start of each activity.

b. 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.

1.10 LOCKOUT/TAGOUT (LOTO)-SAFE CLEARANCE OR HAZARDOUS ENERGY CONTROL PROGRAM (HECP) PROCEDURES

All Contractor work on site must meet the requirements of NWWP 385-1-20 and EM 385-1-1. Digital copies of NWWP 385-1-20 may be obtained from the Contracting Officer upon request. Safe Clearance procedures are used by Project and Contractor personnel to protect personnel, equipment and the environment as well as to ensure continuity of service. Any work performed by the Contractor that requires taking project operated equipment out of service is to be done only after a formal clearance is obtained through the Government. Report violations to the Issuing Individual. Violators of safe clearance program may require retraining and retesting.

For jobs with multiple tasks that require AHA's, prepare and submit an Activity Hazard Analysis (AHA) on the first feature of work that requires a clearance request. Verify AHA requirements at the Pre-Fabrication Meeting.

The following applies to LOTO and HECP procedures:

a. The Government will provide Safe Clearance Tags to Contractor for clearances using the Government Safe Clearance Procedures. The Contractor must provide personal safety locks, meeting NWWP 385-1-20 Chapter 6, for use with the Government's safe clearance procedures. See NWWP 385-1-20, Chapter 6 - Locks and Tags, and Chapter 10 - Outside/Contractor Personnel for further guidance.

b. Use Government HECP procedures on equipment/systems owned by the Government. Use them on all points interfacing with Government owned equipment/systems. In instances where equipment is owned by the Contractor, not yet turned over to the Government, or equipment which is not tied into Government energy sources, the Contractor may use their own Lockout/Tagout Program. Contractor Programs must be pre-approved by the Project's Responsible Official.

c. Submit the names of Authorized Individuals to the Contracting Officer prior to the Pre-Fabrication Meeting. Project-specific training will be given by the Responsible Official or designee and will be approximately 30 minutes in length. Project-specific training will be provided for every contract and only to the Contractor's Authorized Individuals. The Authorized Individuals are required to brief their work crews and subcontractors of any project-specific clearance information. Training is only required once per year and is, with the exception of project-specific training, valid for every facility within the Walla Walla District.

d. If the Responsible Official or designee determines that the

Authorized Individual's knowledge of the HECP procedures are inadequate, the Responsible Official may require retraining and retesting. See NWWP 385-1-20 Chapter 5 - Training for further guidance.

1.10.1 Safe Clearance Training

Contractor, subcontractor, vendors and visitors are required to take the appropriate level of HECP Procedure training commensurate with their job duties. Only HECP certificates generated by Vivid Learning Systems for the Walla Walla District are accepted.

Unless otherwise directed by the Contracting Officer, the Contractor shall have a sufficient number of Authorized Individuals trained to ensure adequate oversight and that there are no delays to the project.

All Contractor personnel working in areas under a Safe Clearance must be trained as Affected Persons. Any non-working personnel, vendors and visitors, entering an area under Safe Clearance must take Awareness Level training. Complete and submit training certificates to the Contracting Officer a minimum of seven (7) calendar days prior to the individual's arrival onsite. Time estimates for training follow:

a. Awareness Level Training: Approximately 1 hour (non-working personnel, vendors and visitors).

b. Affected Persons: Approximately 2 hours in addition to Awareness Level training.

c. Authorized Individuals: Approximately 3 hours in addition to Awareness Level training and Affected Personnel Training.

All costs for this training are considered incidental to the work, and therefore, no additional payment will be made. Training is an annual requirement and expires one year from completion date. Training is provided by Vivid Learning Systems available online at:

https://hecp.vividlms.com/

NOTE: The Contractor may see a "Platform Upgrade Notice" when you click on the link. Ignore the upgrade notice and click on the "Sign Up Here" tab at the bottom of the page to continue.

Cost for the training is displayed on the home page. Maintain training documentation on site, including the individual's name and date of training completion, in accordance with NWWP 385-1-20.

1.11 DISPLAY OF SAFETY INFORMATION

1.11.1 Safety Bulletin Board

Within seven (7) calendar day(s) after mobilizing to the job site, 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, Chapter 2-8 SOH Bulletin Board. Additional items required to be posted include:

a. Confined space entry permit.

b. Hot work permit.

1.11.2 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. Post the list on the project bulletin board and update daily. 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.

1.12 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

1.13 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.14 NOTIFICATIONS and REPORTS

1.14.1 Accident, Mishap, and Near Miss Investigation and Reporting

Report all accidents, mishaps, and near misses occurring incidentally to an operation, project, or facility as applicable according to EM 385-1-1 Chapter 2, Table 2-1. The Contractor is responsible for obtaining appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies.

Any fatality, in-patient hospitalization, amputation, eye loss, or property damage over $600,000 is required to be reported to the Contracting Officer immediately, but no more than eight (8) hours after the mishap occurs.

Immediate notifications includes Contractor name; contract title; type of contact; 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 fabrication equipment used and PPE used).

Preserve the scene of the accident, mishap, or near miss and all related evidence until Government investigators are on-site and the Government investigation is concluded. Assist and cooperate fully with the

Government's investigation(s) of any accident, mishap, or near miss.

1.14.2 Accident Reports

a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1 utilizing ENG Form 3394, to establish the root cause(s) of the accident.

b. Report all accidents to the Contracting Officer, using local mishap reporting procedures, in accordance with EM 385-1-1 Chapter 2, Table 2-1. The Contracting Officer will provide the Contractor the required forms.

c. Conduct an accident investigation for any load handling equipment accident (including rigging gear accidents) to establish the root cause(s) of the accident in accordance with EM 385-1-1 Chapter 2, Table 2-1. 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 copies of any required forms.

1.14.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

1.14.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

Develop and submit a Standard Lift Plan (SLP) using ENG Form 6203 for each lift in accordance with EM 385-1-1 Chapter 16-7. The SLP is required to be developed, reviewed, and accepted by all personnel involved in the lift. Submit SLP to the Contracting Officer for approval a minimum of Fifteen (15) calendar days in advance of planned lift. Keep a copy of the SLP on the LHE for the specific approved lift(s).

Develop a Certificate of Compliance using ENG Form 6209 for each LHE prior to bringing on site in accordance with EM 385-1-1 Chapter 16-8. Submit the Certificate of Compliance to the Contracting Officer. Keep a copy of the Certificate of Compliance on the LHE.

1.14.5 Contractor's Cranes

a. Contractor's cranes and equipment furnished for this work are required to conform to the EM 385-1-1 and all applicable federal, state, local and OSHA requirements. Submit Crane Wheel and Outrigger Loading Diagram and Deck Protection for Outriggers plan at least Thirty (30) calendar days prior to using any crane rated 50 tons or more on any of the Project decks. Provide in the submittal the following information on a plan view sketch or drawing. A marked-up Government-provided contract Supplemental drawing can also be used, if available.

1. Crane outrigger locations with dimensions from the center of each outrigger to identifiable project feature(s).

2. Dimensions of each outrigger.

3. Maximum load on each outrigger.

4. Outrigger pad deck protection dimensions and location. Provide deck protection for all outrigger pads.

5. If cribbing material is used, show the cribbing material dimensions and location.

b. Include, in the submittal, the cribbing material properties, and calculations to verify the cribbing material's adequacy to carry the intended loads. To the greatest extent possible, place the outriggers over existing supports such as walls. Avoid placing the outriggers next to a wall or support. Under no circumstance can an outrigger or cribbing to be placed on metal grating or hatches. See SECTION 01 55 10.00 28 CONTRACTOR WORK, ACCESS AND STORAGE AREAS, paragraph GOVERNMENT ROADWAYS AND DECK ACCESS RESTRICTIONS for information on deck loading capacities.

1.15 HOT WORK

Activities which generate or have the potential to generate heat, sparks, open flame, or explosion (for example, hot riveting, welding, burning, abrasive blasting, brazing, cutting, grinding, powder-actuated tools, or soldering) is considered Hot Work in accordance with EM 385-1-1 chapter 9-2.

Provide at least one, fully charged fire extinguisher, minimum 10 lbs. (4.5 kg), that must be readily available in the immediate area of the hot work. All extinguishers are required to be current inspection tagged, 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. Train the Fire Watch in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes 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 the emergency phone number. Report any fire to the Government POC immediately.

Obtain permit approval from a NFPA Certified Marine Chemist, or Certified Industrial Hygienist for "HOT WORK" within or around flammable materials (such as fuel systems, welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, vaults, etc.) that have the potential for flammable or explosive atmospheres.

1.16 SEVERE STORM PLAN

In case of a severe storm warning, develop an emergency plan to ensure employee safety at the project. The plan must be prepared in writing and be reviewed with all affected employees. The Contractor must complete the following:

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 Applicable)

PART 3 EXECUTION

3.1 FABRICATION 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.

Provide and use PPE in accordance with EM 385-1-1 Chapter 5. The use of 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. Mandatory PPE includes the following, as a minimum, in accordance with EM 385-1-1, chapter 5-8:

a. Head Protection that meets ANSI/ISEA Z89.1.

b. Long Pants (excessively long or baggy pants are prohibited).

c. Leather or other protective footwear. Open-toed shoes are prohibited.

d. Appropriate Class Reflective Vests.

e. Eye and /or face protection is required when there is a potential for eye and/or face injury.

f. Short Sleeved Shirt.

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 (e.g., cellular phone, two-way radios, land-line telephones or other acceptable means).

The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment.

An employee check-in/check-out communication procedure must be developed to ensure employee safety.

3.1.2 Hazardous Material Exclusions

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 Project site.

3.1.3 Unforeseen Hazardous Material

If during the course of fabrication, the Contractor encounters unforeseen hazardous material(s) such as PCB, lead paint, friable and non-friable asbestos that may be hazardous to human health, stop that portion of work and notify the Contracting Officer immediately.

Within Fourteen (14) calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change.

If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to FAR 52.243-4, "Changes" and FAR 52.236-2, "Differing Site Conditions."

3.2 FALL PROTECTION AND PREVENTION PLAN

Prepare, update, review, and approve a Fall Protection and Protection Plan, for the protection of all employees working at heights or exposed to fall hazards.

Specify in the Fall Protection and Prevention Plan, the fall protection systems, anchorage location, connecting means, body harness, and other equipment that Authorized Persons are required to use when exposed to a fall hazard in accordance with EM 385-1-1 Chapter 21-7.

3.2.1 Training

Institute a fall protection training program. As part of the Fall Protection and Prevention Plan, provide training for each employee who might be exposed to fall hazards. Provide training by a Competent Person for fall protection in accordance with EM 385-1-1 Chapter 21-3. Document the training and the practical application of the systems used in the AHA.

3.2.2 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, Chapter 21 "Fall Protection".

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 Chapter 21, 29 CFR 1926 Subpart M, ANSI/ASSP Z359.0, ANSI/ASSP Z359.1, ANSI/ASSP Z359.2, ANSI/ASSP Z359.3, ANSI/ASSP Z359.4, ANSI/ASSP Z359.6, ANSI/ASSP Z359.7, ANSI/ASSP Z359.11, ANSI/ASSP Z359.12, ANSI/ASSP Z359.13, ANSI/ASSP Z359.14, and ANSI/ASSP Z359.15.

3.2.2.1 Additional Personal Fall Protection

a. In addition to the required fall protection systems, other protection such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1 Chapter 21-8.

b. Personal fall protection systems and equipment are required for the following:

1. When working from an articulating or extendible boom, a swing stage, or a suspended platform.

2. When operating other equipment such as scissor lifts.

c. Lanyards are required to be short enough to provide fall restraint and prohibit workers from climbing out of or being ejected from the platform or lift in accordance with EM 385-1-1 Chapter 21-8.

3.2.2.2 Personal Fall Protection Harnesses

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable.

3.2.3 Flexible Horizontal Lifelines (HLL)

Provide a flexible HLL in accordance with EM 385-1-1, Chapter 21-8. 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 in accordance with 29 CFR 1926 Subpart M.

3.2.4 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1, Chapter 21-8 and 29 CFR 1926 Subpart M.

3.2.5 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 comply with the requirements of EM 385-1-1, ANSI/ASSP Z359.2, and ANSI/ASSP Z359.4.

3.3 WORK PLATFORMS

3.3.1 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. Provide an access ladder or equivalent safe access. Where a built-in ladder is part of a scaffold system, it must meet the requirements for ladders according to EM 385-1-1 chapter 24.

b. An adequate gate is required.

c. Employees performing scaffold erection and dismantling must be qualified, and work under the supervision of the Competent Person (CP), Scaffolding.

d. Scaffolding and its components are required to meet the requirements contained in ANSI/ASSP A10.8 or other applicable ANSI/ASSP standards and be capable of supporting without failure at least 4 times the maximum anticipated load.

e. Where the scaffold height exceeds four times the minimum scaffold base dimension (including the width added by outriggers, if used), the scaffold is required to be secured to the wall or structure. Place tie-ins in accordance with EM 385-1-1 Chapter 22-8.

f. Do not use brackets on scaffolds unless the tipping effect is controlled.

g. Scaffolding other than suspended types must bear on base plates upon wood mud sills (2 in x 10 in x 8 in minimum) or other adequate firm foundation.

h. For workers erecting and dismantling scaffolds at or above 6 ft, a CP is required to conduct an evaluation to determine the feasibility and safety of providing fall protection. If fall protection is not feasible, submit an AHA detailing rationale for infeasibility of use of fall protection for approval by the Contracting Officer.

i. When working above six feet or above dangerous operations, delineate fall protection requirements in the Fall Protection and Prevention (FP&P) Plan, and Activity Hazard Analysis (AHA) for the phase of work.

j. A CP must inspect all scaffold and scaffold components for visible defects before each work shift and after any occurrence which could affect the scaffold's structural integrity. All scaffold inspections must be documented on the scaffold inspection tag prior to use.

3.3.2 Elevated Aerial Work Platforms (AWP's)

Workers must be anchored to the basket, bucket, or platform 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 are required to be sufficiently short to provide fall restraint and prohibit worker from climbing out of or being ejected from the basket or platform. Lanyards with built-in shock absorbers are acceptable. Self-retracting devices are not acceptable.

The climbing of rails is prohibited.

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.

AWP's are required to be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWP's are required to have training in accordance with EM 385-1-1 Chapter 22-3. Maintain proof of qualifications on site. Provide qualifications to the Contracting Officer on request.

3.4 EQUIPMENT

3.4.1 Material Handling Equipment (MHE)

a. Do not use forklifts/PITs to support work platforms unless there is no other practical method. The manufacturer must specifically allow the specific machine to lift personnel. Maintain the operator’s manual at the work site on the forklift. If rough terrain (RT) forklift must be used, all the conditions in EM 385-1-1 Chapter 22-8 are required to be met. Do not move the forklift horizontally when a work platform is occupied. Driving a forklift equipped with a personnel work platform in a raised position or with personnel on the platform is forbidden.

b. When PITs, forklifts, or telehandlers are configured to hoist and lower (by means of a winch or hook and/or with rigging) and horizontally move a suspended load, refer to EM 385-1-1 Chapters 15 and 16.

c. Train operators of forklifts, PITs, or telehandlers according to 29 CFR 1910.178, including both classroom and practical operation. Train employees on the same type of truck they are expected to use on the job. The employer must certify that the operator has been trained and evaluated as required by the standard. Include in the certification the name of the operator, the dated of the training, the date of the evaluation, and the identity of the person(s) performing the training or evaluation in accordance with EM 385-1-1 Chapter 18-3.

3.4.2 Load Handling Equipment (LHE)

a. Equip cranes and derricks as specified in EM 385-1-1, Chapter 16.

b. Notify the Contracting Officer a minimum of twenty-one (21) calendar days in advance of any LHE entering the activity, in accordance with EM 385-1-1, Chapter 16, so that necessary quality assurance spot checks can be coordinated. Contractor's operator must remain with the crane during the spot check. Rigging gear must comply with OSHA, ASME B30.9 Standards.

c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.8 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. A Contractor is not allowed to make a lift at, or above 90% of the crane's rated capacity in any configuration.

f. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this hazard and follow the requirements of EM 385-1-1 Chapter 11, and ASME B30.5 or ASME B30.22 as applicable.

g. Do not use LHE to hoist personnel, except where the Contractor demonstrates that the assembly, use, and disassembly of conventional means of reaching the work area (such as personal hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold) is more hazardous or is not possible because of the project's physical features or work site conditions. Document this determination in the Critical Lift Plan following the requirements of EM 385-1-1 Chapter 16-7. Perform all hoisting of personnel as required in 29 CFR 1926.1431 Do not lift personnel with a line hoist or friction crane.

h. Submit an AHA for hoisting personnel to the Contracting Officer, ensuring the activity and AHA are thoroughly reviewed by all involved personnel.

i. Inspect, maintain, and recharge portable fire extinguishers as specified in EM 385-1-1 Chapter 9, and NFPA 10, Standard for Portable Fire Extinguishers.

j. All employees must keep clear of loads about to be lifted, and of suspended loads.

k. Use cribbing when performing lifts on outriggers.

l. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

m. Barricade the accessible areas at the rear of the LHE's rotating superstructure and within the swing radius of permanently or temporarily mounted items to prevent an employee from being struck or crushed.

n. Maintain inspection records in accordance with EM 385-1-1 Chapter 16-5, 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.

o. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Chapter 16-8, 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.

p. Certify that all LHE operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

q. 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 director must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base this determination on the manufacturer's instructions for calculating wind speed . Document the decision to proceed or not

with the lift in the LHE/crane operator's logbook.

3.4.3 Machinery and Mechanized Equipment

a. The operators of vehicles, machinery, and mechanized equipment are required to present operator's license or permit to the Contracting Officer upon request. Failure to do so results in the immediate prohibition of the operator to operate the vehicle, machinery, or equipment. Maintain operator's licenses and permits at the Project site.

b. Manufacturer's operating manual(s)must be on-site and reviewed for safety precautions or requirements. Incorporate manufacturers requirements into AHA's.

3.4.4 Explosives

Explosives must not be used on, or brought to the Project site, unless approved in writing, by the Contracting Officer. Obtain written permission from the Contracting Officer before bringing explosive materials onto the jobsite. Periodic replenishment of previously approved supplies does not require re-approval.

3.5 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Chapters 11 and 12.

3.5.1 Conduct of Electrical Work

a. As required in EM 385-1-1 Chapter 11-8, all equipment and circuits must be de-energized before work is started unless energized work can be justified.

b. In situations where equipment and circuits must be worked on in an energized condition, submit ENG Form 6277 Energized Electrical Work Permit (EEWP) to the Contracting Officer for acceptance fifteen (15) calendar days prior to the work to be performed.

c. Provide an AHA with the EEWP and include a summary of why the equipment/circuit needs to be worked on while energized. Treat underground electrical spaces as confined spaces in accordance with EM 385-1-1 Chapter 34.

d. Cables to 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.

e. When racking in or live switching of circuit breakers, no additional personnel other than the switch operator is allowed in the space during the operation. Plan so that work near energized parts are minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

f. When working in energized substations, only qualified electrical workers are permitted to enter.

g. When work is required 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.

h. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

i. Ensure that each employee is familiar with and complies with NWWP 385-1-20, and 29 CFR 1910 procedures.

3.5.2 Qualifications

a. Electrical work must be performed by Qualified Persons with verifiable credentials who are familiar with applicable code and electrical safety requirements including NFPA 70E. This includes work pertaining to, but not limited to the following: installation and/or removal of electric conductors, equipment, raceways, and manipulation of cables.

b. 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.

c. Train such Qualified Persons to the level of duties as assigned. All training programs are required to be approved by the Authority Having Jurisdiction (AHJ), and be properly documented.

d. Journeyman/Apprentice ratio must be in accordance with State, Local requirements applicable to where work is being performed.

e. Submit all credentials to the Contracting Officer for acceptance.

3.5.3 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 Chapter 11.

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.

3.5.4 Testing

Test temporary electrical distribution systems in accordance with EM 385-1-1. Including testing for polarity, ground continuity, and ground resistance before initial use and before use after modification. Test associated GFCI's monthly.

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DIVISION 01 - GENERAL REQUIREMENTS

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CONTRACTOR WORK, ACCESS AND STORAGE AREAS

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SECTION 01 55 10.00 28

CONTRACTOR WORK, ACCESS AND STORAGE AREAS

PART 1 GENERAL

The work covered by this section of the specifications consists of work common to more than one section of these TECHNICAL SPECIFICATIONS.

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LRFD	(9th Edition 2020; R 2021) LRFD Bridge Design Specifications

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Occupational Health Requirements

Comply with the current edition and all changes posted on the web as of the effective date of this solicitation.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals having an "I" designation are for information only. A designation following the "G" or "I" 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

Transport Loading Diagrams; G, ST

Floating Plant; I, C

1.3 CONTRACTOR DELIVERY AND ACCESS TO STORAGE AREA

1.3.1 Storage Areas

Transformer delivery and storage area is in the Project's "Storage Yard". The Contractor is to offload the transformer in the storage yard per contract requirements during normal business days and work hours only. All access to the storage yard is from the South side of the dam. The Contracting Officer Representative (COR) will designate where the transformer is to be stored.

1.3.2 Contractor Debris

a. Prevent all Contractor tools, and other items from falling into

the Navigation Lock, and river. Debris barriers must be in place at all times Contractor work risks debris falling into the Navigation Lock chamber.

b. The Navigation Lock contains river water at all times during execution of this contract. Prevent hazardous materials, debris, tools, trash, and all liquids (other than clear water) from entering the Lock. See SECTION 01 57 20.00 28 ENVIRONMENTAL PROTECTION for requirements, restrictions. and related information for protection of river water during Contractor on-site activities.

1.4 GOVERNMENT ROADWAYS ACCESS RESTRICTIONS

Hauling of materials and equipment will be permitted on the project's roadways. Submit transport loading diagrams indicating wheel loads and axle configurations for transport vehicles to haul loads exceeding HS-20, in accordance with AASHTO LRFD Bridge Design Specifications. (AASHTO LRFD Bridge Design Specifications defines HS-20 vehicles as having a gross vehicle weight of 72,000 lbs. and a maximum axle load of 32,000 lbs).

1.5 RADIO COMMUNICATION FOR FLOATING PLANTS

a. Furnish a radio on all floating plant capable of transmitting and receiving on all frequencies, including 156.700 mHz (marine band channel 14 - primary channel) and 156.800 mHz (marine band channel 16 - backup channel). When needed, the Little Goose Project Powerhouse operator will communicate with the Contractor by radio on the marine band channels mentioned above.

b. Furnish, for the exclusive use by Government inspectors, two (2) lightweight battery-operated radios complete with extra batteries, rechargers, and belt carrying cases. Radios shall be capable of transmitting and receiving on all frequencies that the Contractor will be using during the contract period, including marine band channel 14. In the event that a radio becomes inoperative, a replacement radio shall be immediately provided upon request by the KO.

c. Radio communication must be provided to Contractor personnel and Government inspectors at all times for all work within the Navigation Lock chamber and Navigation Lock approach.

