



**US Army Corps  
Of Engineers®  
Nashville District**

**RFP No. W912P5-04-R-0013**

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# **GENERATOR REWIND**

**Wolf Creek Powerplant  
Cumberland River  
Russell County, Kentucky**

## **Construction Specifications**

**Nashville, Tennessee**

**April 2004**

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# WOLF CREEK POWERPLANT GENERATOR REWIND

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## SECTION 01005

### DESCRIPTION OF WORK

#### 1.1 GENERAL INFORMATION

The following paragraphs describe the required work. The description of the work in this section is abbreviated with the details provided in the technical sections. The technical specifications are arranged by the Construction Specifications Institute (CSI) numbering system, which does not correspond with sequence in which the work has to be accomplished.

#### 1.2 DESCRIPTION OF WORK

This section covers the technical specifications to perform the following work: All work and quantities are to restack and rewind the generators of Unit 4 and Unit 6 at Wolf Creek Powerplant unless specifically stated otherwise in these specifications. **All work for Unit 6 is to be considered optional.** This list is a general summary of the required work and is not all inclusive:

- a. Design, manufacture, shop test, prepare and load for shipment, deliver f.o.b. destination, and unload a complete set of stator coils and all accessories specified herein.
- b. Partially disassemble the generator. This includes removing the rotor.
- c. Remove old stator coils and stator core.
- d. Design, manufacture, shop test, prepare and load for shipment, deliver f.o.b. destination, and unload a complete set of stator laminations and vent duct spacers and all accessories specified herein.
- e. Restack and test stator core.
- f. Install and test the new stator winding and accessories specified herein.
- g. Inspect, clean, and test the generator rotor.
- h. Furnish spare parts.
- i. Reassemble the generator.
- j. Furnish manufacturer's representative on-site services to supervise the installation of the generator stator coils and to perform start-up, commissioning, and testing of the generator.
- k. Perform all work required to comply with the site operations, environmental protection, and safety and health provisions as specified herein.

1. Perform all work required for painting, miscellaneous welding, machinist, electrician and other skilled craftsman hire.

### **1.3 SPECIFICATIONS**

Technical specifications listed below cover the detailed requirements for the required work:

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### **1.4 DEFINITIONS**

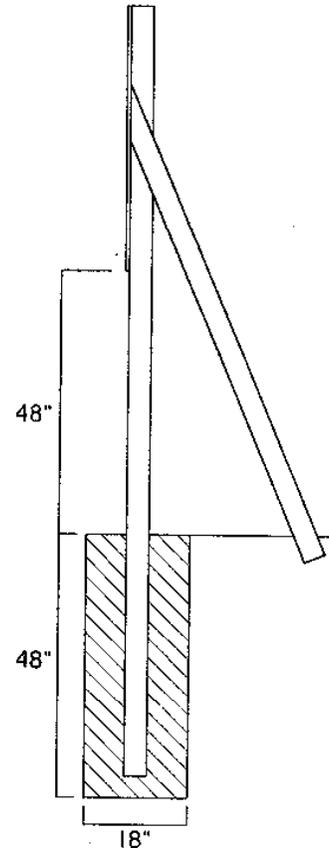
Wherever in these specifications the word "GQAR" is used, it shall be understood to mean "Government Quality Assurance Representative," unless otherwise stated.

Wherever in these specifications the word "weekend(s)" is used, it shall be understood to mean "Saturday, Sunday and Federal Holidays," unless otherwise expressly stated.

**END OF SECTION 01005**

# PROJECT IDENTIFICATION SIGN

|  |     |                                      |     |
|--|-----|--------------------------------------|-----|
| Construction Supervised by:  |     | <b>Project Title</b>                 |     |
| <br><b>US Army Corps of Engineers</b><br>Nashville District |     |                                      |     |
| (WHITE LETTERS-<br>RED BACKGROUND)   |     | (BLACK LETTERS-<br>WHITE BACKGROUND) |     |
| 3"   | 21" | 3"                                   | 45" |



LEGEND GROUP 1: ONE- TO TWO-LINE DESCRIPTION OF CORPS RELATIONSHIP TO PROJECT. COLOR: WHITE. TYPEFACE: 1.25" HELVETICA REGULAR MAXIMUM LINE LENGTH: 19".

LEGEND GROUP 2: DISTRICT NAME PLACED BELOW 10.5" REVERSE SIGNATURE (6" CASTLE). COLOR: WHITE. TYPEFACE: 1.25" HELVETICA REGULAR.

LEGEND GROUP 3: ONE- TO THREE-LINE PROJECT TITLE LEGEND DESCRIBES THE WORK BEING DONE UNDER THIS CONTRACT. COLOR: BLACK. TYPEFACE: 3" HELVETICA BOLD MAXIMUM LINE LENGTH: 42".

LEGEND GROUP 4: ONE- TO TWO-LINE IDENTIFICATION OF PROJECT OR FACILITY (CIVIL WORKS). TYPEFACE: 1.5" HELVETICA REGULAR MAXIMUM LINE LENGTH: 42".