1.6 FLOATING PLANT

Furnish copies of all inspections and certifications associated with the floating plant and any equipment used during operation of floating plant to the Contracting Officer. See requirements in paragraph EQUIPMENT LIST in SECTION 01 11 01.00 28 SUPPLEMENTARY REQUIREMENTS. Submit information prior to the Pre-Delivery Meeting. See EM 385-1-1 for additional requirements.

1.7 PERMITS AND RESPONSIBILITIES

The Contractor is responsible for complying with all Federal, State, and municipal laws, codes, and regulations applicable to work on this contract. This includes obtaining all necessary licenses and permits related to transportation of equipment and/or contract items, and other areas of work on this contract, as applicable. Licenses and permits shall be obtained without additional expense to the Government.

1.8 HAULING MATERIAL

No material shall be allowed to drop off vehicles while in transit. The Contractor shall take all necessary precautions to prevent any material from dropping off the vehicle onto local roads.

1.9 FIRE CONTROL

Each piece of internal combustion engine driven equipment used at the work site shall be equipped with a fire extinguisher in accordance with National Fire Protection Association (NFPA) recommendations as appropriate. The minimum approved rating of extinguishers shall not be less than 5-B:C.

1.9.1 Fire Procedures

In the case of a fire within the contract area, the Contractor shall first attempt to put out the fire. If this is not possible, notify the fire department. The appropriate COR must be notified as soon as possible of the fire and any damage estimates.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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T1 Doble Report

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SECTION 48 19 23.08 26

CLASS II GSU POWER TRANSFORMER (T1)

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

This Section covers the manufacturing and factory testing of three (3), single-phase generator step-up (GSU) power transformers rated 164,000 / 218,666 kVA, 500 kV high-voltage (H), 13.2 kV low-voltage (X & Y), Class ONAN/ONAF cooling, for delivery f.o.b. to Little Goose Lock & Dam storage yard. Each transformer shipment, hauling, site reassembly, field testing are as required in SECTION 48 20 00.04 26. Throughout this Section, the transformer tank layout is identified by Segments 1 through 4, as defined in IEEE C57.12.10, Figure 1, and indicated on the contract drawings.

1.2 GENERAL INFORMATION

1.2.1 Transformer Location

The single-phase transformers specified in this section will be spare transformers for Little Goose, Lower Granite, and Lower Monumental dams. These transformers are meant to be spares for the single-phase T1 Bank transformers at the three Projects. Contract Drawing G-003, shows the site map and the storage yard where the spare T1 transformers will be placed. The spare transformers will be placed on concrete pads in the storage yard. Supplemental drawings LGP-1-4-2/40 and LGP-1-5-0/21 shows the details on the existing transformer mounting pads.

1.2.2 Ratings

Size the new single-phase power transformers per the requirements of paragraph, "Ratings and Electrical Characteristics", to match the impedance, capacitance, and ratings of the existing single phase transformers.

1.3 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 CIVIL ENGINEERS (ASCE)

ASCE 7-22	(2022; Supp 1 2023; Supp 2 2023) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(2024) Unified Inch Screw Threads (UN, UNR, and UNJ Thread Form)
ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)

ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.24	(2022) Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500
ASME B31.1	(2024) Power Piping
ASME BPVC SEC IX	(2023) BPVC Section IX-Welding, Brazing and Fusing Qualifications

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A343/A343M	(2014; R 2019) Standard Test Method for Alternating-Current Magnetic Properties of Materials at Power Frequencies Using Wattmeter-Ammeter-Voltmeter Method and 25-cm Epstein Test Frame
ASTM A664	(2015; R 2022) Standard Practice for Identification of Standard Electrical Steel Grades in ASTM Specifications
ASTM A717/717M	(2012; R 2022) Standard Test Method for Surface Insulation Resistivity of Single-Strip Specimens
ASTM A876	(2017; E 2017) Standard Specification for Flat-Rolled, Grain-Oriented, Silicon-Iron, Electrical Steel, Fully Processed Types
ASTM D923	(2015; R 2023) Standard Practices for Sampling Electrical Insulating Liquids
ASTM D1535	(2014; R 2023) Standard Practice for Specifying Color by the Munsell System
ASTM D3487	(2024) Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2020) Standard Symbols for Welding, Brazing, and Nondestructive Examination
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.6/D1.6M	(2017) Structural Welding Code - Stainless Steel

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 693	(2018) Recommended Practice for Seismic Design of Substations
IEEE 1427	(2020) Guide for Recommended Electrical Clearances and Insulation Levels in Air Insulated Electrical Power Substations
IEEE C57.12.00	(2021) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.10	(2017) Requirements for Liquid-Immersed Power Transformers
IEEE C57.12.70	(2020) Standard Terminal Markings and Connections for Distribution and Power Transformers
IEEE C57.12.80	(2010) Standard Terminology for Power and Distribution Transformers
IEEE C57.12.90	(2021) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.13	(2016) Standard Requirements for Instrument Transformers
IEEE C57.19.00	(2023) Standard General Requirements and Test Procedures for Outdoor Power Apparatus Bushings
IEEE C57.19.01	(2017) Performance Characteristics and Dimensions for Power Transformer and Reactor Bushings
IEEE C57.104	(2019; E 2019) Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers
IEEE C57.113	(2023) Recommended Practice for Partial Discharge Measurement in Liquid-Filled Power Transformers and Shunt Reactors
IEEE C57.116	(2022) Guide for Transformers Directly Connected to Generators

IEEE C57.149	(2012) Guide for the Application and Interpretation of Frequency Response Analysis for Oil-Immersed Transformers
IEEE C57.152	(2013) Guide for Diagnostic Field Testing of Fluid-Filled Power Transformers, Regulators, and Reactors

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
ANSI C80.1	(2020) American National Standard for Electrical Rigid Steel Conduit (ERSC)
NEMA FB 1	(2014) Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA MW 1000	(2023) Magnet Wire
NEMA SG 4	(2009; R 2013) AC High-Voltage Circuit Breakers

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1) National Electrical Code

UL SOLUTIONS (UL)

UL 248-8	(2011; Reprint Aug 2020) Low-Voltage Fuses - Part 8: Class J Fuses
UL 360	(2013; Reprint Jan 2024) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 489	(2025) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 508	(2024) Industrial Control Equipment
UL 508A	(2018; Reprint Jul 2022) UL Standard for Safety Industrial Control Panels
UL 514B	(2012; Reprint Mar 2024) UL Standard for

	Safety Conduit, Tubing and Cable Fittings
UL 969	(2017; Reprint May 2023) UL Standard for Safety Marking and Labeling Systems
UL 1203	(2023; Reprint May 2024) UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
UL 4248-8	(2024) Fuseholders - Part 8: Class J

1.4 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", unless otherwise indicated below:

SD-01 Preconstruction Submittals

Welding Quality Control Plan; G, HDC

Submit for approval the welding quality control plan a minimum of 60 calendar days prior to the start of tank manufacturing. (see paragraph "Welding Quality Control Plan").

SD-02 Shop Drawings

a. Outline and Assembly Drawings; G, HDC

Submit outline and assembly drawings of the transformer for approval no later than 240 calendar days prior to the start of transformer fabrication to demonstrate that the equipment will conform to the requirements and intent of the specifications.

b. Detail Drawings; G, HDC

Submit detail drawings for approval not later than 180 calendar days prior to the start of transformer fabrication to demonstrate that the equipment will conform to the requirements of the specifications.

SD-03 Product Data

Submit for approval the product data no later than 120 calendar days prior to the start of transformer fabrication to demonstrate that the welding materials will conform to the requirements of the specifications.

a. Welding Electrodes and Rods; G, HDC

b. Shielding Gas; G, HDC

SD-05 Design Data

a. Transformer Design Data Review Report; G, HDC

Submit for approval a transformer design data review report within 14 calendar days of the design data review meeting, to demonstrate fully that all parts of the equipment will conform to the requirements and intent of the specifications.

b. Descriptive Data; G, HDC

Submit for approval the descriptive data and catalog data of all accessory devices, ancillary equipment and gaskets to be provided with the transformer not later than 210 calendar days prior to the start of transformer fabrication, to demonstrate fully that all parts of the equipment will conform to the requirements and intent of the specifications. (see paragraph "Descriptive Data")

c. Spare Parts List; G, HDC

Submit for approval a listing of all required spare parts to be provided with the transformer not later than 210 calendar days prior to the start of transformer fabrication (see paragraph "SPARE PARTS").

d. Structural Design Criteria and Seismic Calculations; G, HDC

Submit for approval the structural design criteria and seismic calculations within 45 calendar days after outline and assembly drawing approval. Perform design criteria and calculations utilizing civil or structural engineers who are presently registered professional engineers (PE) in any state or territory of the United States, and provide a cover sheet for the submittal which is stamped or sealed and signed by a PE.

e. Cabinet Heater Sizing Calculations; G, HDC

Submit for approval the calculations not later than 180 calendar days prior to the start of transformer fabrication to verify the ratings of the transformer control and power cabinet heaters, based upon the cabinet sizes, cabinet material, and the regional ambient temperature conditions as shown in Contract Drawing G-005. See paragraph "Lighting, Convenience Receptacle, and Cabinet Heaters" for information.

SD-06 Test Reports

a. Transformer Factory Acceptance Test Report; G, HDC

Submit for approval the transformer factory acceptance test report not later than 14 calendar days following completion of the factory acceptance tests. (see paragraph "Factory Acceptance Test Report").

b. Bushing Design Tests; G, HDC

Submit for approval the transformer bushing design test reports not later than 30 calendar days following completion of the tests (see paragraph "Bushing Design Tests"). If certified copies of bushing design tests previously conducted within ten (10) years are submitted in-lieu of new test results, submit them when the bushing selection is made, but not later than 60 calendar days

prior to the performance of transformer factory acceptance tests.

c. Bushing Routine Tests; G, HDC

Submit for approval the transformer bushing routine test reports not later than 30 calendar days following completion of the tests. (see paragraph "Bushing Routine Tests").

d. Bushing Current Transformer Manufacturer Routine Tests; G, HDC

Submit for approval the transformer bushing current transformer test reports not later than 30 calendar days following completion of the tests. (see paragraph "Bushing Current Transformer Tests").

g. Weld Inspection and Test Report; G, HDC

Submit for approval the weld inspection and test report not later than 14 calendar days following completion of the weld inspections and tests. (see paragraph "Weld Inspections, Tests and Weld Inspector Qualifications").

SD-07 Certificates

a. Transformer Oil Certification; G, HDC

Submit for approval the transformer oil certification documents a minimum of 7 calendar days prior to the delivery of transformer oil to the Little Goose Lock & Dam "Storage Yard". (see paragraph "Quantity and Transformer Oil Certification").

b. Notification of the Date of the Transformer Design Data Review Meeting; G, HDC

For transformer manufacturers located in the United States, notify the COR 30 calendar days in advance of when the transformer manufacturer will be ready for performance of a design data review meeting, to be held at the manufacturer's facility.(see paragraph "TRANSFORMER DESIGN DATA REVIEW MEETING").

For transformer manufacturers located in foreign countries, notify the COR 60 calendar days in advance of when the transformer manufacturer will be ready for performance of a design data review meeting, to be held at the manufacturer's facility.(see paragraph "TRANSFORMER DESIGN DATA REVIEW MEETING").

c. Notification of the Date of Factory Tests; G, HDC

For transformer manufacturers located in the United States, notify the COR 30 calendar days in advance of when the transformer manufacturer will be ready for factory acceptance tests, so that the tests may be witnessed by a Government Representative at the manufacturer's facility.(see paragraph "TRANSFORMER FACTORY ACCEPTANCE TESTS").

For transformer manufacturers located in foreign countries, notify the COR 60 calendar days in advance of when the transformer manufacturer will be ready for factory acceptance tests, so that the tests may be witnessed by a Government Representative at the manufacturer's facility.(see paragraph "TRANSFORMER FACTORY

ACCEPTANCE TESTS").

d. Welder Qualifications; G, HDC

Submit for approval the welding operators and welders qualifications a minimum of 60 calendar days prior to their performance of work. (see paragraph "Welder Qualifications").

e. Weld Inspector Qualifications; G, HDC

Submit for approval the qualifications for the Contractor's Quality Assurance personnel responsible for performing weld inspections a minimum of 60 calendar days prior to the performance of weld inspections. (see paragraph "Inspection and Weld Inspector Qualifications").

SD-08 Manufacturer's Instructions

a. Factory Test Procedures; G, HDC

Submit for approval the transformer factory test procedures a minimum of 60 calendar days prior to the performance of the factory acceptance tests. (see paragraph "TRANSFORMER FACTORY ACCEPTANCE TESTS").

b. Welding Procedures; G, HDC

Submit for approval the welding procedures and specifications, and copies of test reports, a minimum of 60 calendar days prior to the performance of work. (see paragraph "Welding Procedure").

c. Prequalified Weld Procedures; G, HDC

Submit for approval the applicable prequalified weld procedures per the requirements of AWS a minimum of 60 calendar days prior to the performance of work. (see paragraph "Welding Procedure").

1.5 TRANSFORMER WARRANTY REQUIREMENTS

1.5.1 General Warranty Requirements

In addition to the requirements outlined in FAR 52.246-18, provide a manufacturer’s warranty for the power transformers for a period of 5 years from the date of final acceptance of the work. Provide a warranty certificate for each transformer indicating the date of expiry, to be included in the final Operations and Maintenance Instructions. The following transformer issues will also be considered warranty repair items:

a. Transformer gassing quantities or rates exceeding the DGA Status 1 level as defined in Figure 2 Tables 1 through 4 of IEEE C57.104.

b. Transformer oil leaks, at welded joints as well as gasketed connections and valve stem packing.

c. Paint failures resulting in visible loss of adhesion through bubbling, flaking, peeling, or any visible rust due to paint failure.

d. Transformer bushing dielectric integrity and oil leaks.

e. Transformer control cabinet heater functionality.

1.5.2 Devices Exempt from the Transformer Full Warranty Period

Transformer ancillary devices which are not manufactured by the transformer manufacturer are subject to the device manufacturer's standard warranty period, and are exempt from the 5 year duration of the transformer warranty period. All ancillary devices which as not manufactured by the transformer manufacturer, such as gauges, have a minimum 1-year warranty or the part's manufacturer's guaranteed warranty, whichever is higher of the two

PART 2 PRODUCTS

2.1 TYPE AND RATING

2.1.1 General

Provide single-phase, three-winding, with one high-voltage and dual low-voltage windings, oil-immersed type power transformers suitable for outdoor operation in accordance with this specification. The transformers must be self-cooled/forced air-cooled type, Class ONAN/ONAF, and must be of a design that has an established record of satisfactory operation with the type of oil preservation system specified, and manufactured suitable for shipment by sea transportation, railcar, and trucking by heavy hauler. The power transformers are a step-up transformer to be used in direct connection with electrical power generators and will be subject to backfeed mode as defined in IEEE C57.116.

2.1.2 Transformer Limiting Dimensions and Equipment Arrangement

Provide transformers with the layout, equipment arrangement and dimensional requirements as indicated on contract drawings.

2.1.3 Requirements

Except as otherwise specified herein, the transformers, accessories, and spare parts must conform to the applicable requirements of IEEE C57.12.00, IEEE C57.12.10, IEEE C57.12.70, IEEE C57.12.80 and IEEE C57.12.90, and IEEE C57.116.

2.1.4 Standard Products

Provide material and equipment which are standard products from a manufacturer that is regularly engaged in their production, and are items that have been commercially available for at least 3 years prior to bid opening, unless otherwise specifically approved. Provide all materials that conforms to the requirements of these specifications. Materials must be of industrial quality, free from defects and imperfections, presently being manufactured, and of the classification and grades designated. If the Contractor desires for any reason to deviate from the standards designated in these specifications, submit for approval a statement describing the exact nature of the deviation, including complete specifications for the materials that are being proposed for use.

2.1.5 Descriptive Data

Submit for approval descriptive data for all transformer equipment, which includes catalog and technical data of sufficient detail to verify

conformance with the requirements, herein. Highlight or circle the catalog and technical data for the specific device and model, and provide ordering information and cut sheets. The descriptive data is to include the following at a minimum:

1. Electrical core steel, including country of origin
2. Winding conductors, including country of origin
3. Gasket type and material
4. Valves (each type)
5. Oil sampling device
6. Radiators
7. Cooling fans (including wiring connection methods)
8. Nitrogen regulator cabinet
9. Bushings (each type and rating)
10. Core ground bushings
11. Bushing current transformers
12. Bushing current transformer terminal boxes
13. Thermowells
14. Oil level indicator
15. Oil temperature indicator
16. Winding temperature indicator, including associated equipment
17. Pressure relief device, including discharge piping
18. De-energized tap changer, including operating handwheel
19. Rapid Pressure Rise Relay and Seal-in
20. Personal fall arrest system
21. Insulating oil, including vendor and inhibitor
22. Control and power cabinet vibration isolators
23. Fiber-optic probes
24. Fiber-optic tank feed-through plate and connectors
25. Auxiliary power transformer and mounting cabinet
26. Magnetic contactors
27. Molded-case circuit breakers (each type and rating)
28. 480 VAC circuit breaker locking provisions
29. Auxiliary relays
30. Undervoltage relays
31. Control and instrument switches
32. Terminal blocks (each type)
33. Fuses
34. Fuse holders
35. Wire duct
36. Cabinet lighting
37. GFCI receptacle
38. Cabinet heaters
39. Cabinet grounding busbar
40. Cabinet ventilation
41. Thermostat / humidistat
42. Insulated wire and cable (each type) and signal cable
43. Wire labeling method
44. Device nameplate method
45. Conduit and fittings
46. Junction boxes
47. Impact recorders for shipment (analog & digital)

If providing a conservator tank system of oil preservation include descriptive data of the following:

48. Conservator tank bladder
49. Dehydrating breather
50. Buchholz relay

2.1.6 Ratings and Electrical Characteristics

The ratings and electrical characteristics of the transformers are as follows:

a. Continuous rating, at the 65 degrees-C temperature rise, of the high-voltage winding at all taps, kVA:

(1) ONAN Rating: 164,000
(2) ONAF Rating: 218,666

b. Continuous rating, at the 65 degrees-C temperature rise, of each low-voltage winding, kVA:

(1) ONAN Rating: 82,000
(2) ONAF Rating: 109,333

b. Frequency, Hz: 60

c. Number of phases: 1

d. Rated voltage, kV:

(1) High-voltage windings: 500
(2) Low-voltage winding X: 13.2
(3) Low-voltage winding Y: 13.2

e. Winding connections (external to the transformer):

(1) High-voltage windings: Grounded-Wye
(2) Low-voltage windings: Ungrounded Delta

f. Impedance, at ONAN rated current between the high-voltage winding and each low-voltage winding, subject to IEEE tolerances, percent:

(1) 17.7% (H-X)
(2) 17.7% (H-Y)

g. Impedance, at ONAN rated current, between the low-voltage windings (X-Y), as high as feasible for an economic design, but not less than, percent: 40.5%

h. Polarity: Subtractive

i. Basic impulse insulation levels (BIL), kV:

(1) Line ends of the high-voltage windings, not less than: 1425
(2) Neutral ends of the high-voltage windings, not less than: 150
(3) Low-voltage windings, not less than: 110

j. Taps in low voltage windings: None

k. Taps (full capacity) in high voltage winding

(1) Tap 1, percent of high-voltage rating: 107.5
(2) Tap 2, percent of high-voltage rating: 105.0
(3) Tap 3, percent of high-voltage rating: 102.5
(4) Tap 4, percent of high-voltage rating: 100.0

(5) Tap 5, percent of high-voltage rating: 97.5

l. Maximum no-load losses at rated voltage and frequency, kW: 165

m. Maximum load losses at maximum ~~ONAF~~ONAN rated kVA and 1.0 power factor, with each low-voltage winding equally loaded, kW: 314

n. Maximum average sound level at rated voltage and frequency, with all cooling groups in operation, dB: 80

o. Maximum Oil Volume, GAL: **15,339**

p. Maximum transformer total weight, completely assembled and oil filled with all accessories installed, pounds: **591,500**

q. The transformers' capacitances must match those of the existing transformers and be designed to be compatible with bank of single-phase shell-type transformers. See the T1 Doble Report attachment at the end of the specifications.

2.1.7 Transformer Type

The existing transformers in T1 Bank are shell-form type transformers. Shell-form or core-form type transformers are acceptable and must meet requirements described in these specifications. The transformers design must fit existing powerhouse connections without modifications to existing equipment and must not exceed the weight specified. The new transformers, including all attached accessories, must meet the limiting dimensions specified in the contract drawings. The transformers must be designed to be compatible for operation with the existing single phase shell-type transformer in T1 Bank. The transformer must be able to be transported from manufacturer location to Little Goose Lock & Dam Storage Yard.

2.1.8 Unusual Service Conditions

2.1.8.1 Magnetic Fields

The transformer will be subject to the following unusual service conditions, as defined by IEEE C57.12.00, paragraph 4.3:

The transformers' high-current low-voltage bushings will be connected to isolated-phase bus ducts and will exhibit strong magnetic fields during operation, which may cause circulating currents in the transformer tank cover and bus duct housings. Corrective measures must be taken during manufacturing to utilize non-magnetic metals in the cover around the bushings and the bushing housing flanges.

2.1.8.2 Backfeed Mode

The transformers must be designed to operate under IEEE C57.116 related service conditions with the transformers being used as a generator step-up transformer and will be subject to periods of backfeed operation.

2.1.9 Impedance Tolerance

The impedance tolerance between the supplied single-phase transformers and the specified impedance must be limited to a maximum of 3 percent, at the ONAN self-cooled rating, to reduce circulating currents when wye-connected and assure proper operation of the transformers differential relaying.

2.2 STRUCTURAL DESIGN CRITERIA AND SEISMIC CALCULATIONS

Provide Structural design criteria and seismic calculations for the transformers, to include the main tank, base, and all major components such as bushings, oil preservation system, cooling equipment and cabinets.

2.2.1 Structural Design Criteria

Structural design criteria must include the following:

a. Indicate the industry design standards (ASCE or IEEE) and allowable stresses or capacities to which steel plate, structural steel shapes, welds, bolts and studs must conform.

b. Indicate the industry standards (ASCE or IEEE) used in developing the seismic forces and analysis techniques used in the design of the transformer and transformer components.

c. Provide the seismic design for equipment restraint in accordance with Chapter 13, "Seismic Design Requirements for Nonstructural Components," of ASCE 7-22 with the seismic design force computed as per Section 13.3 "Seismic Demands on Nonstructural Components". Provide electrical equipment restraint in accordance with the provisions in IEEE 693 Annex D, or Section 13.3 of ASCE 7-22 whichever produces the more adverse seismic effects. For ASCE 7-22, use a spectral acceleration S_{DS} = 0.32, I_P = 1.5 and z=h=1. Use a moderate seismic qualification level For IEEE 693.

d. Provide wind load calculations based upon Exposure Category "D" of ASCE 7-22. Base the effect of wind load forces upon ASCE 7-22, or 40 psf, whichever is greater.