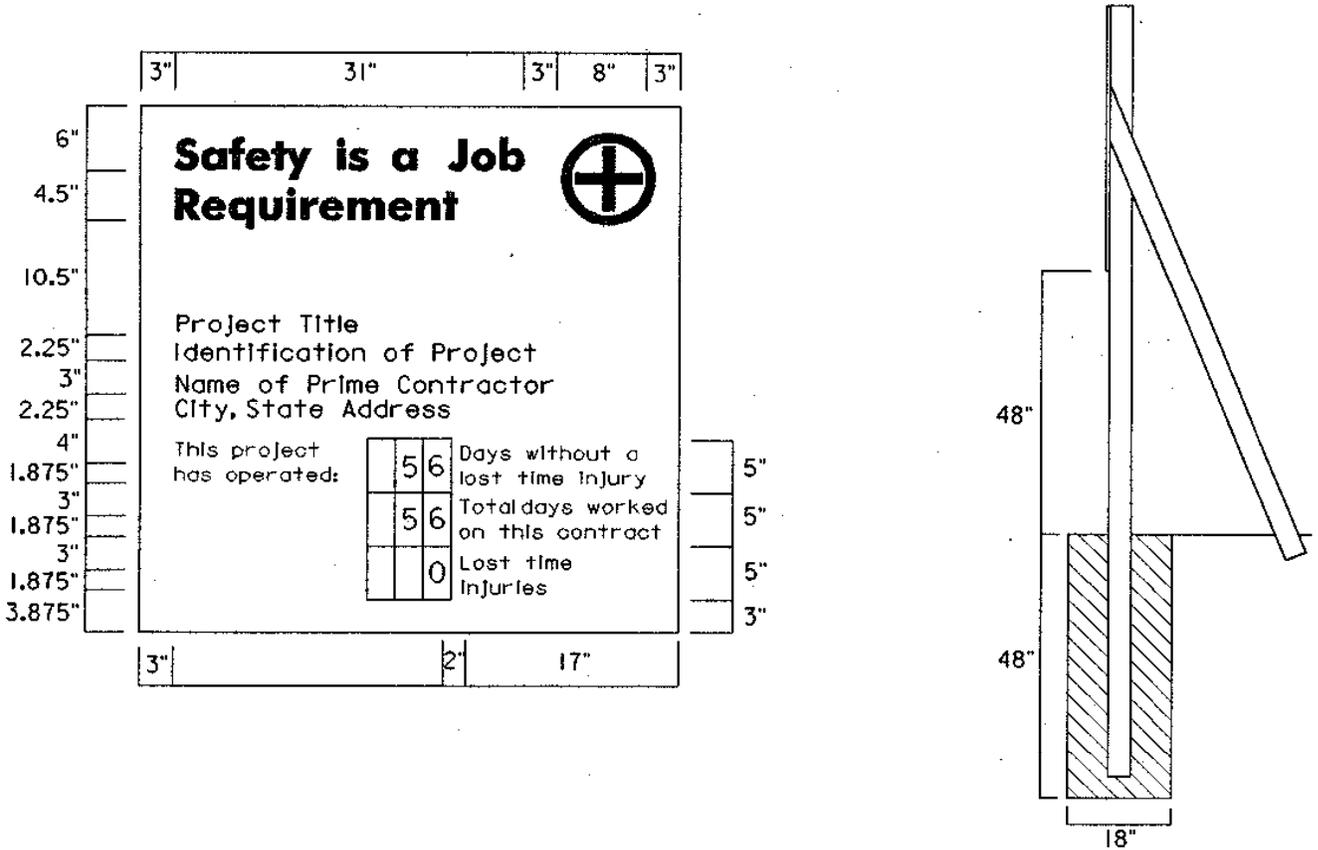
CROSS-ALIGN THE FIRST LINE OF LEGEND GROUP 4 WITH THE FIRST LINE OF THE CORPS SIGNATURE (US ARMY CORPS) AS SHOWN.

LEGEND GROUPS 5: ONE- TO FIVE-LINE IDENTIFICATION OF PRIME CONTRACTORS INCLUDING: TYPE (GENERAL CONTRACTOR, ETC.), CORPORATE OR FIRM NAME, CITY, STATE. COLOR: BLACK. TYPEFACE: 1.25" HELVETICA REGULAR MAXIMUM LINE LENGTH: 21".

ALL TYPOGRAPHY IS FLUSH LEFT AND RAG RIGHT, UPPER AND LOWER CASE WITH INITIAL CAPITALS ONLY AS SHOWN.

PANEL SIZE 4' X 6', POST SIZE 4" X 4", MOUNTING HEIGHT 48", COLOR BKG/LGD WH-RD/BK.

# SAFETY PERFORMANCE SIGN



LEGEND GROUP 1: STANDARD TWO-LINE TITLE "SAFETY IS A JOB REQUIREMENT", WITH (8" OD.) SAFETY GREEN FIRST AID LOGO. TYPEFACE: 3" HELVETICA BOLD COLOR: BLACK.

LEGEND GROUP 2: ONE- TO TWO-LINE PROJECT TITLE LEGEND DESCRIBES THE WORK BEING DONE UNDER THIS CONTRACT AND NAME OF HOST PROJECT. COLOR: BLACK. TYPEFACE: 1.5" HELVETICA REGULAR MAXIMUM LINE LENGTH: 42".

LEGEND GROUP 3: ONE- TO TWO-LINE IDENTIFICATION: NAME OF PRIME CONTRACTOR AND CITY, STATE ADDRESS. COLOR: BLACK. TYPEFACE: 1.5" HELVETICA REGULAR MAXIMUM LINE LENGTH: 42".

LEGEND GROUP 4: STANDARD SAFETY RECORD CAPTIONS AS SHOWN. COLOR: BLACK. TYPEFACE: 1.25" HELVETICA REGULAR.

REPLACEABLE NUMBERS ARE TO BE MOUNTED ON WHITE .060 ALUMINUM PLATES AND SCREW-MOUNTED TO BACKGROUND. COLOR: BLACK. TYPEFACE: 3" HELVETICA REGULAR PLATE SIZE: 2.5" X 5.0".

ALL TYPOGRAPHY IS FLUSH LEFT AND RAG RIGHT. UPPER AND LOWER CASE WITH INITIAL CAPITALS ONLY AS SHOWN.

PANEL SIZE 4' X 4', POST SIZE 4" X 4", MOUNTING HEIGHT 48", COLOR BKG/LDG WH/BK-GR.

## SECTION 01010

### CONTRACTOR'S SITE OPERATIONS

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**PART 2 PRODUCTS**

(NOT USED)

**PART 3 EXECUTION**

(NOT USED)

## SECTION 01010

### CONTRACTOR'S SITE OPERATIONS

#### PART 1 GENERAL

##### 1.1 GENERAL INFORMATION

This section covers the general requirements applicable to specific Contractor's operations or equipment for work performed on site.

##### 1.2 REFERENCES

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

###### 1.2.1 Code of Federal Regulations (CFR)

29 CFR 1926(1992) Safety and Health Regulations for Construction

###### 1.2.2 Federal Highway Administration (FHWA)

FHWA 6 (1988) Manual on Uniform Traffic Control Devices for Streets and Highways

###### 1.2.3 US Army Corps Of Engineers (USACE)

EM 385-1-1 (2003) Safety and Health Requirements Manual

##### 1.3 SUBMITTALS

Submittals required by this section of the Technical Specifications shall be for Government approval (GA) or for information only (FIO), and shall be submitted as stated below in accordance with SECTION 01330. The time of submittal shall be in accordance with SECTION 01330, unless otherwise indicated below.

###### 1.3.1 Roadway Access Agreements (FIO; SD-01 Data)

Provide roadway access agreements a minimum of 30 calendar days prior to use (see paragraph 1.4.2.)

### **1.3.2 Content and Location of Signage (GA; SD-01 Data)**

Provide content and location of signage a minimum of 5 calendar days prior to erection (see paragraph 1.4.4.)

### **1.3.3 Project Security Procedure (GA; SD-01 Data)**

Provide the procedure for identification and control of employees entering or leaving site, a minimum of 90 calendar days prior to the start of site work (see paragraph 1.6.1.)

### **1.3.4 Working Hours (GA; SD-01 Data)**

Provide Contractor's working hours, shifts, and days of the week to be worked, including an estimate of the number of employees working per shift, a minimum of 120 calendar days prior to the start of site work (see paragraph 1.6.2.)

### **1.3.5 Site Work Schedule (GA; SD-01 Data)**

Provide the site work schedule featuring the major stages of the work, a minimum of 30 calendar days prior to the start of site work (see paragraph 1.6.3.)

### **1.3.6 Project Report (FIO; SD-01 Data)**

Provide a project report giving project status, activities, and current project schedules within the first week of each month of site work (paragraph 1.13.)

### **1.3.7 Initial Plant and Equipment List (FIO; SD-01 Data)**

Provide an initial plant and equipment list a minimum of 30 calendar days prior to the start of site work (see paragraph 1.19.)

### **1.3.8 Up-Dated Plant and Equipment List (FIO; SD-01 Data)**

Provide an up-to-date list of all plant and equipment, with the end-of-month request for payment throughout the life of the contract (see paragraph 1.19.)

### **1.3.9 Transportation and Operation of Cranes (GA; SD-01 Data)**

Provide a plan and method of transportation and operation of cranes and heavy equipment, a minimum of 90 calendar days prior to their transportation and site operation (see paragraph 1.20.1.)

### **1.3.10 List of Equipment and Materials (GA; SD-01 Data)**

Provide a list of equipment and materials proposed for temporary storage within Government allocated staging areas, a minimum of 20 calendar days prior to their storage (see paragraph 1.22.)