2.2.2 Transformer Mounting

The transformers must be manufactured with structural bases that meets the requirements of paragraph "Transformer Steel Base, and that rests on the existing concrete pedestals with a steel plate cap as shown in supplemental drawings LGP-1-4-2/40 and LGP-1-5-0/21.

2.3 THERMAL DESIGN

The temperature rise above ambient temperature of the transformers or parts thereof, when tested in accordance with its ratings, must not exceed the limits of observable temperature rise for oil immersed apparatus as stated in IEEE C57.12.00 (paragraph 5.11.1). The winding temperature rise by resistance must not exceed 65 degrees-C, and the hottest spot winding temperature rise must not exceed 80 degrees-C on the tap connections that give the highest losses, at all self-cooled and forced-air cooled ratings. The transformers must be designed for satisfactory continuous operation with any combination of simultaneous loads on the low-voltage windings within their ratings, and also for the case where either low-voltage winding carries maximum rated load and the other low-voltage winding carries no load.

2.4 CORE

The transformers' core steel laminations must be high-quality, non-aging, cold-rolled, grain-oriented steel especially suitable for the

purpose, meeting the requirements of ASTM A664 and ASTM A876, and the following:

a. Lamination maximum thickness of 0.270 mm, and the design flux density less than 1.75 Tesla.

b. Electrical core steel core loss, rms exciting power, rms and peak exciting current, and ac permeability design tested in accordance with ASTM A343/A343M, with the design test reports included with the descriptive data.

c. Each roll of sheet steel used must have the surface insulation resistivity tested in accordance with ASTM A717/717M.

d. The core must be assembled with interleaved joints, and rigidly clamped to ensure mechanical strength to support the windings and to prevent shifting of the laminations during shipment, and also to reduce vibration during operation.

2.5 WINDINGS

The single-phase transformers must be manufactured with windings meeting the requirements of paragraph "Ratings and Electrical Characteristics", consisting of one high-voltage winding (H) and two low-voltage windings (X and Y). Consideration must be given to all factors of service, such as high dielectric and mechanical strength of insulation, coil characteristics, and minimum restrictions to free circulation of oil. Coils must be made up, shaped, and braced to provide for expansion, contraction, and shrinkage due to temperature changes and aging in service in order to avoid abrasion of insulation and to provide resistance to movement and distortion caused by abnormal operating conditions. The insulation of the coils must be designed to withstand possible transient voltages that occur when the transformers are operated in backfeed mode and the secondary windings (high-side) are exposed to typical system transients as described in IEEE C57.116, clause 11. Barriers must be provided between windings and core and between high-voltage and low-voltage windings. End coils must have additional protection against normal line disturbances. The windings must meet the following requirements:

a. Winding conductors manufactured from high-conductivity copper magnet wire meeting the applicable requirements of NEMA MW 1000.

b. Winding assembly of a circular coil design if the transformers are a core-form design.

c. Conductor insulation consisting of thermally upgraded Kraft paper.

d. A de-energized tap changer with taps located in the high-voltage windings. The tap changer contacts must be silvered, and capable of withstanding the full short circuit current of the transformers without damage.

e. Basic impulse insulation level (BIL) of the windings as specified in paragraph "Ratings and Electrical Characteristics", and capable of withstanding IEEE Standard dielectric tests, in accordance with paragraph "Power Transformer Tests", corresponding to the specified winding insulation levels.

f. Capable of withstanding without damage the mechanical and thermal stresses caused by short circuits on the external terminals of any winding or windings, with rated voltages maintained across the terminals of all other windings intended for connection to sources of energy, under the conditions listed in IEEE C57.12.00 (paragraph 7.1.1).

g. Fiber-optic probes embedded in the calculated hottest spot for each high and low-voltage winding duct spacers for direct winding temperature measurement, with quantities and distribution as required in paragraph "Transformer Fiber-Optic Winding Temperature Measurement."

2.6 TANK

2.6.1 Fabrication

The transformers must be manufactured with an oil-tight steel tank, with oil-tight covers per the requirements of IEEE C57.12.10 (paragraph 5.8), with the following features:

a. The main transformer tanks and any attached compartment that is subjected to operating pressures designed and manufactured to withstand, without leakage or permanent deformation, an internal maximum operating pressure not less than 10 psi.

b. Manufactured for vacuum filling (essentially full vacuum) in the field, with all valves, fittings and piping affected by vacuum filling rated for such filling.

c. Welded joints between the tank and cover, and between tank sections, designed to prevent weld splatter from entering the inside of the tank during the welding process.

d. Positioning guides inside the tank to assure the core and windings are in the correct position during the assembly process, and provide additional rigidity during transportation.

e. One or more unobstructed manholes in the cover with minimum dimensions of 24 inches by 24 inches, or 24 inches minimum diameter, to afford easy personnel access to the inside of the tank and the upper portions of the core and coils.

f. Handhole access covers in the tank sidewall for access to low-voltage bushing bottom connection, and the de-energized tap changer switch mechanism for future maintenance.

2.6.2 Lifting, Moving and Jacking Facilities

2.6.2.1 Lifting Facilities

Design loads for lifting facilities must have a safety factor of five in accordance with IEEE C57.12.10 (paragraph 5.3.1). Lifting facilities must positively keep the lifting cable in place even when the cable is slack. Provide transformers with the following lifting facilities:

a. Lifting attachments on the tank covers.

b. Adequate means for lifting the core and coil assembly from the tanks for a core-form design.

c. Lifting facilities and pivot points on the tanks adequate for lifting and pivoting the transformers from the shipping position to the upright position for a shell-form design.

d. Lifting facilities on the tanks adequate for lifting the complete transformer filled with oil. The lifting facilities will also be used for securing of the transformers during shipment.

2.6.2.2 Moving Facilities

Furnish moving facilities in accordance with IEEE C57.12.10 (paragraph 5.3.3).

2.6.2.3 Jacking Facilities

Provide transformers manufactured with jacking facilities to permit jacking the fully assembled transformer filled with oil per the requirements of IEEE C57.12.10 (paragraph 5.3.4). The design loads for jacking facilities must be a minimum of five times the actual loads to allow for possible unequal jacking forces.

2.6.3 Gasketing

2.6.3.1 General

Gaskets between metal surfaces must be set in expansion-limiting grooves so that all contact surfaces are metal-to-metal when tightened. Provide gaskets made of Nitrile NBR (Buna N), with the exception that gaskets for the low-voltage bushings must be fluoroelastomeric rubber, with a Durometer rating between 50 and 70. Circular cross-section gaskets are not acceptable for use in gasket grooves of rectangular cross-section.

2.6.3.1.1 Low-voltage Bushings

Provide low-voltage bushing gaskets that meet the following requirements:

a. Meets the requirements of ASTM D-1418, designation FKM, Type 2.
b. Manufactured with 100% virgin FKM Fluoroelastomer polymer
c. Rated for application in temperature range of -20F to +400F
d. Durometer hardness of 70 (+/- 2)
e. Minimum fluorine content: 66%

2.6.3.2 Sizing

Gasket sizing for rectangular cross-section grooves must be accomplished as follows:

a. Gasket thickness is chosen so that approximately 25-percent of the gasket cross-section protrudes above the depth of the groove, referred to as the 'gasket compression area'.

b. The width of the groove minus the width of the gasket determines the space available for gasket expansion during compression. The amount of groove space available for gasket expansion during the compression process is referred to as the 'gasket expansion area', which must be greater than the gasket compression area to avoid pinching of the gasket between the metal surfaces when tightened.

c. Proper sizing coordination between the gasket groove and the gasket cross-sections results in 25-percent gasket compression, with a remaining gasket expansion area after tightening of between 5 and 10-percent.

2.6.4 Valves

Provide all valves that conform with IEEE C57.12.10 (paragraph 5.1.8), be of ball-type stainless steel design conforming to MSS SP-72, circular flanged mounting, with reinforced PTFE valve seats, unless otherwise specifically indicated. The valves must be of full-port design, designed for use with insulating oil with a 120 degrees Celsius minimum temperature rating and include hasps for locking the handle. Provide the following valves:

a. Upper filter connection. A 1.5-inch valve with a 1.5-inch female NPT threaded open-end connection and a threaded plug, located on the tank sidewall such that it can be used to fill the transformers with oil while the transformers are under vacuum.

b. Vacuum pump connection. A 3-inch valve with a 3-inch circular-flanged open-end connection, located on the tank cover for use in connecting a vacuum pump during the vacuum filling process. Provide a gasketed blind flange cover with an integral 3-inch NPT female connection and threaded plug for the valve open-end connection.

c. Main drain. A 3-inch valve with a 3-inch circular-flanged open-end connection, located at the extreme bottom of the tank for use in gravity draining of the transformers. Provide a gasketed blind flange cover with an integral 3-inch NPT female connection and threaded plug for the valve open-end connection.

d. Oil sampling valve. A 1-inch valve, with a 1/2-inch NPT threaded open-end connection and a 1/2-inch threaded sampling device, complete with protective cover. This valve may be located at the main drain valve location.

e. Lower filter connection. A 1.5-inch valve with a 1.5-inch female NPT thread open-end connection and a threaded plug, located at the extreme bottom of the tank.

f. Tank air vents. Threaded plugs for venting the radiators. Schrader valves are not acceptable for use as vent valves.

g. Nitrogen gas connection. Two 1/2-inch valves for connection of the nitrogen generator system tubing.

h. Radiator drain. A 1/4-turn valve at the lowest point of each radiator to permit draining, with an NPT threaded open-end connection and threaded plug.

i. Isolation valves.

(1) Radiators. At the inlet and outlet of each radiator to permit removal without draining the oil from the tank. Radiator isolation valves at the transformer tanks may be of a butterfly type.

(2) Rapid pressure rise relay. 1.5-inch isolating valve for the

rapid pressure rise relay.

(3) Gas-in-oil monitor interface valve. Two 2-inch valves for future connection to the gas-in-oil monitor

(4) Conservator tank. If providing a conservator tank system, provide a valve isolating the conservator tank from the main transformer tanks, and isolating the Buchholz relay. Isolation valves adjacent to the Buchholz relay may be of a butterfly design.

2.6.5 Connections

2.6.5.1 General

Provide all bolts, studs, machine screws, nuts, and tapped holes designed for customer connection in accordance with ASME B1.1 (inch fasteners). Bolting hardware must be Grade 8 minimum, or equivalent, and all hardware not internal to the tank must be galvanized. Threads for sizes 1/4-inch to 1-inch, inclusive, must be NC or UN series. The sizes and threads of all valves, pipe and fittings, conduit and fittings, tubing and fittings, and connecting equipment, must be in accordance with ASME B1.20.1. Manufacturers' standard threads and design may be used on small items which are integrally replaceable, except that threads for external connections to these items must meet the above requirements.

2.6.5.2 Stainless Steel

Install all stainless steel connecting hardware using an anti-galling compound such as molybdenum disulfide on the threads prior to connection, or the nuts may be of a Nitronic 60 grade stainless steel.

2.6.6 Steel Pipe and Fittings

Provide steel pipe that conform to ASTM A53/A53M, Grade A, Weight Class XS. Dimensions of terminating flanges must conform to ASME B16.1 and ASME B16.24.

2.6.7 Grounding

Provide transformer tanks with four ground pads, with grounding provisions in accordance with IEEE C57.12.10 (paragraph 5.5).

2.6.8 Portable Fall Arrest System

2.6.8.1 Portable Fall Arrest System Anchor Post

Provide one portable fall arrest system anchor post. The anchor post must have the following features:

a. Three-stage, four-position telescoping design of aluminum design.

b. Provision of three independent swivel tie-off points, with horizontal lifeline attachment.

c. Base leveling screws allowing the system to be plumbed to vertical for working stability on inclines up to 15-degrees.

d. Designed for attachment to a uni-anchor mounting plate.

2.6.8.2 Anchor Post Accessories

Provide the following accessories with the portable fall arrest system anchor post:

a. Rescue Davit Arm, with quick mount winch and cable.

b. Carrying bag for the anchor post assembly.

c. Carrying bag for the Davit Arm with mounted winch.

2.6.8.3 Mounting Plates

Provide two portable fall arrest system anchor post mounting plates welded on the transformer covers, located so that the center of each manhole access cover is 36-inches from the mounting plate. The mounting plates must be designed for use with the portable fall arrest system anchor post indicated above.

2.6.9 Transformer Steel Bases

The transformers must be manufactured with an integral structural steel base designed for meeting the following requirements:

a. Suitable for resting on the existing concrete pedestals with steel caps as shown on supplemental drawings LGP-1-4-2/40, LGP-1-5-0/21, and I-003, Volume 1.

b. Capable of supporting the weight of the assembled and oil filled transformers on the existing concrete pedestals with steel caps.

c. Manufactured to be suitable for moving on rollers or skids when the transformers are completely assembled and filled with oil, permitting moving the transformers in a direction parallel to either centerline, with suitable pulling eyes provided.

d. Spare must directly bear on steel bearing plates of the storage structure and the foundation plates in operating locations. Provide at minimum provisions for six (6) 1-inch diameter anchors to be installed in the locations shown in the resource drawings and adequate clearance to install the anchors.

2.7 COOLING EQUIPMENT

2.7.1 Radiators

Provide transformers manufactured with radiators to cool the oil at a 164,000 kVA continuous load, without any cooling groups in operation. The radiators must meet the following requirements:

a. Located on the tanks to ensure uniform circulation of the oil through the windings, with valves installed on each connection to the main tanks so that the radiators may be removed for repairs without taking the transformers out of service.

b. Fully hot-dip galvanized on the outside and remain unpainted.

c. Designed and manufactured to withstand essentially full vacuum to permit filling of the transformers under vacuum with the radiators

in-place and radiator valves open.

d. Provisions for draining and venting each radiator, 1/4-turn ball valve for draining each radiator, and lifting eyes for handling.

e. The welding and fittings must be smooth, both inside and out, so as to present no obstruction to the flow of oil inside, with full penetration welds on the outside of the radiators such that there will be no crevices in which water might collect.

2.7.2 Cooling Fans

Provide Horizontal-draft cooling fans so that the continuous forced-air-cooled capacity of the transformers will be at least 218,666 kVA without exceeding the allowable temperature rise specified in paragraph "Ratings and Electrical Characteristics". Locate the cooling fans to direct the air stream against the radiator and to prevent recirculation of discharged air. Provide cooling fans that meet the following requirements:

a. Balanced cast aluminum fan blades.

b. Hot-dip galvanized steel basket-type fan blade guards.

c. Fan motors to have IP55 enclosure rating.

d. Fan motor housing painted with epoxy primer and aliphatic urethane top-coat.

e. Individual thermal overload protection with automatic-reset.

f. Fan motors with permanently lubricated, double-sealed ball bearings.

g. Fan motors with Class F insulation, Class B temperature rise.

2.7.3 Power Supply Equipment

The power supplies for fan motors will be Government-furnished, 480 V, three-wire, 3 phase, 60 Hz, as indicated on the contract drawings. Provide two 3-pole, 600 V, molded case circuit breaker of proper current rating in the power cabinet for the supply circuit.

2.7.4 Cooling Control Equipment

Furnish and install all necessary protective and control equipment for the fan motors in the control and power cabinets for each transformer (see paragraph "CONTROL AND POWER CABINET EQUIPMENT").

2.8 BUSHINGS

2.8.1 General Bushing Requirements

Provide transformers with one high-voltage, four low-voltage, and one neutral leads brought out from the tank through bushings as specified below. Bushings of the same voltage and current rating must be interchangeable and as applicable, conform to IEEE C57.19.00 and IEEE C57.19.01. All bushings must meet the following requirements:

a. Of recent manufacture and of a type and style currently being

manufactured.

b. Nameplate rated and tested for use at 60 Hz rated frequency.

c. Rated for outdoor service, with UV resistant, porcelain insulating sheds for bushings which will be exposed to direct sunlight.

d. Manufactured so that there will be no stressing of any parts due to temperature changes, and means provided to accommodate conductor expansion.

e. Gastight and oiltight when installed on the transformer tanks.

f. The power factor of each bushing must meet the requirements of IEEE C57.19.01, Table 6, or as otherwise specifically required herein.

2.8.2 High-Voltage and High-Voltage Neutral Bushings

The high-voltage and neutral bushings must be designed to withstand the standard withstand test voltages as indicated in Table 1 of IEEE C57.19.01, and tested in accordance with paragraph "Bushing Tests". Provide Hitachi Type O Plus C bushings that meet the following requirements:

a. Designed for use in an air-to-oil power transformer applications.

b. Manufactured with a normally grounded test tap.

2.8.2.1 High-Voltage Bushing Ratings

a. Insulation class, kV: 500

b. BIL rating, kV: 1,550

c. Minimum current rating, Amperes: 1,600

d. Creepage distance: Light contamination

e. Drawing number: T550W2000VV

2.8.2.2 High-Voltage Neutral Bushing Ratings

a. Insulation class, kV: 25

b. BIL rating, kV: 150

c. Minimum current rating, Amperes: 1,200

d. Creepage distance: Light contamination

e. Drawing number: T025W0412AT

2.8.3 Low-Voltage Bushings

Low-voltage bushings must meet the requirements of IEEE C57.19.01 (1991), and must be tested in accordance with paragraph "Bushing Tests". The bushings must be of solid bulk design of a low-corona design for vertical mounting, and the exterior shell above the mounting flange must be of porcelain design and formed in one piece. Fluoroelastomeric rubber gaskets must be used for the installation of all low-voltage bushings.

Provide Hitachi Type RJ Bushing that meet the following requirements:

a. Insulation class, kV: 25

b. BIL rating, kV: 150

c. Minimum current rating, Amperes: 10,000

d. Thermal rating, degrees Celsius temperature rise: 125

e. Drawing number: T025B1000DS

2.8.4 High-Voltage and Neutral Bushing Terminals and Connections

Provide high-voltage and neutral bushings with threaded copper terminal stud with dimensions in compliance with IEEE C57.19.01.

2.8.5 Core Ground Bushings

The transformers must be manufactured with two external bushings for core grounding; one for the main core connection to ground, and one for the core frame connection to ground. The bushings must be mounted adjacent to each other and located on the transformer tank covers, protected with a removable weatherproof metal cover with device nameplates. Provide bushings manufactured with an integral cast copper stud, with an insulating body of either epoxy or solid porcelain, and include a bolted-flange so that they can be removed for maintenance without having to enter the tank. The stud must be silver plated, with tapped holes for connection of removable grounding straps between the bushing bottom terminal and the core and tank wall. The minimum ground wire size from each bushing top terminal to the tank must be #4 AWG equivalent. The core ground bushings must have the following minimum nameplate ratings:

a. Insulation class, kV: 2.5

b. BIL rating, kV: 45

c. Minimum current rating, Amperes: 100

2.8.6 SFRA Test Shipping Bushings

For the purposes of performing SFRA testing with the transformers in the shipping configuration, each shipping cover installed after the bushings have been removed for shipment must include a bushing that is connected to the winding leads, so that the SFRA tests can be performed just prior to each transformer shipment and immediately after each transformer delivery to the Little Goose Lock & Dam "Storage Yard". This assembly permits the SFRA testing on the transformers without having to gain entrance into, or modifying the transformer shipping assembly. The winding leads must be appropriately braced inside the transformer tanks to assure there is no movement during shipment which could damage the bushings, or potentially alter the SFRA test results. During shipment, the external terminals of these bushings must be grounded to the tank. Testing must be performed per the requirements of paragraph "Sweep Frequency Response Analysis Tests". Each temporary SFRA Test Shipping Bushings must be of the same manufacture and rating as the core ground bushings.

2.8.7 Shipment

For bushings shipped separate from the transformers, each bushing must be crated and packed per the manufacturer's requirements in such a manner to protect the bushing from damage due to moisture, breakage and vibration damage during transit.

2.9 BUSHING-TYPE CURRENT TRANSFORMERS

All bushing-type current transformers must conform to the requirements of IEEE C57.13 and additional requirements in NEMA SG 4, and have revenue metering accuracy classifications as required in Table 6 of IEEE C57.12.10, unless otherwise specifically indicated. The continuous thermal rating factor must be a minimum of 1.33, based upon a 30 degree Celsius average ambient air temperature.

2.9.1 High-Voltage Bushing Current Transformers

Provide two 1200:5, multi-ratio bushing-type current transformers for each transformer high-voltage bushings.

2.9.2 Low-Voltage Bushing Transformers

Provide bushing current transformers on the low-voltage bushings as required for the winding temperature monitoring equipment.

2.10 LOW-VOLTAGE BUSHING HOUSINGS

Provide transformers that are manufactured with four low-voltage bushing housings as indicated on the contract drawings. Provide housings that bolt to the isophase bus housing and to the transformers. The Government will utilize the existing copper conductors to connect the bushing to the isophase bus when the transformers are installed. Provide a weather proof enclosure with an easy to remove cover that allows full access to the bushing and bus bars.

2.11 TRANSFORMER MOUNTED ACCESSORIES

2.11.1 General

Provide rugged outdoor sealed dials, indicators, and gages installed on the transformers with military connectors, tempered glass faces, stainless steel bezel, and stainless steel housings. Provide dials, indicators, and gages with capillary that have stainless steel armor. The dials, indicators, and gages must be mounted at a height of approximately 60 inches above the base of the transformers, unless otherwise indicated, and arranged for convenient reading standing at the level of the base. Provide the following accessory devices that are included in the price for the transformers, and meet the requirements of IEEE C57.12.10 (paragraph 5.1), unless otherwise indicated.

2.11.2 Liquid Level Indicator

Provide one magnetic-type liquid level indicator located on the tank sidewall, equipped with three circuit-closing low-level alarm contacts suitable for use with an ungrounded 125 V DC circuit. The indicator must have a 6-inch dial face with a field-replaceable case, with the dial marked to indicate the 25 degrees Celsius oil level and the maximum and minimum oil levels.