### **1.3.11 Plan for Protection of Materials and Equipment (GA; SD-01 Data)**

Provide a method and plan of protection for materials and equipment, a minimum of 90 calendar days prior to the start of site work or in areas to be protected (see paragraph 1.24.)

### **1.3.12 Location of Contractor's Miscellaneous Buildings (GA; SD-01 Data)**

Provide the location of Contractor's miscellaneous buildings, a minimum of 30 calendar days prior to their erection (see paragraph 1.25.)

### **1.3.13 Scaffolding, Ladder, Stairway & Other Access Schemes (GA; SD-01 Data)**

Provide any scaffolding, ladder, stairway, or other access schemes proposed, a minimum of 90 calendar days prior to their installation and use (see paragraph 1.29.)

### **1.3.14 Location and Plan for Disposal Areas (GA; SD-01 Data)**

Provide the location of disposal area and plan for disposal, a minimum of 90 calendar days prior to the disposal (see paragraph 1.30.)

### **1.3.15 Dust and Fume Control Plan (GA; SD-01 Data)**

Provide a dust and fume control program, a minimum of 90 calendar days prior to the start of site work (see paragraph 1.31.2.)

### **1.3.16 Records of Measurement (GA; SD-01 Data)**

Records of all measurements, upon request or upon completion of the work, paragraph 1.39.2.

### **1.3.17 Organization Chart (FIO; SD-01 Data)**

Provide the organization chart, a minimum of 10 calendar days prior to the start of site work, and updated weekly thereafter to reflect the current organization (see paragraph 1.38.3.1.)

### **1.3.18 List of Personnel Working at Site (FIO; SD-01 Data)**

Provide the list of personnel working on the site, a minimum of 10 calendar days prior to the start of site work and updated weekly thereafter to reflect a current listing (see paragraph 1.38.3.2.)

### **1.3.19 Change Request to Regular Work Schedule (GA; SD-08 Statements)**

Provide request to change schedule of regular work hours, etc., at Contractor's discretion (see paragraph 1.6.2.)

### **1.3.20 Wolf Creek Powerplant Safe Clearance Procedure (FIO; SD-08 Statements)**

Provide request for copies of the Wolf Creek Powerplant Safe Clearance Procedure program at Contractor's discretion (see paragraph 1.15.)

### **1.3.21 Generator Unit Outage (GA; SD-08 Statements)**

Provide requests for generator unit outage, a minimum of 30 calendar days prior to desired unit outage date (see paragraph 1.17.2.)

### **1.3.22 Request for use of Powerhouse Bridge Crane (GA; SD-08 Statements)**

Provide request for use of powerhouse bridge crane, a minimum of 5 calendar days prior to first use (see paragraph 1.18.1.)

### **1.3.23 Crane Operator(s) Qualifications and Medical (GA; SD-08 Statements)**

Provide crane operator(s) qualifications and current medical exam, a minimum of 5 calendar days, excluding weekends, prior to performance of work (see paragraph 1.18.5.2.)

### **1.3.24 Crane Riggers Qualifications (GA; SD-08 Statements)**

Provide crane rigger's qualifications, a minimum of 5 calendar days, excluding weekends, prior to performance of work (see paragraph 1.18.4.3.)

### **1.3.25 Request for Copies of Data (FIO; SD-08 Statements)**

Provide request for copies of data and drawings, at Contractor's discretion (see paragraph 1.37.)

### **1.3.26 Notice of Damaged Equipment (FIO; SD-08 Statements)**

Provide notice of finding damaged equipment or other abnormal conditions of equipment or parts, four hours after discovery (see paragraph 1.23.)

### **1.3.27 Qualifications & ID of Contractor's Agent(s) (GA; SD-08 Statements)**

Provide qualifications and identification of Contractor's agent(s), a minimum of 90 calendar days prior to the start of site work (see paragraph 1.38.1.)

### **1.3.28 Qualifications and ID of Contractor's Rewind Work Supervisor(s) (GA; SD-08 Statements)**

Provide qualifications and identification of Contractor's rewind work supervisor(s), a minimum of 90 calendar days prior to the start of site work (see paragraph 1.38.2.)

## **1.4 WORK AREAS AND ACCESS**

### **1.4.1 Access Roads**

No new access roads are required for this work. Any damage to existing roadways that are used for access purposes shall be repaired and the surface shall be restored to its "as found" condition.

### **1.4.2 Road Restrictions**

The Contractor shall comply with any special requirements of the State, County, Local authorities and Corps of Engineers for use of existing roadways. These special requirements include, but are not limited to, traffic regulations and load limits. The Contractor is responsible for investigating and understanding these restrictions. No time extensions or cost claims will be allowed due to road restrictions. Any agreements negotiated with the State or County for road use will be furnished to the Government before use of roadways begin. Both lanes of roads shall not be blocked by the Contractor. If one lane is blocked the Contractor shall provide the necessary flaggers, based on the visibility, to control traffic.

### **1.4.3 Access by Government Personnel**

Clear access shall be maintained for Government personnel and equipment through all work areas.

### **1.4.4 Contractor's Staging Area and Employee Access**

The Contractor's staging area shall be restricted to the area designated by the Government. His job-site office may be in the staging area, as approved. The project areas off-limits to Contractor shall be all areas other than the work areas. Salespersons or personnel seeking employment will not be permitted inside the powerhouse. Signs may be erected outside the powerhouse containing instructions for personnel seeking the Contractor. The content and location of the signs must be approved. The Contractor shall provide his own office space and administrative facilities and all temporary storage buildings. All temporary Contractor site facilities shall be disposed of before final acceptance of all work.

### **1.4.5 Access to Powerhouse**

Access to the powerhouse shall be obtained from the powerhouse control room operator. The operator can be accessed by dialing "0" or 7011 from the outside phones. The employees shall identify themselves by giving their names to the operator before entering the building. When the employees leave the powerhouse for the day they shall notify the operator of their departure. At

no time will any doors be blocked open upon entering or leaving the building. The powerhouse elevator shall not be used to transport equipment and material.

## **1.5 VEHICLES**

### **1.5.1 Use of Private Vehicles**

Private vehicles of the Contractor and Contractor's employees shall enter and leave the project on the access road from US Highway No. 127. Parking of private vehicles shall be restricted to the areas designated. Spaces for approximately 5 privately owned vehicles will be available in a designated area near the powerhouse. Additional parking will be designated upon request, but may be located up to 1 mile from the powerhouse. Contractor shall maintain his designated parking areas.

### **1.5.2 Identification of Vehicles**

All Contractor's vehicles shall display approved permanent identification of such size and color to allow Government personnel to identify the vehicle.

## **1.6 PROJECT SECURITY AND WORKING HOURS**

### **1.6.1 General**

The project is open to the public during normal working hours. A procedure shall be prepared and submitted for approval for the identification and control of employees entering or leaving the project during the hours of closure. The security of the Contractor's property and items furnished under this contract are the Contractor's responsibility, until accepted, whether stored inside or outside the powerhouse.

### **1.6.2 Working Hours**

Arrangement and scheduling of working hours and crews shall be coordinated with the Government. The normal working hours of the project staff are 6:15 a.m. – 4:45 p.m., Monday through Thursday. Working hours which extend past 4:30 p.m. weekdays, on those Fridays which are off-days, on weekends, and Federal holidays or which are proposed to be different from that suggested above shall be coordinated and approved by the Contracting Officer 14 days in advance.

### **1.6.3 Site Work Schedule**

A site work schedule shall be prepared and submitted. The schedule shall include major and minor work elements and stages of the work. These documents shall be updated and submitted to reflect the actual work elements and progress and that anticipated in the future.

## **1.7 WORK BY THE GOVERNMENT CONCURRENT WITH CONTRACTOR WORK**

The Government will limit interference with the Contractor's work to a minimum.

## **1.8 EXISTING SANITATION FACILITIES**

Restroom facilities are available to the Contractor personnel at Elevation 611 only, near the reception room.

## **1.9 UTILITIES**

### **1.9.1 Government Furnished Utilities.**

All utilities that are required for use in performance of the work under this contract shall be Contractor-furnished except as noted below:

1.9.1.1 Water. All reasonable amounts of non-potable water will be made available from existing outlets. The Contractor will be responsible for freeze proofing all accessed water sources.

1.9.1.2 Electricity. Electric power may be obtained from existing sources located at various locations near the work areas:

- (a) 120-volt, 1-phase, 20-amperes (maximum) circuits
- (b) 480-volt, 3-phase, 50-amperes (maximum) circuits. The 480 volt service is a delta system.
- (c) The Contractor may provide his own temporary electrical power distribution panel and connect a power cable from a 480-volt outlet to this temporary panel.

1.9.1.3 Compressed Air. Up to 100 scfm of compressed air (nominal pressure of 100 psig) will be provided from existing outlets located throughout the powerhouse.

### **1.9.2 Temporary Utility Connections**

All utilities provided by the Government shall be at no cost. Care shall be exercised in conserving all utilities. The contractor shall provide all necessary hoses, cords, couplings, plugs, GFI's and other appurtenances as required to connect to the system(s). All temporary connections shall be subject to approval. All electric power required outside the powerhouse shall be Contractor-furnished. The location of all power lines and all temporary connections for electricity shall be subject to approval. All temporary circuits and devices shall be provided, connected, and maintained and removed prior to final acceptance. Ground fault protection shall be provided for all circuits used, inside and outside, and shall be Contractor-furnished. The temporary panel shall conform to current NEC standards in EM 385-1-1.

### **1.9.3 Telephone**

The project telephone system is not available to the Contractor.