2.11.3 Thermowells

Provide a total of five top oil thermowells and one bottom oil thermowell housed in weatherproof enclosures, with functionality as indicated on Contract drawing E-109 for each transformer. The thermowell locations must be designed such that they are always submerged in the insulating oil during transformer operation. Thermowells must be provided for the following:

a. One thermowell for use with the analog liquid temperature indicator, located on the tank sidewall near the top oil level in the path of the hottest oil.

b. Two thermowells for use with the analog winding temperature indicators, one for each low-voltage winding, located on the tank sidewall near the top oil level in the path of the hottest oil.

c. Three spare thermowells with NPT plugs. One must be for future use with a transformers temperature monitor for top oil temperature, located on the tank sidewall near the top oil level in the path of the hottest oil. One must be for future use with the transformer temperature monitor for bottom oil temperature, located on the tank sidewall.

2.11.4 Analog Temperature Indicating Equipment

The analog indicating equipment must be located on the tank sidewall as shown on the Contract drawings, with functionality as indicated on the control schematics.

2.11.4.1 Liquid Temperature Indicator

Provide one dial-type indicating thermometer for liquid temperature indication with a bourdon-tube sensing element for each transformer. The dial indicator must cover a range of 0 to 120 degrees Celsius and be equipped with two adjustable circuit closing alarm contacts suitable for use with an ungrounded 125 V DC circuit. One switch contact must be used for top oil over-temperature alarm set at 90 degrees Celsius.

2.11.4.2 Winding Temperature Equipment

a. General: Provide Two winding temperature indicators (WTI), with associated equipment, for use in remote indicating of the temperature of each low-voltage winding (X and Y), and for use as an over-temperature trip backup to the future transformer temperature monitor for each transformer. The WTI equipment must be responsive to the current in the phase winding and to the top oil temperature, indicating the approximate hot-spot temperature of the winding, and provided with a means for calibration. Each WTI must include the following:

(1) A bourdon-tube sensing element located in the thermowell for operation of a dial indicator.

(2) A current transformer installed at each low-voltage winding which supplies current to a balancing autotransformer, proportional to the transformer load.

(3) A means for calibration connected each low-voltage winding current transformer and the thermowell heaters.

(4) Thermowell heating elements powered from the current balancing autotransformer, which simulates the winding temperature rise by adding the rise from the heating elements to the top oil temperature.

(5) An ungrounded three-wire 100-ohm platinum resistance temperature detector, which will be used with existing remote temperature recording or logging.

b. Dial Indicator and Switches: The WTI must have four electrically-independent, self-resetting contacts suitable for use on 125 V ungrounded dc circuits. Three switch contacts must be used as follows:

(1) One switch contact for cooling fan control. The setting of this contact is to be determined based on the results of the factory temperature rise tests.

(2) One switch contact for winding over-temperature alarm , set at 110 degrees Celsius.

(3) One switch contact for winding over-temperature trip set 117 degrees Celsius.

c. Leads: The leads from the WTI equipment must be routed through watertight and oiltight conduit fittings, and terminated in the transformer control cabinets. The connecting leads between the RTD elements and control cabinet terminal blocks must be soldered.

2.11.5 Rapid Pressure Rise Relay

Provide a rapid pressure rise relay and all connecting hardware required for each transformer. The rapid pressure rise relay must be designed for operation in oil space and have the following features:

a. Cunstructed with a die cast aluminum housing with ANSI 70 epoxy paint coating and an IP65 rating, designed for horizontal flange mounting.

b. Ambient operating range from -40 degrees Fahrenheit to 180 degrees Fahrenheit.

c. Rated pressure range of -14.7 to 20 pounds per square inch gauge.

d. A snap action, SPDT switch rated for 1/2 amp at 125V DC (resistive).

e. Military connector assembly with cable grip parts provided. Type SOOW, 16 gauge, 3 conductor cable to be provided and custom fit on-site at an estimated length of 40 feet (to be field verified by contractor).

2.11.6 Rapid Pressure Rise Seal-In Relay

Provide a rapid pressure rise seal-in relay rated for 125V DC operation to latch in the momentary switch actuation from the existing rapid pressure

rise relay, to be installed in the transformer control cabinets, with the following features:

a. Designed specifically for use as a seal-in relay for the rapid pressure rise relay

b. LED Status indicating light and an LED Trip indicating light.

b. Two output relays with contacts rated for 8A at 250 Vac.

c. Reset button to unlatch the relays.

d. Redundant make/break circuit requirements that protect against false trips.

e. Surrounding air temperature range of -49 degrees Fahrenheit to 158 degrees Fahrenheit.

2.11.7 Pressure Relief Device

2.11.7.1 General

Provide each transformer tank with a self-resetting, mechanical-type high-flow pressure relief device mounted on the tank cover to automatically relieve internal pressure, and to protect the tank against rupture due to arcing below the surface of the oil. One pressure relief device must be provided for a volume of insulating oil contained within the main tank of less than 10,000 gallons, and two pressure relief devices must be provided for a volume of oil greater than 10,000 gallons. The relief device must be capable of withstanding full vacuum without rupture or loss of accuracy, designed to minimize oil discharge during operation, and to exclude air and water after it opens. It must be equipped with a metal semaphore-type visual indicator and an alarm contact suitable for operation on a 125 V DC ungrounded circuit. The pressure relief device must have an oil-directed cover.

2.11.7.2 Oil Discharge Piping

Provide metal discharge piping for directing the oil discharged from the pressure relief device to the base of each transformer tank that is sized to match the discharge outlet of the pressure relief device. The discharge piping must extend to approximately 24-inches above the base of the transformers, with mounting supports to the transformer tanks not spaced more than 36 inches apart, and the piping outlet provided with a screen with a maximum hole size of 1/8-inch to discourage entry by animals, birds, and insects. The manufacturing details of the oil discharge piping must be included in the manufacturer's shop drawings.

2.11.8 Gas and Oil Actuated Relay (Buchholz)

If providing a conservator tank system of oil preservation, each transformer must be provided with a gas and oil actuated relay (Buchholz relay) located in the pipe connecting each transformer tank to the constant-pressure, reservoir tank. The relay must conform to the requirements in this paragraph. Pipe-work must be so arranged that all gas arising from the transformers must pass into the relay, and the size and arrangement of pipe-work must conform with the recommendations of the relay manufacturer. A flanged, flexible section of oil pipe must be provided between the Buchholz relay and the transformer tanks. The relay

must have the following features:

a. Provide a relay that is manufactured of a corrosion-resistant, oil-tight alloy casting, have flanged housing connections, and must have graduated inspection glass windows that enable the volume of gas and the contact system to be inspected.

b. Two floats (one for gas accumulation and one for low oil level) and one flap with counterbalance weight for the detection of oil speed.

c. A push-button for testing the relay electric circuits.

d. A pneumatic test device.

e. The relay must have independent alarm contacts wired back to the transformer control cabinets that close on collection of gas or at low oil level, and contacts that close following an oil surge. Mercury-based contacts will not be acceptable. The normally-open, electrically separate alarm and tripping contacts must not be exposed to oil, and must have a rated nominal current of 2A a.c./d.c. and a rated nominal voltage of 240V a.c./d.c.

f. Operation of the relay must be immune to seismic disturbances.

2.11.9 De-Energized Tap Changer Control

Provide each transformer with an external, manually operated tap changer for changing connections to the taps in the high-voltage windings when the transformers are de-energized. The tap changer control must have the following features:

a. Include an operating hand wheel, indicating pointer and dial, and means for locking the tap changer in any desired tap position.

b. The operating hand wheel must be mechanically interlocked with the tap mechanism to prevent its removal when the mechanism is not in a completed tap position.

c. Transmission of motion from the operating hand wheel shaft to taps by interaction of rigid members.

d. The tap changing mechanism must render it impossible to leave a winding open or short circuited when the operating wheel is placed in a locked position.

2.11.10 DGA Mounting Brackets

Provide mounting brackets for installation of a future on-line DGA monitor. Mounting brackets should have multiple holes to accommodate positioning of future upper and lower unistrut mounting brackets to accommodate a DGA monitor that the Government will procure in the future.

2.11.11 Contacts and Devices

The contacts of all relays, gages, and thermometers must be insulated from ground and must be of a positive snap-action type. Alarm contacts must be suitable for operation on 125 V DC ungrounded circuits and rated 0.5 amperes (resistive) at 125 V DC.

2.12 INSULATING OIL

2.12.1 Quantity and Transformer Oil Certification

Provide all the oil required to fill the transformers to the proper operating levels at Little Goose as well as the oil required for factory tests. Submit for approval the transformer oil certification documents prior to prior to the factory tests and delivery of the transformer oil to the Little Goose Lock & Dam "Storage Yard", indicating that the oil furnished for placing the transformers in service will meet the requirements specified below.

2.12.2 Type of Oil

The grade of insulating oil furnished must be unused, produced from a naphthenic base crude petroleum specifically prepared and refined for use in electrical equipment as an insulating and cooling medium. Paraffinic and Paraffinic-blends are not acceptable. Except for the oxidation inhibitor, the insulating oil must be free from additives of every kind, either natural or synthetic in any quantity, such as silicone or ester oil contamination from hoses or processing equipment.

2.12.3 Chemical, Physical and Electrical Characteristics

The insulating oil provided must have all tests performed per the requirements of ASTM D3487, Table 1, Type II, with an oxidation inhibitor content of between 0.25 and 0.30 percent by mass, prior to shipment.

2.12.4 Sampling

Samples for testing must be obtained as specified in ASTM D923.

2.12.5 Testing

Chemical, physical, and electrical tests must be conducted by the Contractor in accordance with the test methods listed in ASTM D3487, Table 1. A PDF copy of the test reports must be submitted for approval prior to shipment of the oil.

2.13 OIL PRESERVATION SYSTEM

2.13.1 General

Provide transformers with either an inert-gas pressure system or a constant oil pressure system. Any oil preservation system provided must meeting the dimensional requirements shown in the Contract drawings.

2.13.2 Inert-Gas Pressure System

2.13.2.1 General

An inert-gas pressure system is the preferred oil preservation system. If the transformers are provided with an inert-gas pressure system, the system must conform to all the requirements listed in section "Inert-Gas Pressure System." The system must consist of a nitrogen cylinder regulator enclosure that holds two cylinders, one of which is connected to the single regulator and supplies the blanket space and all associated stainless-steel piping and two 1/2-inch stainless-steel ball valves located at the top of the tank for connection of the nitrogen piping. The

nitrogen gas must be supplied from the high-pressure cylinders through a pressure regulator, conforming to the requirements of IEEE C57.12.00 paragraph 6.6.3. Two cylinders of nitrogen gas must be furnished with the transformer for use with the regulating equipment and must remain the property of the Government.

2.13.2.2 Additional Gas Space

Use the vacuum bracing, and, if required, an additional external gas expansion tank to implement the inert-gas pressure system.

2.13.2.3 Pressure Regulating Equipment

The pressure regulator must be of a make and type which has been in successful operation with transformers for a period of not less than five years. All fittings and tubing for nitrogen connections between the pressure regulating equipment and the transformer tanks must be furnished with the transformers, and must be stainless steel flex tubing manufactured at the correct length for the routing and application with integral screw-on fittings, and matching terminations. The tubing must be anchored to the transformer tanks along its length a maximum of every 36-inches. The pressure regulating equipment must maintain the transformers' nitrogen pressure as follows:

a. Low pressure regulator: 0.5 psi

b. High pressure regulator: 5.0 psi

c. Pressure relief valve: 6.5 psi

2.13.2.4 Alarm functions

Alarm contacts suitable for use on a 125 V DC ungrounded circuit, wired back to the control cabinet to indicate the following:

a. Empty cylinder alarm: 200 psi

b. Low pressure alarm: 0.25 psi

c. High pressure alarm: 8.5 psi

2.13.2.5 Enclosure

A NEMA 3R rated steel enclosure mounted as low as possible on the transformer tanks containing the gas cylinders and pressure regulating equipment, meeting the requirements of NEMA 250 with the following features:

a. A gasketed window permitting viewing of the gauges without opening the door.

b. A removable stainless steel floor with a 'lipless' threshold.

c. A means for locking of the door.

d. A door activated light.

e. A thermostatically controlled heater.

f. A GFCI outlet.

g. The enclosure must be grounded to the transformer tanks by means of a bonding jumper.

2.13.2.6 External Gas Expansion Tank

If required to implement the inert-gas oil expansion tank, provide an external gas expansion tank located as indicated on the contract drawings.

2.13.3 Air Cell, Constant-Pressure, Reservoir Tank System

2.13.3.1 General

If the transformers are provided with a constant oil preservation system of oil preservation, the system must conform to all the requirements listed in section "Air Cell, Constant-Pressure, Reservoir Tank System." The system must consist of one oil reservoir mounted on the transformer tanks, with the location and height coordinated with the high-voltage bushing turrets. The dimensions of the transformers must fit within the dimensional requirements shown in the Contract drawings. The tanks must also meet all electrical clearances as required in IEEE 1427 from the high voltage equipment when installed in place. The reservoir tank must be designed for full vacuum during vacuum treatment and oil-filling, with valves provided for equalizing the pressure to the air bladder during these processes. The reservoir must be provided with a sump chamber to collect any impurities, and a minimum of two locations within the tank for suspending the air bladder, other than the flanged air vent connection. The reservoir liquid level indicator must be arranged to close the set of low-level alarm contacts when the oil level becomes too low or the air bladder sinks.

2.13.3.2 Air Bladder

The oil reservoir must contain an air bladder arranged to prevent direct contact between the oil and air. The air bladder material must be nylon-impregnated nitrile rubber designed for long life and for service in contact with hot oil, and must include a minimum of two integral straps used for suspending the air bladder from the inside top of the reservoir tank. The air bladder must be vented through a weather-tight maintenance-free electronic dehydrating breather provided with a suitable desiccant. Dimensions and drawings of the air bladder must be included in the descriptive data.

2.13.3.3 Maintenance-Free Dehydrating Breather

Provide one maintenance-free dehydrating breather designed for a generator step-up transformer less than or equal to 200MVA for each conservator tank, utilized for removing atmospheric moisture from the air drawn into the reservoir tank air bladder, must be located on the transformer tanks at a height of approximately 48 inches above the base of the transformers. The hygroscopicity must be based upon a silica gel and sensor-controlled heated high-grade steel filter. During normal operation, the silica gel dries the air entering the piping to the reservoir tank. When the relative humidity exceeds a selected value, the self-regulating heating element inside the dehydrating breather is activated, and extracts moisture from the silica gel, which condenses and drips out of the filter system. The vent piping connecting the oil reservoir air bladder to the maintenance free dehydrating breather must be

metal, of 1-1/2-inch minimum diameter, and galvanized inside and out to help reduce corrosion. Provide a maintenance free dehydrating breather with the following characteristics:

a. Visual sight inspection glass.

b. Sealed control housing suitable for outdoor operation.

c. Designed for ambient temperature operation between -40 and 80 degrees C.

d. Status indicators for Power On, Heater On, and Device Malfunction, with one normally closed contact for Device Malfunction annunciation.

e. Supply voltage of 120 V AC - 240 V AC, 60 Hz

f. Filter heating system

g. Test button

h. Analog output: 4-20 mA

2.14 TRANSFORMER CONTROL AND POWER CABINETS

2.14.1 General

Provide the transformers with control and power cabinets, mounted on the transformers' Segment 3 tank sidewall, as indicated. The fabrication and assembly of each cabinet must conform to the requirements of UL 508, UL 508A, and NEMA 250. The cabinets must be manufactured such that all 480 V AC wiring and equipment reside only in the power cabinet, and the control cabinet only includes wiring and equipment at maximum operating voltages of 125 V DC or 120 V AC. The cabinets must have the following features:

a. Environmental enclosure rating of NEMA Type 4.

b. Fabricated out of type 304 stainless steel that will remain unpainted on the exterior.

c. No. 12 Manufacturer's Standard Gage minimum thickness.

d. Rainproof enclosure vents of NEMA Type 3R construction, installed on the control cabinet enclosure back panel.

e. Bundled wire runs within the cabinet, routed through low-smoke, halogen-free wiring duct with slotted walls and interior corner guards to protect the wiring.

f. "Piano-hinges" will not be acceptable for cabinet doors.

g. Cabinet interiors powder-coated white.

h. Solar shielding provided on the top, front and side panels of the enclosures, with cut-outs as required for the enclosure door viewing windows.

i. Door handles provided with provisions for locking, with all doors keyed the same.

j. Ground bonding jumper from each cabinet to the main transformer tanks.

2.14.2 Cabinet Mounting and Conduit Interface Provisions

The control and power cabinets must be configured as indicated on the contract drawings. Provide a structural steel framework for mounting the control and power cabinet assemblies to the transformer tanks' cabinet mounting frame rails, utilizing vibration isolation mounts. The vibration isolation mounts must be natural rubber with integral mounting stud provisions, sized for the maximum anticipated load of the cabinet assembly, and be a standard commercially available product for the purpose. Removable, gasketed plates must be provided in the bottom of the control and power cabinets, to which the external conduit connections to the Project will be installed. All wire and cable entering the control and power cabinets must be through conduit, and all conduit connections to the cabinets made through the base bottom plate of the cabinets.

2.14.3 Control Cabinet Requirements

Provide control cabinets with device layouts must be as indicated on contract drawings, and have the following features:

a. Devices mounted on the back of hinged panel doors that are not visible from the panel door fronts mounted such that device mounting screws do not penetrate the panel doors.

b. Provide windows in the control cabinet doors made of tempered glass, utilizing Claytonrite style rubber seals installed with silicone sealant so as to provide a waterproof installation.

c. Provide a 2-inch diameter wiring access hole between the power and control cabinets near the base of the cabinets, with protective bushings, for the routing of 120 V ac power from the control cabinet to the power cabinet for heaters and lights, and the permissive wiring to fan contactors..

d. Provide terminal blocks and wiring layouts such that all wiring for interconnection to the Project are located in the same vicinity near the base of the cabinet.

e. Provide two internal swing-panels for future installation of the transformers temperature monitor controls and annunciators.

f. Provide a 90-degree hinged, fold-down computer tray on the inside of the control cabinet door, with a means of securing the tray in the upright position.

2.14.4 Power Cabinet Requirements

Provide all 480 V AC protective and control equipment for the cooling fans, including the molded-case circuit breakers, contactors, and power terminal blocks in each transformer's power cabinets, as indicated, conforming to the applicable requirements of NEMA ICS 2. The 480 V AC Government power supply will route through conduit connected directly from the Project to the base of the power cabinet, as indicated on contract drawings.

2.14.5 Device Nameplates

Provide an engraved nameplate for each item mounted in the transformer control and power cabinets that are comprised of anodized aluminum or stainless steel, engraved and provided with black lettering. Each nameplate must be fastened to the panels in proper locations, with either corrosion-resistant black finished round head screws, or on screw posts with corrosion-resistant black finished nuts. Nameplates must not be fastened to the wire ducts or duct covers. Labeling and marking must meet the requirements of UL 969, paragraph 7.3, "Marking and labeling systems for hazardous locations products".

2.15 CONTROL AND POWER CABINET EQUIPMENT

2.15.1 Cooling Control Equipment

2.15.1.1 General

The control equipment must be fully automatic, and manufactured to start and stop the fan motors as each transformer's winding temperature requires. The controls must de-energize all fans in the event of a transformer shutdown operation, as indicated. Provide additional circuit breakers for branch circuit protection of cooling circuits as required. All cooling control equipment must meet the applicable requirements of the NFPA 70.

2.15.1.2 Stages of Cooling

The cooling control circuits must provide for the following:

a. Provide transformers that are self-cooled through natural convection of the oil with no cooling fans in operation, capable of operation at the 100% base nameplate rating (ONAN) without exceeding the maximum allowable temperature rise.

b. Provide a winding temperature indicator fan contacts to activate the forced-air cooling group when the transformers are operating at a winding temperature corresponding to a load equal to the 100% self-cooled (ONAN) rated condition, as obtained during performance of the factory temperature rise testing.

c. When the maximum safe winding temperature for continuous operation has been reached, the winding temperature indicator alarm contact must provide an alarm for "Winding High Temperature" indication. This winding temperature setting must be at 110 degrees-C.

d. When the maximum allowable winding temperature has been reached, the analog winding temperature indicator must initiate a transformer shutdown utilizing the lockout relay in the powerhouse and set at a temperature of 117 degrees-C.

2.15.2 Transformer Fiber-Optic Probes and Connectors

Fiber optic probes must be installed in each transformer's windings and terminated at the fiber-optic feed-through plate interface on the tanks for future use with a temperature monitor. The fiber-optic probes must be made of non-conducting materials allowing for them to be immersed in oil and held in close contact to transformer windings for direct accurate measurement of temperature. Provide probes, connectors and their

installation that meet the following requirements:

a. Provide probes that function based on the principles of Gallium Arsenide (GaAs), be capable of measuring transformer temperatures from -40 degrees Celsius to 200 degrees Celsius.

b. The fiber-optic jacket must feature a continuous slit to allow for complete oil immersion.

c. Utilize Fiber-optic feed-thru connectors at a tank wall plate, for connection of the internal fiber-optic probes to the fiber-optic extension cabling.

d. Feed-through connectors with internal sealing using glass metal soldering.

e. Stainless steel tank wall plate interface for the feed-thru connectors, including a removable, weatherproof cover.

f. Provide 2-inch conduit from the feed-through wall plate interface down to the control cabinets for routing of fiber-optic extension cables.

g. Provide the necessary extension cables from the wall plate to the control cabinets.

2.15.3 Auxiliary Power Transformer

The auxiliary power transformer must have 480 V AC primary - 120 V AC secondary, single-phase, conforming to the requirements for general purpose transformers in UL 508, and must be mounted on the transformer tanks adjacent to the power cabinet, as indicated. The auxiliary transformer will be used to power all AC circuits rated below 480 VAC as indicated. The Volt-Ampere capacity must be coordinated with the connected control circuits, and indicated on the shop drawings. The auxiliary power transformer must have the following characteristics:

a. Isolating transformer design, with an electrostatic shield

b. Housed in a NEMA Type 3R rated enclosure

c. Manufactured with all copper windings with a 200 degrees-C rated insulation system

d. Finger-safe terminals

2.15.4 Magnetic Contactors

The 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). Provide NEMA Size 2 contactors as a minimum, and must be rated 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 rated for continuous operation for 120 V ac circuits. Alternating-current contactors must be three-pole, except where otherwise noted, and must be insulated for 600 V ac and of the electrically-operated, magnetically-held type.

2.15.5 Molded-Case Circuit Breakers

2.15.5.1 General

Provide Molded case circuit breakers that are listed to UL 489, and have voltage ratings and interrupting ratings hereinafter stated. They must be the manually-operated, quick-make, quick-break, automatic-trip, bolt-in, heavy-duty, industrial 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. Single pole trip units with handle ties are not permitted. The operating handles must clearly indicate whether the breakers are in "On," "Off," or "Tripped" position. Miniature circuit breakers, circuit breakers listed for residential and commercial use, and plug-in type breakers are not acceptable.