### **1.10 SITE INVESTIGATIONS AND CONDITIONS AFFECTING THE WORK**

The Contractor shall take steps reasonably necessary to ascertain the nature and location of the work, and investigate the general and local conditions which can affect the work or its cost. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expenses to the Government. The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless the understanding or representation is expressly stated in this contract. Site conditions which should be investigated include, but are not limited to:

- (1) conditions bearing upon transportation, disposal, handling, and storage of materials
- (2) the availability of labor, water, electrical power, and roads
- (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site
- (4) the conformation and conditions of the ground and equipment and facilities to be replaced and/or rehabilitated
- (5) the character of equipment and facilities needed preliminary to and during work performance
- (6) amount of work space, accessibility, lighting, etc.

### **1.11 PERMITS AND RESPONSIBILITIES**

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence, and shall take proper safety and health precautions to protect the work, the workers, the public, and property of others. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

## **1.12 BARRICADES AND DANGER, DETOUR AND WARNING SIGNS**

### **1.12.1 Barricades, and Danger and Detour Signs**

The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient red lights, danger signals, and detour and other signs; provide a sufficient number of watchmen; and take all necessary precautions for the protection of the work and the safety of the public.

Roads or access ways closed to traffic shall be protected by effective barricades, and the obstruction shall be continuously illuminated day and night. Suitable warning signs shall be illuminated by lanterns or flares day and night.

### **1.12.2 Warning Signs**

Warning signs shall be erected 500 feet in advance of any place on the project where operations interfere with the use of a road by traffic. Warning signs shall conform to the standards established in Part IV of the "Manual on Uniform Traffic Control Devices for Streets and Highways," published by the U.S. Dept. of Transportation.

## **1.13 PROJECT REPORTING**

Monthly reports shall be prepared giving the project status and activities information. An updated CPM should be included in this report, if appropriate. This report shall include a written summary, accompanied with detailed information relating to current status of procurement, construction, and delivery activities, and an updated site work schedule.

## **1.14 WEEKLY MEETINGS**

Once each week a general meeting will be held between the Contractor and the Government. This meeting will be used to discuss progress in the last week and work planned in the upcoming week. A meeting time and place shall be mutually agreed upon.

## **1.15 SAFE CLEARANCE PROCEDURES**

Hazardous Energy Control (HEC) procedures are implemented for all the maintenance and construction activities on Corps property. These procedures are in accordance with OSHA regulation 29 CFR 1910.147, 1910.333, 1910.269 and USACE EM 385-1-31, The Control of Hazardous Energy (safe clearance). Any work performed at the Wolf Creek project will be performed under safe clearance. The Contractor shall request clearance on a piece of equipment or system before any work may begin. The Corps will establish the limits of the clearance, tag and lock the equipment or systems. The Contractor will be required to institute their own safe clearance procedures in accordance with OSHA and USACE regulations, within the perimeter or the Corps clearance. The Contractor's clearance shall not inhibit or interfere with the Corps operation of the plant. The clearances shall not be violated. Any violation of Hazardous Energy Control procedure (Safe Clearance Procedures) will be grounds for removal of the offender(s). Up to five copies of the Wolf Creek Powerplant Safe Clearance Procedure will be supplied to the Contractor upon request.

## **1.16 DRAWINGS AND MANUALS**

Existing drawings and manuals that may be of value for the work will be available for viewing at the powerplant during normal project day shift working hours. Drawings and manuals shall not be removed from the office. However, one (1) copy of available technical data and drawings not included in the reference drawings will be made at no cost to the Contractor within 7 normal working days after the request for such copies has been made. The drawings and manuals are furnished for information only and the Government does not guarantee the drawings or manuals will match actual field conditions. Reference drawing deviations shall not be the basis for a contract claim.

## **1.17 GENERATING UNIT AVAILABILITY AND ACCESS**

### **1.17.1 General**

The Government will arrange for the unit outages. An attempt will be made to make the unit available on the date the Contractor desires, and in accordance with the approved site schedule; however, power demands and emergency maintenance requirements may limit unit availability. Should this occur, the Contractor will be notified. The first day of availability shall not be a weekend day. The Contractor shall carefully plan all contract work logistics and shall secure Contracting Officer approval of all work procedures and schedules prior to requesting each generator unit outage. Only one outage per unit will be allowed.

### **1.17.2 Request for Unit Availability**

The Contractor shall notify the Government in writing of the time and date it would like the generator unit made available for generator rewind work. The Government will, within 10 calendar days after receipt of the notice, inform the Contractor in writing as to unit availability and verify the time and date of availability.

### **1.17.3 Readyng the Unit for Access**

1.17.3.1 Unit Unwatering. Contractor personnel shall not enter the unit until given assurance in writing by the Government that all Safe Clearance steps have been completed. The Government will arrange for unit outages as required, unwater the unit, and secure the unit for safe access. The unit's lubrication oil, grease systems, and governor oil system will remain functional. The wicket gates will be locked in the fully open position while the unit is open, unless otherwise requested in writing by the Contractor.