2.15.5.2 Trip Units

The circuit breakers must be of the automatic type provided with combination thermal and instantaneous magnetic or solid state trip units, with instantaneous trip units set at approximately 10 times the continuous ratings of the circuit breakers. The Government reserves the right to change the indicated trip ratings, within frame limits, of the trip devices at the time the shop drawings are submitted for approval.

2.15.5.3 480 V AC Circuits

Circuit breakers for 480 V AC circuits must be rated 600 V AC, and have a minimum interrupting capacity of 18,000 Amperes at 480 V AC, and must come equipped with an integrated trip-handle padlocking provision.

2.15.5.4 120 V AC Circuits

Circuit breakers for 120 V AC circuits, must be rated not less than 250 V DC, and either 120/240 or 240 V AC, with a minimum NEMA interrupting capacity of 10,000 Amperes symmetrical.

2.15.5.5 125 V DC Circuits

Circuit breakers for 125 V DC circuits must be of the heavy duty type conforming to the applicable requirements of UL 489, rated for not less than 125/250 or 250 V DC operation with a minimum NEMA interrupting capacity of 10,000 A dc.

2.15.6 Control and Instrument Switches

Control and instrument switches must be of the rotary switchboard type with handles on the front and the operating mechanisms on the rear of the panels, and have the following features:

a. Suitable for operation on 600 V AC or 250 V DC circuits, capable of satisfactorily withstanding a life test of at least 10,000 operations at rated current, and capable of continuously carrying 20

Amperes without exceeding a temperature rise of more than 30 degrees Celsius above ambient.

b. Provided with ample contact stages to perform the functions of the control system.

c. Self-aligning contacts which operate with a wiping action.

d. A positive means of maintaining high-pressure on closed contacts.

e. Compression springs or pivoted joints must not be depended upon to carry current.

f. The covers or plates on the switches must be readily removable for inspection of contacts.

g. A single-breaking inductive load minimum interrupting rating of 1.5 Amperes for 125 V DC, or 10 Amperes for 120 V AC.

h. An escutcheon clearly marked to show each operating position, with the switch identifications engraved on the escutcheon plate and on a separate nameplate.

2.15.7 Terminal Blocks

Provide terminal blocks for control signal and current transformer secondaries with the following features:

a. Washer-head screw type, designed for connection of two No. 10 AWG conductors to each terminal.

b. Rated, at minimum, for 90 degree C terminations.

c. White or other light colored marking strips for circuit designation, with each connected terminal of each block having the circuit designation or wire number indicated on the marking strip with permanent marking fluid. One reversible or spare marking strip must be furnished with each terminal block.

d. Terminal blocks provided to terminate all external cables, containing at least two spare terminals, or 10 percent of total terminals as spares, whichever is greater, per terminal block.

2.15.7.1 Control Signal Type

Provide terminal blocks for control wiring, with a sliding link disconnect molded or fabricated type with barriers, rated not less than 600 volts with 30 Ampere capacity.

2.15.7.2 Short-Circuiting Type

Provide dedicated short-circuiting type terminal blocks for each current transformer's secondary leads, which will allow for shorting together the secondary leads of the current transformers without opening any circuit.

2.15.7.3 Power Distribution Blocks

Provide power distribution blocks to be used for branch circuits and feeders 600 volts and less with wire size #12 AWG and larger. Power

distribution blocks must have lugs suitable for copper conductors, must be two-pole for single-phase circuits (phase and neutral conductors, or two phase conductors), and three-pole for three-phase circuits (three phase conductors).

2.15.8 Fuses and Fuseholders

Provide Class J fuses meeting the requirements of UL 248-8, rated for 600 V AC operation, and be dual-element with a 10 second time-delay at 500 percent overload. Provide Class J fuseholders, meeting the requirements of UL 4248-8, and be of a finger-safe modular type, consisting of a removable fuse carrier which allows fuse replacement away from the base.

2.15.9 Lighting, Convenience Receptacle, and Cabinet Heaters

Provide cabinet lighting, convenience receptacle and heaters that have the following features:

a. Lighting consisting of 120 V AC Size A19 LED bulbs with a medium E26 base, each with integral heat sink and 800 Lumens minimum output, complete with industrial grade socket with bulb safety cage, wiring, and door-activated switches.

b. Provide a 125 V AC, 3-wire, 20 Ampere, hospital grade GFCI type receptacle for the inside the control cabinet.

c. Provide industrial grade enclosure heaters in each cabinet to prevent condensation when the outside temperature is as low as -25 degrees Celsius, while maintaining a minimum interior cabinet temperature of 10 degrees Celsius. The enclosure heaters must be mounted on the cabinet side panels towards the bottom, and be of a touch-safe, positive temperature coefficient (PTC) resistor type with an integral fan. The heaters must have a rated operating voltage of 120 V AC, and be thermally sized for the cabinet volume in which they are installed. Submit for approval the Cabinet heater sizing calculations, with considerations given to cabinet sizing and material. Provide a separate humidity and temperature control device which controls the cabinet heaters and independently monitors the relative humidity and enclosure temperature, which have the following characteristics:

1) Temperature setting range: 0C - 60C
2) Relative humidity setting range: 50% - 90%
3) Operating voltage: 100 VAC - 240 VAC
4) Switching relay output (minimum): 10A resistive, 1.6A inductive @ 240 VAC
5) Inrush current (minimum): 30A for 10 sec
6) Heaters set at 20 C
7) Humidistat set to 20% relative humidity

2.16 INSULATED WIRE AND CABLE

Provide all insulated wire and cable that conform to the requirements of Section 26 05 19.00 26 INSULATED WIRE AND CABLE.

2.17 CONDUIT SYSTEMS

2.17.1 General

Run all wiring from the transformer devices and accessories listed below in rigid galvanized steel conduit greater than 1-inch in diameter, installed plumb and level, and terminated at devices, connection boxes and at the control cabinet using fittings suitable for wet locations. Conduit runs used on the transformer tanks' cover must be installed so as to help maintain an obstruction-free walking surface. The conduit systems must be electrically continuous and all threaded joints must have the threads coated with an approved high temperature lithium based, anti-galling conductive joint compound, rated for -70 degrees-C 1800 degrees-C, such as Crouse-Hinds Type HTL high temperature thread lubricant. The use of PTFE (polytetrafluoroethylene) tape at conduit threaded joint connections will not be allowed. Conduit threads must be tapered, and no running threads will be allowed. Conduit runs must be deburred and cleaned of shavings and debris prior to the routing of wire and cable.

2.17.2 Corrosion Protection

Provide conduit, conduit fittings, conduit bodies, and conduit outlet boxes made of ferrous metal materials that is hot-dip galvanized in accordance with ASTM A123/A123M and ASTM A153/A153M.

2.17.3 Conduit and Fittings

a. Rigid Metal Conduit. Provide rigid metal conduit that is zinc-coated both inside and outside by the hot-dip galvanizing method, conforming to the requirements of ANSI C80.1.

b. Rigid Metal Conduit Fittings. Provide threaded fittings for rigid conduit that is made of solid zinc or malleable iron conforming to the requirements of UL 514B and/or NEMA FB 1. Malleable iron fittings must be zinc-coated both inside and outside by hot-dip galvanizing method, with hubs having a grounding screw on the locknut.

c. Liquid-Tight Flexible Metal Conduit. Provide liquid-tight flexible metal conduit that is made from steel strip that is zinc-coated by the hot-dip galvanizing method with a water-proof extruded PVC cover conforming to the requirements of UL 360. The liquid-tight flexible metal conduit must have either have an integral bond wire or be an interlocked design with no bonding wire. Lengths of liquid-tight flexible metal conduit connections to equipment must not exceed 36-inches, and must be securely fastened to the transformer tanks.

d. Liquid-Tight Flexible Metal Conduit Fittings. Provide fittings for liquid-tight flexible metal conduit that is made from steel or malleable iron with a zinc coating and positive bonding, conforming to the requirements of UL 514B.

2.17.4 Conduit Bodies

Provide conduit bodies and covers that meet the following requirements:

a. Be made from malleable cast iron, be corrosion resistant and UL listed.

b. For the purposes of mechanical and environmental integrity, all

conduit bodies must be raintight and suitable for use in hazardous locations, conforming to UL 1203 installed in outdoor locations subject to adverse environmental conditions.

c. Conduit body covers must attach to the conduit bodies that come with a neoprene gasket, and be attached by screw connections.

d. Provide conduit bodies for use in locations to provide for change in conduit direction, access to conductors, and as pull boxes.

2.17.5 Conduit Outlet Boxes

Provide conduit outlet boxes and covers that meet the following requirements:

a. Be made from malleable cast iron, be corrosion resistant and UL listed.

b. For the purposes of mechanical and environmental integrity, all conduit outlet boxes must be raintight and suitable for use in hazardous locations, conforming to UL 1203 installed in outdoor locations subject to adverse environmental conditions.

c. Provide conduit outlet boxes and covers made from malleable cast iron with externally threaded body and internally threaded cover. All conduit entrances must be bossed, drilled, and tapped with tapered NPT threads. Conduit entrances must be located on the bottom or sides of the box to the greatest extent possible to prevent the ingress of water. If required, outlet and junction boxes must be equipped with external mounting lugs.

2.18 SPARE PARTS

Provide all spare parts that are duplicates of the original parts furnished and interchangeable therewith. Furnish the following spare parts, and submit for approval a spare parts list, indicating the quantity furnished, manufacturer, catalog or model number, and the retail cost of each item in US Dollars.

a. One complete set of all gaskets needed to seal all openings into the transformer tanks at the cover, manholes, handholes, openings for accessory devices, openings for each type bushing, and pipe connections for radiators.

b. One complete set of all gaskets required to replace the shipping gaskets, for use during final assembly of the transformers.

c. One complete relay and contactor of each type and rating

d. One pressure relief device (Qty. 1)

e. One liquid level indicator (Qty. 1)

f. One winding temperature indicator (Qty. 1)

g. One oil temperature indicator (Qty. 1)

h. One bushing current transformer, of each type and rating

i. One rapid pressure rise relay and seal in relay (Qty 1)

j. Two fans, complete with motors, cables and connections (Qty. 2)

k. One crated radiator complete with inlet and outlet isolating valves, vent and drain valves, and blank flanges (Qty. 1)

l. Three fiber-optic extension cables that connect from the feed-through wall plate to the control cabinet (Qty. 3)

m. One fuse of each type and rating

n. One pressure regulator for nitrogen-gas equipment (Qty. 1) (if supplying nitrogen blanket type oil preservation system)

o. One Buchholz Relay (Qty.1) (if supplying a COPS type oil Preservation system)

p. One spare valve of each type and size

2.19 NAMEPLATES

Transformer nameplates must be Type 316 stainless steel, with the information chemically etched then filled with baked enamel paint.

2.19.1 Transformer Nameplate

Each transformer nameplate must conform to the requirements of IEEE C57.12.00, Table 6, and also include the following information:

a. Government contract number

b. Transformer X/R ratio

c. Estimated weight of the insulation system

d. The nameplate or an adjacent nameplate must also include the following information for each current transformer furnished: the accuracy class, the primary and all secondary ampere ratings, the thermal rating, and identification of the terminals to which the current rating applies.

2.19.2 Lifting Nameplate

Provide a lifting diagram nameplate mounted on each transformer, adjacent to the transformer nameplate showing the following:

a. Various sling and lift positions required for proper lifting of the core and coil assembly.

b. Lifting or jacking the completely assembled transformer.

c. The overall height required for untanking.

d. Indication that the transformers can be lifted or jacked when filled with oil.

2.19.3 Device Nameplates

Provide nameplates for the following devices that are mounted on each transformer. The nameplate must be permanently affixed onto a bracket adjacent to the device.

a. High-voltage bushings (H1, H0)

b. Low-voltage bushings (X & Y)

c. Core ground bushings

d. Center of gravity markers

e. Winding temperature indicator

f. Oil temperature indicator

g. Thermowells

h. Valves

2.19.4 Additional Transformer Identification

Provide the following additional transformer identification for each transformer:

a. The transformers serial number welded onto the tank, or on the face of the jacking pad nearest the main drain valve, with letters approximately 1-inch in size.

b. The location of the centers of gravity (c.g.) of the completely assembled transformer filled with oil, and for the shipping configuration without oil, permanently marked with weld-on nameplates or tags on two adjacent sides of the transformer tank and identified "c.g. complete" and "c.g. for shipment".

c. Stamping of the serial number on the core frame structure or into the tank immediately adjacent to the transformer nameplate.

d. The 25 degrees Celsius operational oil level must be indicated on the outside of the tank sidewall by either a raised surface weld bead with contrasting paint color, or with an etched nameplate permanently affixed to the tank wall.

PART 3 EXECUTION

3.1 TRANSFORMER DESIGN DATA REVIEW MEETING

3.1.1 General

Conduct a transformer design data review meeting at the transformer manufacturing facility, with representatives of the Contractor, transformer manufacturer, and the Government representative in attendance, not later than 120 days after contract award. Provide the notification of the date of the transformer design data review meeting, the location, the duration, and the proposed agenda. Notification must be no less than 30 days in advance for domestic travel in the US and 60 days in advance for travel outside the continental US. The intent of the design data review

meeting is to:

a. Meet with the manufacturing personnel and tour the manufacturing facility.

b. Discuss the technical specifications which address transformer manufacturing, testing, and shipment.

c. Perform a design data review with transformer manufacturing engineers and key personnel.

3.1.2 Design Data Review Meeting Requirements

The purpose of the design data review portion of the meeting is to help assure prior to official submittals that the key elements of the transformer specification requirements are being met, and to describe the transformer manufacturing and design data features. In preparation for the design data review meeting, the transformer manufacturer must have submitted a transformer design data review report in PDF format for the transformer design, which includes the following elements as a minimum:

a. Transformer nameplate data and ratings

b. Preliminary transformer layout drawing

c. Winding connection diagram

d. Winding design information, including:

(1) Proposed winding material supplier.
(2) Winding manufacturing details, including the turn design, dimensions and weight.
(3) Block diagram of the winding arrangement.
(4) Conductor type
(5) Insulation type
(6) Tabular listing of the calculated and maximum allowable voltage stresses within the windings for chopped-wave and full-wave conditions, including the factory design factor of safety margins.
(7) Block diagram of the windings indicating the various voltage stresses.
(8) Calculated resistance (@ 85 degrees-C reference)
(9) Drying and clamping methods.
(10) Design features added to assure reliable operation in back feed mode.

e. Thermal calculations and distribution throughout the windings, including proposed locations for the fiber-optic temperature probes.

f. Core design information, including:

(1) Proposed core lamination steel supplier
(2) Core manufacturing details, including the number of limbs, dimensions and weights
(3) Core material type
(4) Joint construction
(5) Banding
(6) Acceptable gap/burrs
(7) Cooling ducts

(8) Rated flux density
(9) Calculated exciting current

g. Calculated short-circuit currents and forces

h. Loss calculations

i. Impedance calculations

j. Accessories, including:

(1) Bushings
(2) Cooling equipment
(3) De-energized tap changer

3.2 TRANSFORMER DRAWINGS

3.2.1 Outline and Assembly Drawings

Submit for approval the transformer outline and assembly drawings to demonstrate that the equipment will conform to the requirements and intent of the specifications, to include the following at a minimum:

a. Transformer nameplate information, for both the main and lifting nameplates as required in paragraph "NAMEPLATES".

b. Outline drawings, indicating the following:

(1) Layout and dimensions of the assembled transformer, including an elevation view for each side of the transformer, a plan view, and details of the tank structural base with the centers of gravity indicated with the transformer empty and filled with oil.

(2) Jacking, lifting and pulling facility locations.

(3) Locations of all ancillary equipment, dimensioned to the transformer centerlines or edges, as appropriate, including bushings, control and power cabinets, valves, gauges, relays, nitrogen regulator cabinet, radiators and fans, and grounding pads.

(4) Drawing legend and transformer weight information.

(5) A transformer elevation view indicating clearances required for untanking or disassembling.

(6) Information for the transformer oil levels, including: the minimum oil level in the tank without exposing the core and coil assembly, and the corresponding volume of oil to remove at 25 degrees Celsius; the maximum oil level in the tank to allow access to any bottom connected bushings utilizing handhole access covers, and the corresponding volume of oil to remove at 25 degrees Celsius.

c. Transformer winding layout and configuration diagram, consisting of a physical representation of the active assembly installed in the transformer tank, including a sectional elevation view of sufficient detail to identify the following basic features of the core/coil fabrication:

(1) Core legs
(2) High-voltage winding
(3) Low-voltage winding
(4) Winding taps
(5) De-energized tap changer and lead support structure
(6) Bushing configuration and connections
(7) Shielding (if present)
(8) Pressboard
(9) Tank wall surface

d. Control and power cabinets layout, including internal device layouts and component lists.

e. Electrical schematic diagrams which reference the associated detailed wiring connection diagrams, including:

(1) Cooling power schematic diagrams
(2) 120 V AC and 125 V DC control schematic diagrams
(3) Annunciation schematic diagrams
(4) Transformer accessories block schematic diagrams

f. General electrical drawings including:

(1) Wiring and ferruling methods
(2) Wire types, sizes and color coding
(3) Graphic symbols
(4) Device nameplates and marking methods

3.2.2 Detail Drawings

Submit for approval the transformer detail drawings, to include the following at a minimum:

a. Further refinement of the outline and assembly drawings, including the routing of conduit, piping, and locations of junction boxes and external devices.

b. Shipping drawing showing the outline of the transformers disassembled as required for shipment, including the following:

(1) Overall shipping dimensions, including indication of centers of gravity for the transformers in the shipping configuration. All devices remaining installed on the transformers during shipment must be indicated.

(2) Lifting details and overall height required for the slings and crane hook, including recommended sling length and ratings.

(3) Location of temporary covers for bushings, valves and control and power cabinets left installed during shipment.

(4) Method and locations for securing the transformers during shipment.

(5) Details indicating the method of installing the SFRA test shipping bushings, their locations, and a description of the method of bracing the winding leads to these bushings during shipment.

(6) Location of impact recorders, shipping gas pressure gauge and pressure regulator system.

(7) A note indicating the requirement for shrink-wrapping of the transformers for shipment, and the type of material used.

c. Wiring connection diagrams showing terminal block and conductor designations, including detailed control and power cabinet interconnections and device locations, based upon the actual equipment arrangement.

d. A transformer outline drawing indicating the locations of all gaskets on the transformer, a schedule of each gasket type and size cross-referenced to the location on the outline drawing, and a detail for each design of gasket showing the gasket dimensions, groove dimensions and compression requirements.

e. A transformer outline drawing indicating the locations of typical welds, with structural weldment details for each type of weld.

3.3 TRANSFORMER FACTORY ASSEMBLY

3.3.1 General

Each transformer must be completely assembled and adjusted at the factory, and be subjected to the manufacturer's routine shop tests and other tests as specified below. All parts and accessories must be properly match-marked and identified for ease of re-assembly after delivery to Little Goose Lock & Dam "Storage Yard". After the transformer has been completely assembled and oil-filled, the overall weight of the transformers must be measured using a load cell when lifted with a crane or moved with an air pallet, and the measured weight must be included in the factory test reports, the as-built drawings, and on the final nameplate information.

3.3.2 Welding

3.3.2.1 General

Welding will not be accepted if the welding does not conform to the requirements of this specification, unless otherwise approved by the Government. Develop procedures for the welding all metals included in the work. Do not start welding until welding procedures, welders, and welding operators have been qualified and approved. Weld symbols must be in accordance with AWS A2.4. In all instances requiring adherence with AWS specifications, equivalent country of origin standards will also be accepted. If using equivalent country standard, welding submittals must provide table showing equivalency with AWS standards.

3.3.2.2 Welding Quality Control Plan

Before the start of tank manufacturing, submit for approval a welding quality control plan which 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. Indicate any manufacturer specific requirements used to verify the tanks are oil-tight in addition to those required herein.

3.3.2.3 Welder Qualifications

Welding operators and welders must be qualified and, as necessary, requalified for the particular type of weld to be performed. Qualification must be in accordance with AWS D1.1/D1.1M. The welder record of qualification must be submitted and approved. The Contractor must certify by name, the welders and welding operators so qualified including the date of qualification, code, and procedures under which qualified. Certification and testing of welders and operators must be performed by an independent testing company. Prior qualification may be accepted provided the welder has performed satisfactory work within the preceding three months under the code for which qualified, documentation of continuous welding in process and certification of prior qualification from an independent testing company is furnished. If at any time, the work of an operator appears questionable, such operator will be required to pass additional qualification tests to determine their ability to perform the welding of work on which they are engaged. All such additional qualification tests for welding operators and the physical tests of the welded specimens must be witnessed by the Government, unless waived in writing.

3.3.2.4 Welding Materials

Welding materials must comply with AWS specifications. Welding equipment, electrodes, welding wire, and fluxes must be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

3.3.2.5 Welding Procedures

Submit for approval a complete schedule of welding procedures including certified copies of reports of test results, consisting of detailed procedure specifications for each structure to be welded, and tables or diagrams showing the procedure to be used for each required joint. Do not perform welding without an approved procedure. Applicable prequalified weld procedures in AWS D1.1/D1.1M may be submitted for approval. Weld procedures not meeting the requirements of prequalified weld procedures in AWS D1.1/D1.1M may be submitted and qualified through testing under AWS D1.1/D1.1M or ASME BPVC SEC IX. All welds must be made using low-hydrogen welding rods or electrodes/electrode-flux combinations capable of depositing weld metal with a maximum diffusible hydrogen content of 8 mL/100g (H8). If the use of other filler metals is preferred, submit for approval a written justification of why an alternative is preferred and indicate where these welds will be utilized. Perform all welding using the electric-arc method, by a process which will exclude the atmosphere from the molten metal. Submit for approval the product data on welding electrodes and rods and shielding gas. All welded joints must conform to AWS publications, or as otherwise specified or approved, and the qualification plates representing those joints must be tested in accordance with AWS D1.1/D1.1M or AWS D1.6/D1.6M. All oil piping welds must meet the requirements of ASME B31.1.

3.3.2.6 Preheat and Interpass Temperature

Preheating must be performed as required by Section 3 of AWS D1.1/D1.1M, or as otherwise specified except that the temperature of the base metal must be at least 70 degrees Fahrenheit.

3.3.2.7 Weld Inspections, Tests and Weld Inspector Qualifications

a. All welds must be visually inspected to ensure conformance to the requirements of this specification, the appropriate section of AWS D1.1/D1.1M, and the approved welding procedure. Submit for approval the weld inspector qualifications, meeting the requirements of AWS D1.1/D1.1M and ANSI/ASNT CP-189, for the personnel responsible for inspections. Inspections must be performed visually, and during the transformer leak tests per the requirements of paragraph "Pressure Test". If the weldment is determined to be the cause of failure to pass the pressure test, the Government reserves the right to either a Non-Destructive Examination or Destructive Examination of any welds with the cost borne by the Contractor.

b. The following tests must be performed on all welds, and the results included in a Weld Inspection and Test Report:

(1) Dye penetrant test performed on all welds.

(2) Magnetic particle test performed on all lifting lug welds.

(3) Ultrasonic test performed on 25-percent of all full penetration welds.

3.3.3 Manufacturing Inspection by Government Personnel

Manufacturing inspections of each transformer may be performed by a representative of the Contracting Officer, at the option of the Government. These inspections would be performed at, but not necessarily limited to, the following manufacturing hold points:

a. Manufacturing facility inspection during the Design Data Review Meeting.

b. Weld inspection during tank manufacturing, to include dye penetrant, magnetic particle and ultrasonic testing.

c. Inspection of the windings after completed, but prior to being landed on the core. During this inspection, winding and core material bill of material information must be provided, and the materials inspected, for comparison with the manufacturer's design data to assure conformance.

d. Transformer manufacturing: Inspection of the completed core and coil assembly prior to tanking. Winding and core assembly drawings, including the lead support structure, must be made available during performance of these inspections.

e. Completely assembled transformers during performance of the factory acceptance tests.

3.4 FACTORY CLEANING AND PAINTING

3.4.1 General

All interiors and exteriors of the tanks, enclosures, cabinets, and other metal parts which are not galvanized or of corrosion resistant material and are exposed to oil or weather must be thoroughly cleaned and painted. Cleaning must be by degreasing and abrasive blasting or other means to

remove all grease, scale, corrosion, and foreign substances. All paint must be lead-free.

3.4.2 Interior Surfaces

All interior surfaces of the main tanks must be given at least one priming coat and one finish coat of oil-resistant paint or enamel. The interior tank color must be white. After painting of the tank interior, the surfaces must be allowed to cure for one week prior to the introduction of insulating oil.

3.4.3 Exterior Surfaces

All exterior surfaces of the transformers, except as otherwise indicated, must be given a primer and two finish coats of paint in the factory. The paint color must be Munsell 5BG 7/0.4 high gloss (ANSI No. 70 gray), per the requirements of ASTM D1535, and must consist of a polyurethane top coat over an epoxy base coat. The dry film thickness of the primer must be a minimum of 1.5 mils, and that of the top and base finish coats a minimum of 3.5 mils. At minimum, supply one gallon of primer and one gallon of the polyurethane paint, from the same batch used on the transformers, for transformer field paint repairs. All SDS information must be provided with the touch-up paint, in the English language, and included in the Operations and Maintenance Manual. With prior approval of the Contracting Officer, other comparable paint types may be used. The cover surface of the transformer tanks must have a non-slip additive added to the paint, so that the color is the same as the tank color.

3.4.4 Machined Surfaces

All machine finished or corrosion-resistant surfaces must remain unpainted, and be thoroughly cleaned, coated with a suitable, easily removed, corrosion resistant compound, and wrapped or otherwise protected from damage in shipment.

3.5 TRANSFORMER FACTORY ACCEPTANCE TESTS

3.5.1 General

Perform all routine power transformer tests as indicated in IEEE C57.12.00, Table 17 on each transformer, fully assembled with all components installed which are being provided for the final assembled transformer. In addition to the required routine tests, the following design tests and specific test requirements must be performed, unless otherwise specifically indicated. Do not perform any power transformer acceptance tests until all submittals required up to the point of factory testing have been reviewed by the Government and given an Action Code 'A' or 'B' approval. The factory acceptance tests, including test equipment, test methods, measurements, and computations, must be in accordance with the applicable requirements of IEEE C57.12.00, IEEE C57.12.80 and IEEE C57.12.90, unless otherwise specified, and submit for approval the Factory Test Procedures. Except where otherwise specified in the Standards, all measurements and tests involving alternating voltage must be made with 60 Hz sine wave voltage. The cost of performing all tests must be borne by the Contractor and must be included in the unit prices for the items of the Schedule. The Government representative will witness all tests required herein unless waived in writing, and do not ship any transformer, or parts until it has been released for shipment by the COR. Submit the notification of the date of factory tests as follows so that

arrangements can be made for the Government representative to be present at the tests:

a. **For transformer manufacturers located in the United States**, notify the COR 30 calendar days in advance of when the transformer manufacturer will be ready for factory acceptance tests, so that the tests may be witnessed by a Government Representative at the manufacturer's facility.

b. **For transformer manufacturers located in foreign countries**, notify the COR 60 calendar days in advance of when the transformer manufacturer will be ready for factory acceptance tests, so that the tests may be witnessed by a Government Representative at the manufacturer's facility.

3.5.2 Factory Acceptance Test Report

Submit for approval an electronic PDF copy of the Transformer Factory Acceptance Test Report for each transformer tested, including digital waveform printouts, data files for the SFRA, insulation power factor, and leakage reactance tests, and complete data on all tests performed. The witnessing representatives of the Contractor and the Government must sign reports of all witnessed tests. The certified test reports must include the information as listed in IEEE C57.12.00, paragraph 8.7, and include all additional required tests results with the corresponding digital waveform and color thermal imaging printouts.

3.5.3 Dissolved Gas-In-Oil Analysis

Samples of the transformer insulating oil must be taken from each transformer, and dissolved gas-in-oil analysis tests performed as indicated, herein. Identity of samples and results of analyses must be included in the certified test reports, and the results of all insulating oil tests made available for inspection by the Government representative during the transformer factory acceptance testing.

a. After oil-filling of each transformer, and prior to the performance of any transformer factory acceptance tests.

b. After performance of dielectric tests.

c. After performance of temperature rise tests at each cooling rating.

d. Eight hours after performance of all transformer factory acceptance tests, to allow any possible generated gases to fully disperse within the oil.

3.5.4 Temperature Rise Test

Perform a temperature rise test on one transformer with measurements made at each cooling rating (ONAN, ONAF). During the temperature rise tests use temporary fiber leads and temporary multi-channel fiber-optic temperature monitor to monitor and record the temperatures on all of the embedded winding fibers. During the temperature rise tests, obtain thermal images of all parts of the transformer utilizing a color infrared camera, and include the thermal images with corresponding temperatures indicating the ambient and hottest temperatures, including loading conditions, in the transformer's factory acceptance test report. The tank wall hot-spot temperature rise must not exceed 70 degrees-C while operating at 100

percent of its forced-air cooled rating.

3.5.5 Core Insulation Resistance

In the case of a core type transformer, the transformer core insulation resistance test must be performed on each transformer at each core ground bushing, for the main core connection to ground, and the core frame connection to ground.

3.5.6 Impulse Tests

All transformer impulse tests must be completed on a winding connection (bushing) before performing tests on a different winding connection. The impulse tests must be made by direct application without 60-Hz excitation. Computer-based waveform recordings must be taken of surge voltages during all impulse tests and of neutral current during the reduced full-wave and full-wave impulse tests, with the digital waveforms adjusted to give the same deflection on reduced-voltage and full-voltage impulse waves to facilitate comparison. Comparisons must also be made of the consecutive chopped-wave impulse waveforms. Waveform comparisons must be printed, and provided in the certified test report. Any deviation in voltage or neutral current wave shape between reduced-voltage and full-voltage full-wave tests, must be explained to the satisfaction of the COR or it may be considered cause for rejection of the transformer.

3.5.7 Induced Voltage Test With Partial Discharge Measurements

3.5.7.1 General

Partial discharge measurements during the induced voltage test must be per the requirements of IEEE C57.12.90, paragraph 10.8, and IEEE C57.113. It is recognized that sizable partial discharge readings during tests are likely to occur from causes external to the transformer, such as partial discharge in the high-voltage test circuit, noise from shop equipment, other tests being performed, and radiation or induction pickup through air between the measuring circuit and the high-voltage test equipment. All reasonable precautions must be taken to minimize such external interference, and if necessary, the manufacturer must demonstrate that this partial discharge is not internal to the transformer. It is permissible to utilize special bushing corona shields during performance of the tests.

3.5.7.2 7,200 Cycle Enhancement Level

During the 7,200-cycle test, the partial discharge level, excluding background noise, must not exceed 500 pico-coulombs. Any variation in corona intensity before and after application of full 7,200-cycle test voltage must be explained to the satisfaction of the Contracting Officer.

3.5.7.3 One-Hour Level

During the one-hour test, the partial discharge level must not exceed 300 pico-coulombs, and the increase in partial discharge levels must not exceed 100 pico-coulombs.

3.5.7.4 Data Reporting

All records, meter readings, and data taken during the above described tests, together with a diagram of the circuit employed, must be

incorporated in the certified test report. The measurement of partial discharge using the apparent charge (pico-coulomb) method must be performed during the induced voltage test, and the measurements included with the test report.

3.5.8 Audible Sound Level Test

Perform an audible sound level test and it must be performed, and must not exceed the manufacturer's guaranteed sound level included in the proposal documents. The sound level tests must be performed at the ONAN rating, and at the ONAF rating with all cooling fans in operation. If the sound level exceeds the manufacturer's guaranteed level, the transformers must be modified as required to reduce the sound level and the test repeated. The abatement technique used to reduce the tested sound level to the guaranteed sound level must be subject to approval of the Contracting Officer. All data records taken during the sound level test, including a diagram of the transformer and how the measurements were taken, must be included in the certified test report. The data reporting format must be similar to that indicated in Figures 30 and 31 of IEEE C57.12.90.

3.5.9 Leak Test

Perform a leak test on each transformer tank and radiators when filled with oil. The test pressure must be a minimum of 4 psi, maintained for a minimum of 24 hours with no loss in gas pressure during the test period. The dial gauge used for this test must have a scale of 0 - 10 psi. During the pressure test, an alcohol-based industrial marking chalk, or another similar method of oil leak detection, must be applied to the tank welded seams and all gasketed connections and monitored for oil leaks. After the leak test is completed, all chalk must be cleaned off each transformer.

3.5.10 Leakage Reactance Measurement Test

Perform a leakage reactance measurement tests per the requirements of IEEE C57.152, paragraph 7.2.12, between the high-voltage winding and the low-voltage winding, for use as baseline data for future testing. Voltage, current, and phase angle measurements must be recorded, and the corresponding impedance calculated. Use standard equipment for performance of the leakage reactance test. The proposed test setup and procedures must be included in the factory test procedures submittal.

3.5.11 Sweep Frequency Response Analysis Tests

3.5.11.1 Required Tests

Two Sweep Frequency Response Analysis (SFRA) tests must be performed at the manufacturing facility, per the requirements of IEEE C57.149, at the following manufacturing stages for use as baseline data for future testing and for shipping purposes for each transformer.

a. After all factory tests have been performed, and while each transformer is still fully assembled and filled with oil.

b. After each transformer has been drained of oil and disassembled for shipment, and in its shipping configuration (see paragraph "SFRA Test Shipping Bushing). The test equipment and connections must be as indicated in paragraph "Test Equipment and Test Parameters", below, with the tests performed at the rated tap position.

3.5.11.2 Test Equipment and Test Parameters

Use a Sweep Frequency Response Analyzer for performance of the SFRA test. The proposed SFRA setup and procedures must be included in the factory test procedures submittal. The excitation source must be capable of providing consistent and controlled peak to peak voltage over the entire frequency range, with the test equipment parameters as follows:

a. A test voltage of 20V peak-to-peak minimum.

b. Testing performed over the 20 Hz to 2 MHz frequency range as a minimum.

c. Frequency response measurements made using a log-based scale for frequency.

d. An interference bandwidth (IBW), or equivalent, of less than 1 Hz at 10Hz used for each measurement frequency.

e. Record the magnitude of the response on a decibel (dB) scale for each measurement point.

f. The dB accuracy within 1 dB at every measurement point, using calibrated equipment.

g. A test set with a dynamic range better than 100 dB.

h. Record the phase, in degrees, for each measurement point, with an accuracy within 1 degree at every measurement point, using calibrated equipment.

i. High frequency coaxial test cables, with a 50 ohm matched impedance.

j. A three lead system, which consists of a signal, a reference and a test measurement lead.

k. All cables of the same length. A consistent ground connection should be available at the bushing end of the leads and be the same length for each cable.

l. The size and type of all temporary grounding leads identified.

3.5.11.3 Test Cable Integrity

Prior to the performance of any SFRA tests, the integrity of the test cables must be tested by a short-circuit test. Each coaxial test cable must be laid together, side-by-side on the floor, with the measurement clips connected together and the ground clips connected together. The frequency response of the test cables when connected in this fashion should be "flat", with the exception of a gradual "roll-off" above 100 kHz due to pre-fitted cable grounds, and any variation could indicate damage within the coaxial cables. Any anomalies in the cable test results must be brought to the attention of the COR.

3.5.11.4 Test Connections

During performance of the SFRA tests, the test coaxial cables must be directly connected to the transformer bushings. For tall bushings, ground

jumpers may be used to facilitate connection of the coaxial cable ground shield to the base of the bushing. All windings must be tested as indicated below, for the 'neutral' (or rated kV) tap position, and for the tap position that includes all of the windings, with each SFRA result identified by the applied and measured terminals. The SFRA tests must be per the requirements of IEEE C57.149, Table 5, Group 2, second column).

3.5.11.5 Data Reporting

Test equipment must be capable of producing a test report file which is in the Extensible Markup Language (XML) format. Test data must be able to be viewed without the editing, reorganizing or reformatting of the data. A simple format of separate measurements being in separate spreadsheet columns is required. The test data must show all waveforms in graphical form with the response in linear scale dB units on the Y-axis and the Frequency in logarithmic scale Hz on the X-axis. The Y-axis must auto-scale and the X-axis must display the range from 20 Hz to 2 MHz, as a minimum. The electronic version of the test report must include the complete data on a CD in the format and organization that will permit the file to be viewed completely using standard spreadsheet software. Data reporting must meet the requirements of IEEE C57.149, paragraph 5.

3.5.11.6 Data Interpretation

SFRA testing produces traces which provides information related to the physical geometry of the test specimen. The factory SFRA tests performed creates baseline data for use in future testing, and helps in recognizing obvious manufacturing defects, such as open circuits, short circuits, and winding deformations.

3.5.12 De-Energized Tap Changer Test

Each transformers' completely assembled de-energized tap changer (DETC) must be subjected to five complete tap changing cycles (end-tap to end-tap) during the process of transformer testing to demonstrate that all linkages, contacts, and indicating mechanisms are properly assembled and aligned and free from excessive slack, deformation, or fragility.

3.5.13 Transformer Turns Ratio Test

For Each transformer perform a transformer turns ratio (TTR) test on each tap in accordance with "Ratio Tests" paragraph of IEEE C57.152 after the completion of the DETC testing.

3.5.14 Insulated Wire and Cable

Perform testing on all insulated wire and cable within each transformer's control and power cabinets, extending to all transformer mounted equipment per the requirements of SECTION 26 05 19.00 26, INSULATED WIRE AND CABLE.

3.6 BUSHING TESTS

3.6.1 General

Bushing tests must be performed in accordance with IEEE C57.19.00 and IEEE C57.19.01. Any bushing that fails to pass all tests to which it is subjected will be rejected. Provide electronic PDF copies of all bushing and bushing current transformer test reports for each transformer.

3.6.2 Bushing Design Tests

Bushing design tests must be performed on one bushing of each type provided in accordance with IEEE C57.19.00, unless these tests have previously been performed on bushings of the same manufacture, design, type, and rating as those being provided within 10 years of the date of this contract, in which case the requirements for repeating these design tests will be waived and certified copies of the test results of satisfactory tests of this kind must be furnished to the Contracting Officer. If any bushing given the impulse tests fails to pass any of the tests, then all bushings of the same type and rating must be subjected to the impulse tests at no additional cost to the Government.

3.6.3 Bushing Withstand Test Voltages

The bushings must be tested per the applicable requirements of IEEE C57.19.01, Table 1.

3.6.4 Bushing Routine Tests

Each new bushing provided must be subjected to routine tests by the bushing manufacturer in accordance with IEEE C57.19.00, Table 3. Power factor tests must be performed on each design bushing per the following requirements:

a. Perform a power factor test at 10 kV for C1. The power factor must not exceed 0.35 percent.

3.6.5 Bushing Current Transformer Manufacturer Routine Tests

Provide electronic PDF copies of all bushing current transformer test data.

3.6.5.1 Routine Tests

Each bushing current transformer is to be given bushing current transformer manufacturer routine tests, including an applied voltage test, in accordance with IEEE C57.13, Annex B.8.

3.6.5.2 Tests Performed After Installation

Each current transformer is to be checked for proper nameplate and polarity markings prior to installation on the transformers, and be given a polarity and ratio check after installation and prior to the performance of the factory acceptance tests to ensure correct installation. The following bushing current transformer tests are to be performed after all other transformer acceptance tests have been completed, and the test results included in the factory acceptance test report:

a. Excitation curves for each turn ratio.

b. Ratio correction factor curves for each turn ratio.

c. The resistance of the secondary winding at 75 degrees Celsius, including the resistance of the secondary leads from the bushing current transformer to the terminal blocks in the control cabinet.

3.7 TRANSFORMER SHIPMENT, HAULING AND SITE ASSEMBLY

Each transformer and it's equipment, accessories, and spare parts must be prepared for shipment f.o.b. Little Goose Lock & Dam, transported, inspected, unloaded, moved into its storage location in the storage yard, re-assembled, oil-filled, and tested per the requirements of SECTION 48 20 00.04 26.

-- End of Section --

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SECTION 48 20 00.04 26

TRANSFORMER SHIPMENT, HAULING AND SITE ASSEMBLY

PART 1 GENERAL

1.1 GENERAL INFORMATION

This Section, in conjunction with Sections 48 19 23.04 26 CLASS II GSU POWER TRANSFORMER (T2), 48 19 23.08 26 CLASS II GSU POWER TRANSFORMER (T1), and 01 11 01.00 28, SUPPLEMENTARY REQUIREMENTS, covers the contractor's responsibilities for shipment of the transformers for delivery f.o.b. destination the Little Goose Lock & Dam storage yard, hauling, ~~off-loading~~offloading and placement, site assembly, oil-filling, field testing, and provisions for long-term storage and provision of Erecting Engineer services.

1.2 DESCRIPTION OF WORK

Deliver the transformers to the Little Goose storage yard per the required delivery schedule as included in Clause 52.211-8, "TIME OF DELIVERY", and perform the following site work on each transformer:

a. Perform on-car, or on-barge inspections and testing (as required).

b. Perform transformer cleaning.

c. ~~Off-load~~Offload and coordinate movement of the transformers and locate the transformer on the ~~mounting pad in position~~storage locations.

d. ~~Off-load~~Offload the accessory crates at the location directed by the COR.

e. Perform transformer reassembly, vacuum treatment, oil-filling and processing, all required field tests, and final transformer cleaning and touch-up painting.

f. Provide manufacturer's Erecting Engineer services for witnessing all site movement and work performed, as required in paragraph, "ERECTING ENGINEER SERVICES".

1.3 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 D923	(2015; R 2023) Standard Practices for Sampling Electrical Insulating Liquids
ASTM D1933	(2003; R 2017) Standard Specification for Nitrogen Gas as an Electrical Insulating Material
ASTM D3283	(1998; Reapproved 2020) Standard

	Specification for Air as an Electrical Insulating Material
ASTM D3487	(2024) Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2016) Standard Requirements for Instrument Transformers
IEEE C57.93	(2019) Guide for Installation and Maintenance of Liquid-Immersed Power Transformers
IEEE C57.149	(2012) Guide for the Application and Interpretation of Frequency Response Analysis for Oil-Immersed Transformers
IEEE C57.152	(2013) Guide for Diagnostic Field Testing of Fluid-Filled Power Transformers, Regulators, and Reactors

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

SD-01 Preconstruction Submittals

1. Delivery/Shipping Plan; G, AO

Submit for approval a transformer movement plan detailing movement of the transformers to the *Little Goose* storage yard not later than 60 calendar days prior to shipment of the transformer (see paragraph "TRANSFORMER MOVEMENT PLAN").

2. Transformer Site Assembly Procedure; G, HDC

Submit for approval a transformer site assembly procedure and schedule detailing the reassembly of the transformers, vacuum treatment, heated oil-filling, final field testing and durations not later than 60 calendar days prior to delivery of the transformer (see paragraph "Transformer Site Assembly Procedure").

3. Field Supervisor Experience; G, HDC

Submit for approval the field supervisor experience qualifications a minimum of 60 calendar days prior to the performance of site work, if the proposed field supervisor is different than that included with the proposal documents. (see paragraph "Field Supervisor Experience").

4. Erecting Engineer's Qualifications; G, HDC

Submit for approval the manufacturer's Erecting Engineer's

qualifications not later than 60 calendar days prior to delivery of the transformer (see paragraph "Erecting Engineer's Qualifications").

5. Site Assembly Contractor Experience List; G, HDC

Submit for approval the site assembly contractor's experience list not later than 60 calendar days prior to delivery of the transformer (see paragraph "Site Assembly Contractor Experience").

SD-03 Product Data

Submit for approval descriptive data of the following no later than 90 calendar days prior to transformer shipment, to demonstrate fully that all items will conform to the requirements and intent of the specifications.

1. Insulating Oil Oxidation Inhibitor; G, HDC

2. Dry-Air; G, HDC

3. Nitrogen; G, HDC

4. Grounding Conductors; G, HDC

5. Valve Locks; G, HDC

6. Impact Recorders; G, HDC

SD-06 Test Reports

1. Delivery Transformer Oil Test Report; G, HDC

Submit for approval a transformer oil field test report, showing that the transformer oil meets the requirements of ASTM D3487, Table I, Type II, with an oxidation inhibitor content of between 0.25 and 0.30 percent by mass, not later than 15 working days following taking of the oil samples (see paragraph "Transformer Oil for Processing").

2. Transformer Field Test Report; G, HDC

Submit for approval a transformer field test report for each transformer no later than 7 calendar days following completion of the field tests (see paragraph "Electrical Tests").

3. Oil-Filled Transformer Oil Test Report; G, HDC

Submit for approval a transformer oil test report for each transformer after the final transformer oil-filling process has been completed, showing that the transformer oil meets the requirements of TABLE 1, TRANSFORMER INSULATING OIL TEST REQUIREMENTS, included at the end of this section, not later than 15 working days following taking of the oil samples (see paragraph "Oil Tests").

SD-07 Certificates

Shipping bills and Notices; G, AO

Submit a list of articles shipped with descriptive data within 7 calendar days of the shipment for each transformer (see paragraph "Packaging and Marking for Shipment").

SD-08 Manufacturer's Instructions

1. Training Outline; G, AO

Submit for approval a training outline covering the material to be used for performance of the on-site training session, including a schedule, not later than 60 calendar days prior to completion of the transformer field tests (see paragraph "CONTRACTOR-FURNISHED TRAINING OF GOVERNMENT PERSONNEL").