1.17.3.2 Unit Access and Scaffolding. The Contractor shall be provided access to the unit to disassemble the generator. Ladders and any required scaffolding will be furnished and installed by the Contractor. The Government will furnish one powerplant employee to assist the Contractor in its work where unit equipment operation is required.

#### **1.17.4 Notice of Generator Reassembly**

The Contractor shall provide written notice to the Government a minimum of 10 calendar days prior to generator reassembly.

#### **1.17.5 Access to Unit for Final Acceptance**

The Contractor and Government shall jointly assist each other in checking out the unit and its auxiliaries, and readying the generator for final acceptance tests. Contractor personnel shall fully comply with Safe Clearance procedures, clearances tagged on equipment, and requests from the Government to vacate areas or stop work temporarily during this period.

### **1.18 USE OF POWERHOUSE BRIDGE CRANE**

#### **1.18.1 General**

There is one 250 ton capacity bridge crane at the powerhouse. The powerhouse crane will be made available on an as needed basis for work under this contract. The Contractor will be held liable for all damages incurred as the result of the negligent operation or use of the crane.

#### **1.18.2 Availability and Scheduling**

The Contractor shall cooperate with the Government in the use of the crane for scheduled and emergency project maintenance. The Government will have priority use of the crane in emergency conditions, e.g., for needed use that could not be foreseen or scheduled. The bridge crane at the project will be made available for the Contractor's use, but must be shared with the Corps project forces and possibly other contractors as directed. Allocation of crane time between the primary Contractor and other contractors will be made by the Government, and the decision will be final in any dispute arising relative thereto. Crane usage scheduling shall be discussed at the weekly Contractor/Government site meeting.

#### **1.18.3 Crane Maintenance**

The Government will perform all maintenance on the crane. The Government has the right to board the crane at any time for inspection and observation of crane operation.

#### **1.18.4 Operators and Riggers**

1.18.5.1 General. The Contractor shall provide crane operator(s) and rigger(s) to operate the crane through the duration of the on-site work. At the option of the Contractor, minor crane services, including operator(s) may be provided to the Government to reduce impacts to the Contractor's work caused when operation of the crane by the Government is needed.

1.18.4.2 Contractor Crane Operator. Qualified Contractor bridge crane operators shall be furnished for the operations. In addition to meeting the requirements of EM 385-1-1, each crane operator shall have had at least 1-year's experience on a bridge crane with similar characteristics

and equal or greater capacity. Qualifications, for each operator in the form of an affidavit signed by the operator and the Contractor shall be submitted. The affidavit shall include a complete record of all related work with particular emphasis on experience directly related to operation of a counterpart crane handling comparable loads. Before any operator is approved they shall spend at least 1 hour being checked out on the crane under the direct surveillance of the Government. The operator may be retested at any time. The crane operators shall have current (within the previous 12 months) medical examinations with emphasis on hearing, eyesight, and cardiovascular conditions. The medical exams shall be submitted with the affidavit.

1.18.4.3 Contractor Riggers. Qualified riggers shall be furnished for lifting and in attaching such loads to the crane. An affidavit stating the riggers qualifications shall be submitted. The affidavit shall include a complete record of all related experience and be signed by the rigger and the Contractor. Riggers shall be checked for knowledge of hand signals by the Government. Hand-held portable radios may be used where operators can not see the signalman, but only on non-Government frequencies.

### **1.18.5 Lifting Devices**

Any special lifting device (such as but not limited to slings, shackles beams, and appurtenances) required for the work shall be provided by the Contractor and shall be turned over to the Government upon completion of the contract. All lifting devices shall be provided new. Slings shall be used for direct inline pulls or loading, and not used for wrapping around a load and lifting that load. The availability of lifting devices furnished by the Government for the Contractor use must be coordinated with the Project Manager prior to use.

## **1.19 PLANT AND EQUIPMENT LIST**

A complete list of all plant and equipment, exclusive of shop equipment, to be used on the project shall be furnished. An up-to-date plant and equipment list shall be submitted with the end-of-the-month request for payment, throughout the life of the contract. The lists shall include rented equipment as well as lease-purchase or sale-leaseback equipment. The initial list and the revised monthly lists shall indicate dates equipment is assigned to, or removed from, the project, dates deadlined for repairs and returned for use, 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.

## **1.20 CONTRACTOR'S EQUIPMENT AND MATERIAL**

### **1.20.1 General**

The planned method of transportation and operation of cranes and other heavy equipment to be used in the performance of this contract shall be submitted. This shall include the type, size, and loadings of equipment and the proposed transportation routes and work areas to be used on the project. Operation of heavy equipment adjacent to existing structures shall be avoided when possible.

### **1.20.2 Movement of Equipment and Materials by the Contractor**

The Contractor shall provide all cranes, rigging, lifts, operators, and other necessary means to move equipment or material as required to pursue and complete the work whether owned by the Government or by the Contractor unless otherwise specifically mentioned. This includes but is not limited to the unloading and loading of equipment and material.