2. Site Delivery Inspection Procedure And Schedule; G, HDC

SD-09 Manufacturer's Field Reports

1. Impact Recorder Summary Report; G, AO

Submit for approval the impact recorder summary report for each transformer, including a copy of the digital impact recorder log and photos of any impacts greater than 3.0g on any axis for the analog impact recorder trace, within 24 hours after delivery of the transformer (see paragraph "Site Delivery Inspection Procedure and Schedule")

2. Site Delivery Inspection Report; G, AO

Submit for approval the site delivery inspection report for each transformer within 48 hours following completion of the site delivery inspection for the transformer (see paragraph "Site Delivery Inspection Report")

3. Tools and parts control checklist; G, AO

Submit for approval a copy of the tools and parts control checklist at the end of every working shift for each transformer. (see paragraph "Tools and Parts Control").

1.5 FIELD SUPERVISOR EXPERIENCE AND RESPONSIBILITIES

1.5.1 Field Supervisor Experience

The field supervisor must have been engaged in the field (site) movement, reassembly, oil-filling and testing of similar power transformers as specified herein, based upon performance of this work at a minimum of five projects within the previous ten years. Submit for approval the field supervisor experience, which includes a listing of projects performed, scope of the work, and a contact name and phone number. The field supervisor and erecting engineer may be the same person, provided the qualifications for both are met.

1.5.2 Responsibilities

One full-time employee of the contractor must be available at the worksite anytime other contractor or subcontractor personnel are working on the site, to supervise and direct the work specified herein, who is fluent in

the spoken and written English language. The supervisor must be present at the Little Goose Lock & Dam "Storage Yard" during all site work including transformer site movements, reassembly, oil-filling and testing, and be responsible for following OSHA safe clearance procedures and the Government's Safe Clearance procedures. The supervisor must keep all as-built drawings current and provide copies upon completion of the work. The field supervisor must be responsible for the performance, oversight and correctness of all site work identified in these specifications, including the following:

a. Compliance with all safety, health and reporting requirements of these specifications, including Safe Clearance procedures, accident prevention, environmental protection, activity hazard analysis, fall protection, and confined space entry.

b. Preparation of all required submittals and documentation.

c. Securing an inventory of all materials entering the transformers to ensure no unintended foreign objects remain in the tank.

1.6 SITE ASSEMBLY CONTRACTOR EXPERIENCE

Submit for approval a site assembly contractor experience list, if the transformer site assembly contractor is other than the transformer manufacturer, documenting that the proposed contractor has been engaged in the site assembly and oil filling of generator step-up transformers, rated greater than or equal to 500 kV and 75 MVA single-phase for the last five (5) or more years.

1.7 ERECTING ENGINEER SERVICES

1.7.1 General

Provide a transformer manufacturer’s erecting engineer on the site of the work continually during the progress of each transformer delivery, movement, assembly, oil-filling and testing, who is fluent in the spoken and written English language. The erecting engineer and field supervisor may be the same person, provided the qualifications for both are met.

1.7.2 Erecting Engineer's Qualifications

Provide an erecting engineer who is a permanent employee of the transformer manufacturing facility, or a factory certified representative thereof, who has been engaged in the witnessing of field (site) assembly and installation of similar power transformers, as specified herein, for a minimum of five years, and has performed this work on a minimum of 20 transformers. Erecting engineer must also have experience with 500 kV rated transformers. Submit for approval the Erecting Engineer’s Qualifications, consisting of a listing of this required experience, including a verifying contact, name and phone number for three facilities at which this work was performed. The Erecting Engineer has the authority to make decisions on behalf of the transformer manufacturer.

1.7.3 Responsibilities

The transformer manufacturer's Erecting Engineer is responsible for the transformers, and for the oversight and correctness of instructions given during their reassembly, including the following:

a. Witness and guide ~~off-loading~~offloading and loading of the transformers at each transloading location (transferring a shipment from one mode of transportation to another) during shipment, and ~~off-loading~~offloading from the transport trucks at the Little Goose Lock & Dam "Storage Yard".

b. Witness and guide movement of the transformers to its final long-term storage location, and coordinate placement on the mounting pads with the Corps COR representative.

c. Witness and guide the reassembly of the transformers, including the oil filling process.

d. Witness, guide or perform all transformer inspections and tests for each transformer.

e. After completion of all transformer site work, conduct training for Government personnel, per the requirements of paragraph "CONTRACTOR-FURNISHED TRAINING OF GOVERNMENT PERSONNEL".

1.7.4 Reporting

Maintain a record of all data taken during site assembly and installation, including inspection activities, instructions provided, test results, recommendations and observations for each transformer, and provide this information to the Field Supervisor for inclusion in the daily reports.

1.8 FIELD VERIFICATION OF SITE CONDITIONS

If shipping the transformers by barge, the proposed mooring and offloading location must be field-verified. This verification will ensure the site is suitable for mooring the barge and capable of supporting the transformers, as well as the associated offloading and transport equipment. This verification should be completed prior to the shipment of the transformers. See SECTION 01 11 01.00 28 SUPPLEMENTARY REQUIREMENTS for specific requirements for shipping by barge.

PART 2 PRODUCTS

2.1 DRY-AIR

Submit for approval the descriptive data for the proposed Dry-air for use onsite in conformance with the following paragraphs.

2.1.1 Dry-Air in Cylinders

Dry-air provided in cylinders that meets the requirements of ASTM D3283, Type I, with the composition and properties as follows:

a. Oxygen, volume: 19.5% to 23.5%

b. Carbon monoxide, max. volume: 0.0020%

c. Carbon dioxide, max. volume: 0.10%

d. Nitrogen: predominantly balance

e. Dew point, max.: -58 Degrees Celsius

2.1.2 Air Compressor Dryer

Dry-air supplied by an oil-less compressor must include the following, as a minimum:

a. Desiccant system on the output of the compressor for removal of dirt, water, oil and uncondensed moisture from compressed air lines.

b. Maintain a maximum -40 degrees Fahrenheit dew point, while achieving a 0% compressed air humidity.

c. Coalescer that removes oil and sub-micron particles down to 0.01 microns.

d. Filter that provides removal of water and contaminants down to 5 microns.

e. Provides a filtration capacity up to 30 CFM @ 175 psi.

f. Replaceable or regenerative desiccant system which provides indication of silica gel saturation.

2.2 NITROGEN

If transformers with nitrogen oil preservation systems were provided, submit for approval the descriptive data for the nitrogen proposed for use during the transformer reassembly process, and for establishing the nitrogen blanket headspace after the vacuum oil-filling process for the transformers. Provide nitrogen that meets the requirements of ASTM D1933, Type III in cylinders that fit the applicable nitrogen regulator cabinet.

2.3 GROUNDING CONDUCTORS

Provide bare No. 6 AWG, Class A stranded conductors for grounding of each transformer's bushings to the tank, and from the tank to the existing project chain link fence grounding clamp. Ground conductors are to meet the requirements of SECTION 26 05 19.00 26, paragraph "Ground Conductors". Submit for approval the descriptive data for the grounding

2.4 VALVE LOCKS

Provide locks for locking each valve on each transformer as listed in paragraph "VALVES" in SECTIONS 48 19 23.04 26 CLASS II GSU POWER TRANSFORMER (T2), and 48 19 23.08 26 CLASS II GSU POWER TRANSFORMER (T1), coordinated with the size of the valve lock hasps. All locks are to be keyed the same, with two keys provided for each transformer. Submit for approval the descriptive data for the valve locks proposed for use in locking the hasps of all valves.

2.5 IMPACT RECORDERS

Provide a 3-axis analog impact recorder for each transformer shipped, and for transportation within North America also provide a digital impact recorder with GPS satellite tracking for each transformer. that meet the following:

a. Solar powered with battery backup with sufficient life to supply power to the recorder for the entire duration of the shipment, or replaceable batteries.

b. Programmable to recorder and transmit impacts greater than 1.0g

c. Provides reports every 30 minutes.

d. Includes a shield to protect the recorder.

e. Capable of real-time data that is Internet viewable

PART 3 EXECUTION

3.1 PROTECTION OF MATERIAL AND WORK

At all times prior to delivery and during the assembly and testing process, all materials, supplies, and equipment of every description including property which may be Government-owned and all work performed must be protected and preserved. If, as determined, material, equipment, supplies, and work performed are not adequately protected, such property may be protected by the Government and the cost thereof may be charged to the contractor or deducted from any payment due. All machinery, materials, and articles in a complete or incomplete state for which progress payment has been made prior to delivery must be adequately protected from loss and from corrosion and all other forms of damage. The contractor must also be responsible for, and make good for, any damages due through their fault or negligence occurring during assembly and testing of the equipment at the Little Goose Lock & Dam "Storage Yard".

3.2 TRANSFORMER SHIPMENT PREPARATION

3.2.1 General

Supply units of shipping dimensions and weight that allow for transport from the point of manufacture to the Little Goose Lock & Dam "Storage Yard", including any beams or cribbing required to distribute loading during shipment. Color any internal shipping blocking or bracing that is to be removed from the transformers at its destination a bright yellow, and specifically address these components and their removal during the reassembly process in the transformer site assembly procedure. Any material to be returned to the vendor after transformer shipment must be returned at the contractor's expense, and include identification of material ownership and the shipping address. Materials not so marked will be disposed of at the Government's discretion.

3.2.2 Packaging and Marking for Shipment

a. Prepare and load all material and articles for each shipment in such manner as to protect them from damage during transit, and include the following at a minimum:

(1) Protect all bushings left installed on the transformers during shipment using covers fabricated of either wood or metal, securely fastened.

(2) Protect the control cabinets, and all valves located within 48 inches of the base of the transformer tanks, using covers fabricated of either wood or metal, and securely fastened.

(3) For each transformer, wrap the entire transformer with a marine/industrial shrink film of 7-mil thickness, with provisions

made for the following:

(a) Access to any transformer tank tie-down locations required during shipment.

(b) Exposure of the impact recorder's solar cells if applicable.

(c) Access to any testing terminals which require access during shipment.

(d) Access to the shipment dry-air gas cylinder regulator and gauges.

b. Each transformer and accessories must not be shipped until after the inspections by Government personnel have been performed with all noted deficiencies corrected (unless inspection of the equipment has been waived in writing), factory acceptance tests have been completed and the test reports approved, and the Delivery/Shipping Plan has been reviewed and approved with either an Action Code A or B.

c. Prepare all transformer accessories removed for shipment, including spare parts, in crates with integral skids and lifting means for a fork lift. Package and wrap all accessories within the crates so that they are water resistant. Identify each shipping crate with a unique number which corresponds to an overall packing list for each transformer, and a crate contents packing list which is securely affixed within a see-through weatherproof envelope, and includes the following:

1. Manufacturer

2. Contract number

3. Each spare part or accessory identified so that it can be easily matched with the transformer, its entry on the packing list, and with the transformer layout drawing.

4. Clearly identify the hardware included for installation of each accessory device, and fasten the hardware securely to the device if possible.

d. Identify all crates containing equipment that should be stored indoors, including electronic devices, bushings, gaskets and spare parts, with 2-inch high lettering indicating "STORE INDOORS". Identify items that are required to be shipped and stored in a particular arrangement with 2-inch high lettering indicating "THIS SIDE UP".

e. Submit for approval the shipping bills and notices as soon as each shipment is made, which includes a description of the article furnished, the item number of the contract schedule to which the article applies, the shipping weight of each item, the number of pieces, the total weight, and, if shipped by railroad, the car number.

3.3 SHIPPING

3.3.1 Preparation for Shipment

Deliver each transformer with the oil drained from the tanks. Purge each tank with dry air meeting the requirements of paragraph "DRY-AIR", and install a dry air cylinder and pressure regulator set to at least 2.5 psi during shipment, including gauges to indicate both the transformer tank pressure and the cylinder pressure. Attach a shipping marker with the regulator equipment showing the regulator setting, bottle pressure, tank dew point measurements, and date each tank was sealed for each transformer. Prior to shipment, perform a transformer tank pressure test on each transformer in the shipping configuration, maintained for a minimum of 24 hours, to verify that there are no leaks and there is no appreciable reduction in bottle pressure. If part of the shipment is by rail, then ship the transformer on rail cars equipped with hydraulic draft gear and hydraulic snubbing devices.

3.3.2 Impact Recorders

Mount the impact recorders on each transformer's tank reinforcing channels, covered with a shield. Calibrate the digital impact recorder to record and transmit impact data greater than 1.0g, and provide timed on-line reports every 30 minutes during transformer movement. Provide the Government with the login and password information necessary for website access prior to shipment. Provide the impact recorder serial number and corresponding transformer serial number information for the device.

3.3.3 Shipment

Prepare each transformer and ancillary equipment for shipment from the manufacturing facility to the Little Goose Lock & Dam "Storage Yard", after completion of factory testing and each transformer have been released for shipment by the COR. Perform the following at all transformer transloading operations and include with the site delivery inspection report:

a. Inspection and logging of each transformer tank dry air shipping pressure.

b. Inspection for any signs of transformer movement or shipping damage.

c. Take photos of each transformer and transloading movement operations.

3.3.4 Hauling

The dimensions and weight (without oil) of the largest piece being transported must not exceed that allowed for truck transport and for movement to the Little Goose Lock & Dam "Storage Yard". In the event the shipping dimensions or weight of the largest piece exceed those allowed for truck transport or at the project, the transformers must be designed and manufactured such that its weight and dimension can be safely reduced in the field to that allowed for transport. Any limitations affecting transportation must not become the basis for claims or damages, or for extension of time for completion of work.

3.4 TRANSFORMER DELIVERY/SHIPPING PLAN

The Contractor is responsible for the loading, delivering and offloading of all finished products. Government personnel will not assist the Contractor in the offloading process. Delivery of each transformer is to be made to the Little Goose Lock & Dam "Storage Yard". Refer to contract drawings for location of delivery. Government approval of the movement plan does not constitute approval by railroad or transportation authorities. Submit for approval Delivery/Shipping Plan drawings, approved with either an Action Code A or B prior to transformer shipment, to include the following as a minimum.

a. The method and means of transformer lifting and movement from the manufacturing facility to the Little Goose Lock & Dam "Storage Yard", including all transloading locations. Transloading locations must be identified and scheduled for inspections during these occurrences. Provide descriptions of methods of delivering each transformer, including details for support during shipment to prevent distortion, damage to paint system or other structural members. Include the orientation and location of each transformer on the delivery barges or vehicles prior to shipment for Government approval.

b. Drawings or detailed maps showing the intended route to be taken by the transporters to the Little Goose Lock & Dam "Storage Yard".

c. Wheel, axle, outrigger, and track loads of each transport truck, as applicable, and their locations along the route. Axle loading and road loading limitations must be coordinated with the applicable state and county Departments of Transportation.

d. If transported by barge, the shipping/delivery plan should also include:

1. Details of where and how the barge(s) will be moored at the navigation locks.

2. Barge arrival and duration of offloading tasks.

3. Method of offloading, specific equipment to be used, precise location including rigger placement, ground protection measures to offload and move the transformers to the Little Goose Lock & Dam "Storage Yard".

e. The method and means of ~~off-loading~~offloading and handling of each transformer at the Little Goose Lock & Dam "Storage Yard", including equipment, crane operations, loading plans for equipment, and intended route while on Government property at the Little Goose Lock & Dam "Storage Yard".

f. Store material above ground on platforms, skids, or other supports. Protect material from dirt, oil, and other foreign matter. Protect material so that water is not permitted to collect and pool. Employ handling methods that do not result in damage to components during fabrication, assembly, loading, shipment, and unloading of components. Replace damaged material with new material or repair using a procedure approved by the Engineer of Record. Shipping of each transformer is to be at the Contractor's expense. Arrange each transformer on the delivery vehicles such that no damage occurs during shipping.

3.5 SITE DELIVERY INSPECTIONS

3.5.1 Site Delivery Inspection Procedure and Schedule

Submit for approval a transformer site delivery inspection procedure and schedule, which contain a step-by-step activity listing and a schedule that defines critical path activities and activity dependencies. Include in the procedure the persons on each shift responsible for superintendence and safe clearance, and the activities which are hazardous, affect plant operation, or require participation by Government personnel.

3.5.2 Sample Site Delivery Inspection Procedure

The following outline is based on the expected site delivery inspection and shipping procedure, and is intended to show the scope of the required work. The actual step-by-step procedure submitted must be applicable to the transformer actually furnished, and list methods of repair and/or retesting if unacceptable results of the inspections are obtained.

a. Perform an on-car or transporter external inspection of each transformer and associated equipment for shipping damage, including signs of movement and loose or damaged tie rods. Provide photographs of any noted rail or transporter shipping damage, and included in the Site Delivery Inspection Report.

b. Record each transformer tank and bottle gas pressures at the shipping regulator gauges. Maintain positive pressure on each tank. If a tank pressure is found other than positive, contact the transformer manufacturer to determine the necessity for field dry-out procedures, per the requirements of IEEE C57.93, paragraph 5.8.2, high-vacuum drying, Method 2 with hot oil circulation.

c. Perform a dew point check on each transformer and determine the insulation moisture content, per the methods of IEEE C57.93, Annex C, paragraph C.2.1.1. Moisture content, in terms of temperature, pressure, and dew point should essentially be the same as when the respective transformer was shipped. If the moisture content is greater than 0.5 percent of the dry weight of insulation, perform field dry-out procedures per the requirements of IEEE C57.93, paragraph 5.8.2, high-vacuum drying, Method 2 with hot oil circulation. If it becomes necessary to dry-out any part of the transformer, the contractor must perform all such operations as required at no additional cost to the Government.

d. For each transformer, inspect the impact recorders before removal for tight securement, in position as loaded, protective cover intact, seals in position, and whether the area the device is secured to is intact, loose, or deformed. Any exceptions to the shipment observed must be brought to the attention of the COR. Remove the impact recorder mounting provisions. Inspect the analog impact recorder charts, and the digital GPS data files, in the presence of the COR for any indication of excessive impacts during shipment. Inform the transformer manufacturer of any impacts greater than 3.0g on any axis, and perform inspections and tests as required, below. For each transformer, submit for approval an Impact Recorder Summary Report.

e. The contractor must be responsible for acceptance of all delivered materials and equipment, the condition, and completeness as compared

to the manufacturer's shipping packing list.

f. Perform an SFRA test of each transformer in its shipping configuration, as specified in Sections 48 19 23.08 26 CLASS II GSU POWER TRANSFORMER (T1), and 48 19 23.04 26 CLASS II GSU POWER TRANSFORMER (T2), as defined in paragraph "Sweep Frequency Response Analysis Tests" and paragraph "FIELD TESTS", below, and compare to the factory SFRA tests as performed with each transformer in its shipping configuration. Wavetrace comparisons are expected to match closely, with little differences between matched scans. Wavetrace comparisons that do not match closely must be explained to the satisfaction of the COR, and may be grounds for transformer rejection, requiring an internal inspection of the transformer by the contractor to determine the cause of the deviations, or requiring the transformer to be sent back to the manufacturing facility for repair at no expense to the Government.

g. If shipping damage is suspected or impacts greater than 3.0g on any axis was recorded on the impact recorders and/or charts for any transformer, perform an internal inspection of that transformer to check for internal damage such as loose coils, broken lead supports, dislodged end insulation, frayed lead insulation, core grounds, or loose nuts or bolts. During this internal inspection, follow the requirements of paragraph, "REQUIREMENTS FOR PERFORMANCE OF WORK WITHIN THE TRANSFORMER TANK" and include the inspection results, with photos and manufacturer repair and test recommendations, in the transformer's site delivery inspection report. Reseal the transformer after the internal inspection has been completed, perform vacuum treatment, and repressurize the transformer to 2.5 psi with dry-air. Maintain positive pressure during transportation of the transformer to the project, ~~off-loading~~offloading, and until such time that the tank is opened during assembly. Perform an additional dew point check 24 hours after reseal of the transformer.

3.5.3 Site Delivery Inspection Report

Submit for approval a Site Delivery Inspection Report after completion of the transformer site delivery inspections for each transformer, based upon the approved procedural outline. The Government will not accept delivery of any transformer until a Government review of the report verifies no damage to the transformer has occurred during shipping. The site delivery inspection report must include, but not necessarily be limited to, the following for each transformer:

a. Records of inspections performed and photos taken for all transloading operations.

b. Record of the tank pressure, cylinder pressure and dew point, including the procedure for diagnosis and correction in the event of loss of positive gas pressure during shipment.

c. Visual inspection log, including photographs of any shipping damage and any evidence of transformer movement during shipment, and the proposed method of repair.

d. Results of internal inspection, if required, including photographs of any shipping damage and the proposed method of repair including any recommended tests.

e. Sweep Frequency Response Analysis test results.

3.6 TRANSFORMER CLEANING

Perform heated water pressure washing and cleaning of each transformer prior to moving to the long-term storage location, if determined necessary by the COR. This cleaning process may be performed on the transport truck, at a location approved by the COR. Avoid the ingress of moisture into any electrical cabinets during the cleaning process. Any cleaning agent used during this process must be biodegradable, and subject to the approval of the COR.

3.7 SITE MOVEMENT AND ASSEMBLY

3.7.1 Transformer Movement and Site Placement

~~Off-load~~Offload and move each transformer at the Little Goose Lock & Dam "Storage Yard" as indicated below:

a. Offload the accessory crates at the staging location, as indicated. Notify the COR of any crates which require indoor storage, and coordinate their storage for future access.

b. ~~Off-load~~Offload each transformer to its long-term storage location, locating the transformer on the concrete pad in a containment vault in the position as indicated by the Government representative.

c. After placement on the concrete pad in a containment vault, perform transformer reassembly, vacuum processing, oil-filling, all required field tests, and final transformer cleaning and touch-up painting.

d. Provide manufacturer's Erecting Engineer services for witnessing all site movement and work performed, as required in paragraph, "ERECTING ENGINEER SERVICES".

3.7.2 Transformer Site Assembly Procedure

The contractor is responsible for the complete reassembly of each transformer, operational verification of all transformer components, vacuum processing, oil-filling and performance of the final field tests as required in paragraph "FIELD TESTS". For each transformer type, submit for approval a transformer site assembly procedure which includes a step-by-step activity listing and a proposed time line for each specific task, with references to the transformer manufacturer's instructions, as follows. Include any activities which are hazardous, affect plant operation, or require participation by Government personnel.

a. Torque all bolted connections to the manufacturer's recommendations, and indicated with a permanent marker on every connection that the torquing process has been performed.

b. Perform an internal inspection of each transformer during the assembly process, by visual inspection through the manhole and bushing covers, for evidence of shifting components during transportation, condition of high-voltage lead insulation for evidence of abrasion, and verification that no tools or hardware were inadvertently left inside the tank after the manufacturing process. Any discovered

anomalies must immediately be brought to the attention of the COR. Take photos of the inside of the transformer during this inspection process, and include in the field test report.

c. Hand-clean each bushing and inspect for damage prior to its installation. Perform pre-installation insulation power factor and capacitance tests on each bushing which includes a test tap and a hot collar test on the LV bushings and compare to nameplate values, including the spare bushings being provided. Install the bushings on the transformers in the same phase locations as installed at the manufacturing facility for performance of the factory acceptance tests.

d. Remove any interior shipping braces. Install and connect the bushings, radiators, low-voltage bushing housings and accessory devices removed for shipment. Install new gaskets at gasketed connections for the re-installation of components removed for shipping purposes. Thoroughly clean all gasketed grooves and mating surfaces prior to installation of the new gasket, and apply a high-temperature lubricant designed for transformer gasket applications to the gasket during installation. Do not use Vaseline as a lubricant. Inspect each gasket during installation to assure no damage exists, and the gasket is properly sized to provide approximately 25% compression for filling of the groove when installed, and not oversized causing the gasket to be compressed out of the groove and pinched between the mating surfaces.

e. Do not install the cooling fans, they must be turned over to the Government in their shipping crates must not be installed on the transformer and must be turned over to the Government in their shipping crates for storage after they have been thoroughly inspected for shipping damage or missing parts.

f. Pressure test each assembled transformer.

f. Perform a vacuum leak test on each completely assembled transformer, per the requirements of IEEE C57.93, paragraph 5.7.4, and these specifications.

g. Perform vacuum treatment and hot oil-fill each transformer under vacuum to the normal operating level per the requirements of paragraph "TRANSFORMER OIL-FILLING AND PROCESSING", and the manufacturer's recommendations (whichever is more stringent). Provide a listing of all equipment to be used during the filling process.

h. Perform routine accuracy tests on all bushing current transformers for each transformer in accordance with IEEE C57.13, paragraph 6.11. After completion of the tests, verify that all the shorting screws on the bushing current transformer terminal blocks within the control cabinet are installed, and the current transformer are shorted to ground.

i. Perform an inspection of each transformer and verify the correct installation of the transformer ancillary equipment and devices after reassembly.

j. Verify the tightness of all valve stem packing glands on each transformer.

k. Completely clean each transformer after completion of the

reassembly process, including the insulator sheds on the bushings, and perform touch-up painting.

3.8 REQUIREMENTS FOR PERFORMANCE OF WORK WITHIN THE TRANSFORMER TANK

3.8.1 General

Perform the following on each transformer when working within, or around an opening of, the transformer tanks:

a. Thoroughly clean and vacuum the top of the transformer prior to the removal of any tank man-hole covers, to minimize the possibility of contaminants entering the tank.

b. Monitor the temperature and relative humidity around the transformer during the performance of work. Do not open the tank if the measured relative humidity is greater than 80%, or if there are signs of external condensation on the tank surfaces.

c. Continuously purge the tank with dry air through the lower filter valve, utilizing a dry-air compressor delivering that meets the requirements of paragraph "Dry-Air" any time a transformer tank internals are exposed to the atmosphere.

d. Purge the tank with dry air until analysis of the gas in the transformer indicates at least 19.5 percent oxygen, prior to personnel entry.

e. Provide disposable coverall personal protective equipment suit for all personnel entering the transformer tank. Maintain a logbook of all items entering and leaving the transformer tank to assure nothing has inadvertently been left inside (See paragraph "Tools and Parts Control and Accountability Procedure").

f. Cover all openings into the transformer tank whenever possible to prevent any falling objects from entering the tank.

g. Re-seal the tank at the end of each working day, and pressurize with 2.5 psi of dry-air that meets the requirements of paragraph "DRY-AIR".

3.8.2 Tools and Parts Control and Accountability

A tool and parts control and accountability program is necessary for each transformer to ensure that foreign objects are not left within the transformer tank during internal inspections and transformer reassembly work. Personnel must remove all personal items from their person prior to entering the transformer tank. Log all tools and parts taken into the transformer tank, or which are used within the transformer tank, and any personal items which must remain with the contractor personnel when working within the tank, onto a Tools and Parts Control Checklist. At the end of each shift, and prior to resealing of the transformer tank, account for all tools and parts identified on the checklist, and inspect the interior of the transformer tank for any loose tools or parts. To maintain control of the tools entering the transformer tank, all personal transportable tools will be checked out of a controlled space, such as a tool bin, and checked back during each shift. The contractor Field Supervisor is responsible for assuring that inventoried tools for each craftsperson are accounted and signed for, and logged on the Tools and

Parts Control Checklist during each shift. To control parts entering the transformer tank, the Quality Control manager must inventory and issue the parts during each shift. At the end of each shift, a count will be made of the installed parts to ensure that the quantity checked out matches what was installed. Provide a copy of the Tools and Parts Control Checklist to the COR at the end of each shift for work being performed within each transformer tank, or when the transformer tank is open, and discrepancies in tools or parts must be brought to the attention of the COR.

3.9 TRANSFORMER DRY-OUT

It is not anticipated that it will be necessary to dry-out the transformers; however, if gas pressure has been lost during shipment or shipping damage is suspected on any transformer, then dry-out may be necessary. If the moisture content is greater than 0.5 percent of the dry weight of insulation, perform field dry-out procedures per the requirements of IEEE C57.93, paragraph 5.8.2, high-vacuum drying, Method 2 with hot oil circulation. If it becomes necessary to dry-out any part of the transformer, the contractor must perform all such operations as required at no additional cost to the Government

3.10 TRANSFORMER OIL-FILLING AND PROCESSING

Provide all oil handling and high-vacuum processing equipment for filling of each transformer per the requirements of IEEE C57.93, paragraph 5.7, or the manufacturer's recommendations, whichever is more stringent. Include the transformer oil-filling and processing procedure in the transformer site assembly procedure. No Government provided power source will be available to the contractor for this equipment.

3.10.1 Oil Containment

Utilize one-piece spill containment berms under the oil tanker trucks, vacuum processing trailers, and generator, sized to completely surround the equipment, for all oil-handling operations. Provide berms that are manufactured from a reinforced geomembrane of a minimum 30 mil thickness, chemically resistant to transformer oil, with supported collapsible walls. During the oil handling operations, all hose joints which are located outside of the spill containment berms must have interlocking connections, be wrapped with an absorbent material, with 5-gallon buckets located beneath the joint to help avoid oil spills. Submit for approval an oil spill plan and provide the necessary equipment to contain an oil spill.

3.10.2 Tank Pressure Test

Perform a transformer tank pressure test after each transformer has been fully assembled, but prior to oil-filling. Verify that all bolted connections have been torque-checked for the correct tightness prior to performing the test, and perform testing at a gauge pressure of 4 psi for a minimum of 8 hours. The tank must hold pressure during the test duration without leakage, and any leaks detected resolved prior to proceeding to vacuum treatment.

3.10.3 Vacuum Leak Test

Perform a transformer tank vacuum leak test after each transformer has been fully assembled, but prior to oil-filling. Ensure that all devices which are not suitable for vacuum have been valved off prior to testing.

A vacuum level of 0.25 Torr must be achieved, and during the initial 30 minutes of the test the maximum allowable pressure rise must not exceed 0.15 Torr. If more than 0.15 Torr of vacuum is lost during the first 30 minutes, or if the rate of loss of vacuum increases over an hour, determine the source of the vacuum leak and take the necessary corrective actions, and re-perform the vacuum leak test until the maximum allowable pressure rise has been achieved.

3.10.4 Vacuum Treatment

On each transformer, after an acceptable leak rate has been achieved, perform vacuum treatment by holding a maximum vacuum of 0.25 Torr for a duration per the manufacturer's recommendations, but must be a minimum of 24 hours. If a vacuum of 0.25 Torr cannot be achieved, check all bolted fittings for tightness, and explain to the satisfaction of the COR. During this period, hot oil at a temperature between 60 - 65 degrees Celsius may be introduced to aid in heating the windings for moisture removal, then drained to allow for moisture removal using vacuum.

3.10.5 Transformer Oil for Processing

Provide insulating transformer oil which meets requirements Sections 48 19 23.04 26 CLASS II GSU POWER TRANSFORMER (T2), and 48 19 23.08 26 CLASS II GSU POWER TRANSFORMER (T1), paragraph "INSULATING OIL" for each transformer. Prior to filling, take oil samples from each oil tank and test per the requirements of paragraph "Oil Tests". Provide any temporary oil storage facilities required for handling and processing the transformer oil.

3.10.6 Vacuum Filling

For each transformer, after vacuum treatment, handle the oil from the tanker trucks to each transformer via a high-vacuum purifier. Vacuum-fill the transformer with hot oil, at a temperature between 60 - 65 degrees Celsius, circulating a minimum of two full volume passes of hot oil after completion of the vacuum filling process to aid in moisture removal. Fill the transformer in a continuous operation to the correct oil level based upon the oil temperature, per the manufacturer's recommendations. Establish the nitrogen blanket if supplying transformers with a nitrogen oil preservation system per the manufacturer's recommendations.

3.11 TOUCH-UP PAINTING

For each transformer, thoroughly clean any abrasions to the transformer paint, and touch-up paint any damaged areas with one coat of primer and one finish coat of paint. Clean all finished surfaces to receive primer on which the factory coating has deteriorated or been damaged by means of solvents, degreasers, light sanding or polishing with 240 grit aluminum oxide paper or cloth moistened with kerosene, or other approved means which removes all grease, paint markings, dirt, rust, and other foreign substances. Protect adjacent surfaces and equipment from overspray or paint splatter during the touch-up painting operations. The use of wet or dry cloths or paper must be approved by the COR on an individual basis. Primer paint and finish coats must be as specified in Sections 48 19 23.04 26 CLASS II GSU POWER TRANSFORMER (T2) and 48 19 23.08 26 CLASS II GSU POWER TRANSFORMER (T1), paragraph "FACTORY CLEANING AND PAINTING".

3.12 FIELD TESTS

3.12.1 Device Functional Tests

After reassembly of each transformer, all devices and wiring connections removed for shipment must be functionally tested to verify proper operation. The functionality of the cooling fan circuits must be verified by voltage check.

3.12.2 Electrical Tests

Perform the electrical tests on each transformer in accordance with the applicable requirements of IEEE C57.152 and the approved transformer site assembly procedure, after each transformer has been filled with oil, the bushings installed, and assembly of each transformer is complete. A copy of each transformer's factory acceptance test report must be on-hand during performance of the field tests, and test result comparisons made to verify an acceptable transformer condition after reassembly and oil-filling each transformer. Any deviations between the factory and field test results must be brought to the attention of the COR for determination of acceptance. Submit for approval the Transformer Field Test Report for each transformer after completion of the tests. Electronic data test results for the tests listed below must be provided in standard Doble file formats, as applicable, for uploading into the Doble online database and comparison to factory and future tests performed by Government personnel. The witnessing representatives of the contractor and the COR must sign the reports of all witnessed tests. Perform the following electrical tests on each transformer prior to final acceptance by the Government:

a. Transformer Turns Ratio test (TTR) on each tap (IEEE C57.152, paragraph 7.2.10)

b. Exciting Current (IEEE C57.152, paragraph 7.2.11)

c. Winding insulation resistance of each winding to ground and between windings (IEEE C57.152, paragraph 7.2.13)

d. Winding resistance of each winding (IEEE C57.152, paragraph 7.2.7)

e. Polarization Index (IEEE C57.152, paragraph 7.2.13.4)

f. Power Factor test and excitation current of each transformer winding (IEEE C57.152, paragraph 7.2.14)

g. Power Factor Test of each transformer bushing (IEEE C57.152, paragraph 7.3.3)

h. If providing a core type transformer, core insulation resistance (IEEE C57.152, paragraph 7.2.6.2), for both core-to-frame and frame-to-ground.

i. Leakage Reactance Measurement Tests, per the requirements of IEEE C57.152, paragraph 7.2.12. Perform leakage reactance measurement tests between the high-voltage winding and each low-voltage winding, and between the two low-voltage windings (H-X, H-Y, X-Y, and H-X/Y), using the same model test equipment and methods as used in the manufacturing facility. The leakage reactance test results must not deviate more than 0.5 percentage points as compared to the factory

test reports. Deviations in excess of 0.5 percentage points must be explained to the satisfaction of the COR, and may be grounds for requiring an internal inspection of the transformer by the contractor, at no expense to the Government, to determine the cause.

j. Sweep Frequency Response Analysis Test. Perform a sweep frequency response analysis (SFRA) test per the requirements of IEEE C57.149, using the same equipment and methods as used during the transformer factory acceptance testing. Include the proposed SFRA test equipment, setup, and test procedure in the field test procedures submittal. Compare the SFRA test results with the factory acceptance test "baseline" results, to determine the integrity of the core and winding structure after shipment from the manufacturing facility. Load the SFRA data obtained during the factory acceptance testing into the test equipment software to facilitate Wavetrace comparisons. Wavetrace comparisons are expected to match closely, with little differences between matched scans. Wavetrace comparisons that do not match closely must be explained to the satisfaction of the COR, and may be grounds for transformer rejection, requiring an internal inspection of the transformer by the contractor to determine the cause of the deviations, or requiring the transformer to be sent back to the manufacturing facility for repair at no expense to the Government.

3.12.3 Oil Tests

Perform testing on the supplied transformer oil per the requirements of TRANSFORMER INSULATING OIL TEST REQUIREMENTS, included with these specification, and obtain oil samples per the requirements of ASTM D923.

a. New oil certification, as delivered. Provide a copy of the transformer oil certification tests from the transformer oil supplier upon delivery, and prior to filling of each transformer. If the oxidation inhibitor content is below 0.25 percent by mass, the inhibitor content must be increased during the oil-filling process by the addition of a liquid concentrated oxidation inhibitor for insulating oil. Submit for approval the proposed Insulating Oil Oxidation Inhibitor, including the calculations for the amount of additive required to bring the overall oxidation inhibitor content to 0.30 percent by mass.

b. Delivery sample. Obtain an oil sample from each oil-filled compartment from each tanker truck upon arrival to the site, and send out for testing. Submit for approval a Delivery Transformer Oil Test Report. Any nonconformance with the required oil characteristics must be remedied during field processing, at no cost to the Government, by a process submitted for approval.

c. Post oil-filling samples. After transformer oil filling and processing on each transformer has been completed, obtain samples of the insulating oil from the transformer and send to two independent laboratories for analysis. Submit for approval an Oil-Filled Transformer Oil Test Report, which includes the identity of samples and results of analyses.

3.13 GROUNDING CONNECTIONS FOR LONG TERM STORAGE

After each transformer has been reassembled, oil-filled, and tested, all bushing terminals must be connected together using a #6 AWG ground conductor, as specified in 26 05 19.00 26 INSULATED WIRE AND CABLE,

paragraph "Ground Conductors" and then connected to one of the tank grounding pads. The stud-to-flat bronze terminal connectors, must be installed on the high-voltage and neutral bushings for the purposes of connecting the grounding conductors during long-term storage. During installation of the terminal connectors, the bushing terminal threads must be coated with an approved conductive joint compound. Crimped fittings and connecting hardware must be provided for all grounding conductor connections, sized for the attachment to each transformer bushing terminal and tank ground pad.

3.14 NITROGEN GAS CYLINDER(S)

If providing transformers with a nitrogen preservation system, provide nitrogen gas in cylinder(s) that meets the requirements of paragraph NITROGEN to replace the existing nitrogen gas cylinders for each transformer.

3.15 CONTRACTOR-FURNISHED TRAINING OF GOVERNMENT PERSONNEL

3.15.1 Training General Requirements

Conduct a training course at the Little Goose Lock & Dam "Storage Yard" in the theory, operation, and maintenance of the power transformer within three weeks after performance of all transformer field tests have been completed. Coordinate the date the training is to be performed with the COR. The course must include the theory of operation of the transformer control circuits and the manufacturer’s recommended preventive maintenance. Record audio and visual of the training session and provide three digital copies for future use by the Government. The course must be of 8 hours minimum duration for approximately 10 Government personnel.

3.15.2 Sample Training Outline

Course material must include the use of the site specific Operations and Maintenance Manual, and particular attention must be paid to the special accessories listed in paragraph “Transformer Mounted Accessories” of Sections 48 19 23.04 26 CLASS II GSU POWER TRANSFORMER (T2), and 48 19 23.08 26 CLASS II GSU POWER TRANSFORMER (T1). Submit for approval a training outline of the material to be covered, including a proposed schedule. Prepare the training course using Microsoft PowerPoint, and include an electronic copy and bound hard copy of the training material to be left with Project personnel for future reference. The training outline must include the following material:

a. Name and contact information for the contractor, and special equipment manufacturer representatives performing the training.

b. Summary technical data for two transformer types provided, including manufacturer location.

c. Overview of the structure of the O&M manual, the manufacturer's drawings, and the factory test data.

d. Thorough review of the transformer outline drawings, including the locations and descriptions of the ancillary equipment.

e. Photographs of the transformer manufacturing process, and configuration of the core and coils within the transformer tank.

f. Description of the manufacturer's recommended maintenance and inspection procedures for the transformer equipment, and the associated intervals.

g. Description of the recommended maintenance testing, and the associated intervals.

h. Overview of the fall arrest system.

i. Overview of the transformer spare parts, including any special storage and maintenance recommendations.

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.
W912EF26RA003

TITLE AND LOCATION
LGA Lower Snake River Spare Transformers

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		01 11 01.00 28	SD-01 Preconstruction Submittals															
			Equipment List	1.8	I	C												
			Project Schedule	1.10	G	C												
		01 14 00.90 28	SD-01 Preconstruction Submittals															
			Suspicious Activity Reporting	1.6	G	C												
			Pre-Screen Candidates Using	1.8	G	C												
			E-Verify Program															
		01 35 29.10 28	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.8	G	C												
			Activity Hazard Analysis (AHA)	1.9	G	C												
			Safe Clearance	1.10	I	C												
			Authorized Individuals	1.10	I	C												
			Standard Lift Plan	1.8.1.1	G	C												
			Critical Lift Plan	1.8.1.2	G	C												
			Crane Wheel And Outrigger	1.14.5	G	ST												
			Loading Diagram And Deck															
			Protection For Outriggers															
			Competent Person Qualifications	1.7.1.2	G	C												
			Confined Space Entry Permit	1.11.1	G	C												
			Site Safety And Health Officer	1.7.1.1	G	C												
			(SSHO) Designation Letter															
			Eng Form 6277 Energized	3.5.1	G	C												
			Electrical Work Permit															
			Master or Journeyman Electrician	3.5.2	I	C												
			SD-06 Test Reports															
			Accident Reports	1.14.2	I	C												

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		01 35 29.10 28	LHE Inspection Reports	1.14.3	I	C												
			Accident, Mishap, and Near Miss Investigation and Reporting	1.14.1	I	C												
			SD-07 Certificates															
			Crane Operators/Riggers	1.7.1.4	I	C												
			Hot Work Permit	1.11.1	I	C												
			Certificate of Compliance	1.14.4	I	C												
			Competent Person Trainer	1.7.1.3	G	C												
			Naval Architecture Analysis	1.8.1.2	I	C												
		01 55 10.00 28	SD-01 Preconstruction Submittals															
			Transport Loading Diagrams	1.4	G	ST												
			Floating Plant	1.6	I	C												
		48 19 23.08 26	SD-01 Preconstruction Submittals															
			Welding Quality Control Plan	3.3.2.2	G	HDC												
			SD-02 Shop Drawings															
			Outline and Assembly Drawings	3.2.1	G	HDC												
			Detail Drawings	3.2.2	G	HDC												
			SD-03 Product Data															
			Welding Electrodes and Rods	3.3.2.5	G	HDC												
			Shielding Gas	3.3.2.5	G	HDC												
			SD-05 Design Data															
			Transformer Design Data Review Report	3.1.2	G	HDC												
			Descriptive Data	2.1.5	G	HDC												
			Spare Parts List	2.18	G	HDC												

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		48 19 23.08 26	Structural Design Criteria and	2.2	G HDC													
			Seismic Calculations															
			Cabinet Heater Sizing	2.15.9	G HDC													
			Calculations															
			SD-06 Test Reports															
			Transformer Factory Acceptance	3.5.2	G HDC													
			Test Report															
			Bushing Design Tests	3.6.2	G HDC													
			Bushing Routine Tests	3.6.4	G HDC													
			Bushing Current Transformer	3.6.5	G HDC													
			Manufacturer Routine Tests															
			Weld Inspection and Test Report	3.3.2.7	G HDC													
			SD-07 Certificates															
			Transformer Oil Certification	2.12.1	G HDC													
			Notification of the Date of the	3.1.1	G HDC													
			Transformer Design Data Review															
			Meeting															
			Notification of the Date of Factory	3.5.1	G HDC													
			Tests															
			Welder Qualifications	3.3.2.3	G HDC													
			Weld Inspector Qualifications	3.3.2.7	G HDC													
			SD-08 Manufacturer's Instructions															
			Factory Test Procedures	3.5.1	G HDC													
			Welding Procedures	3.3.2.5	G HDC													
			Prequalified Weld Procedures	3.3.2.5	G HDC													
		48 20 00.04 26	SD-01 Preconstruction Submittals															

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		48 20 00.04 26	Delivery/Shipping Plan	3.4	G	AO												
			Transformer Site Assembly	3.7.2	G	HDC												
			Procedure															
			Field Supervisor Experience	1.5.1	G	HDC												
			Erecting Engineer's Qualifications	1.7.2	G	HDC												
			Site Assembly Contractor	1.6	G	HDC												
			Experience List															
			SD-03 Product Data															
			Insulating Oil Oxidation Inhibitor	3.12.3	G	HDC												
			Dry-Air	2.1	G	HDC												
			Nitrogen	2.2	G	HDC												
			Grounding Conductors	2.3	G	HDC												
			Valve Locks	2.4	G	HDC												
			Impact Recorders	2.5	G	HDC												
			SD-06 Test Reports															
			Delivery Transformer Oil Test	3.12.3	G	HDC												
			Report															
			Transformer Field Test Report	3.12.2	G	HDC												
			Oil-Filled Transformer Oil Test	3.12.3	G	HDC												
			Report															
			SD-07 Certificates															
			Shipping bills and Notices	3.2.2	G	AO												
			SD-08 Manufacturer’s Instructions															
			Training Outline	3.15.2	G	AO												
			Site Delivery Inspection	3.5.1	G	HDC												
			Procedure And Schedule															

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		48 20 00.04 26	SD-09 Manufacturer's Field															
			Reports															
			Impact Recorder Summary	3.5.2	G AO													
			Report															
			Site Delivery Inspection Report	3.5.3	G AO													
			Tools and parts control checklist	3.8.2	G AO													