### **1.20.3 Area Lighting**

The Contractor shall provide all lighting necessary to perform his work and to provide a safe work environment.

## **1.21 GOVERNMENT FURNISHED TOOLS AND EQUIPMENT**

Government tools and equipment at the project, i.e., lathes, drill presses, hand tools, etc., are not available for use.

## **1.22 STORAGE OF EQUIPMENT AND MATERIALS**

Indoor and outdoor storage of equipment and materials will be permitted only in designated staging areas. All equipment and materials proposed for temporary storage within the Government allocated staging areas shall be approved. A minimum access space of three feet shall be maintained between the Contractor's stored items and the existing powerhouse equipment.

## **1.23 DAMAGED EQUIPMENT OR ABNORMAL CONDITIONS**

The Government shall be informed immediately upon finding any damaged equipment or other abnormal conditions involving additional work in which the Contractor believes it has no responsibility. The failure or abnormality shall not be disturbed until witnessed. Any damage or abnormal conditions not reported as specified above but discovered at a later date shall be corrected at the Contractor's expense.

## **1.24 PROTECTION OF MATERIAL AND WORK**

All materials, supplies, tools, equipment, and Government property (including all tools, equipment, and special devices supplied by the Contractor and to be turned over to the Government at the end of the Contract) shall at all times be protected and preserved in an approved manner, and in accordance with manufactures recommendations. If material, equipment, supplies, and work performed are not adequately protected, such property may be protected by the Government and the cost thereof will be charged to the Contractor or deducted from any payment due. Protection of the powerhouse floors and walls shall be provided and maintained by the Contractor. The Contractor shall be responsible for the satisfactory removal of all stains and residues, and the satisfactory repair of damage to structures and equipment.

Operating components of existing powerhouse equipment shall be protected by suitable methods as approved.

### **1.25 CONTRACTOR'S MISCELLANEOUS BUILDINGS**

The building of structures, or of the erection of tents or other forms of protection, will be permitted only at such places as approved, and the sanitary conditions of the grounds in or about such structures shall at all times be maintained in a satisfactory manner. Temporary facilities provided during Construction shall be removed upon satisfactory completion of the last operational test. The area shall be left looking "broom clean".

### **1.26 TEMPORARY FACILITIES**

Temporary facilities provided during Construction shall be removed prior to final payment.

### **1.27 DISPOSAL OF ELECTRICAL AND MECHANICAL EQUIPMENT AND MISCELLANEOUS MATERIALS**

Title to all materials and equipment to be disposed of, excepting salvage items and hazardous waste, is vested in the Contractor upon receipt of signed contract and such materials and equipment are designated scrap only as directed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed. The Contractor may retain these items in usable form and take possession of them providing that there is no subsequent cost or inconvenience to the Government. The Government does not guarantee that these items are complete or in working order, and the Contractor shall assume responsibility for any damages caused by their use immediately upon taking possession of them. Scrap materials shall be removed from the Government's property within 14 days of removal from the crane. Scrap shall not be sold on the site. Disposal of hazardous wastes shall be in accordance with SECTION 02081.

### **1.28 PROTECTION AND RESTORATION OF EXISTING FACILITIES**

The Contractor shall provide all necessary enclosures and equipment to protect the existing equipment from any adverse environmental conditions (such as dust, dirt, and ambient conditions which may cause condensation on the unit components). The Contractor shall submit the method of protection for approval prior to installation of any enclosures or equipment. All existing facilities shall be protected whether or not shown on the drawings. Upon completion of the work, all the existing facilities, not included as a portion of the work, shall be left in a condition equal to the original condition prior to the contract. Costs for repair and restoration of any facilities shall be considered to be incidental to and included in the contract price.

### **1.29 SCAFFOLDING**

Any scaffolding, ladder, stairway, or other access schemes proposed to be used shall be submitted for approval, including type, layout, and connections. Approved antislip surface

material shall be installed on scaffolding platforms. Scaffolding shall comply in every respect with EM 385-1-1.

### **1.30 DAILY CLEANUP AND DISPOSAL**

In conjunction with SECTIONS 01350, and 02081, work areas shall be kept reasonably neat on a daily basis. All debris resulting from the work, such as waste metalwork, packing cases, scrap lumber, oil and grease spills, and other debris shall be collected, removed, and disposed of off-site at least once per week. The location of the Contractor's off-site disposal area and a plan for safe disposal of material shall be submitted for approval. The Government's trash cans, dumpboxes, and other containers shall not be used. Liquid waste shall not be disposed of in powerhouse drains. All costs of removing debris shall be incidental to the work, and no separate payment will be made therefore.

### **1.31 DUST AND FUME CONTROL IN THE POWERHOUSE**

#### **1.31.1 General**

Depending upon the Contractor's plant and equipment and methods of operation, additional provisions for satisfactory dust control will be required and shall be included in the proposed dust control program. Decisions of the Government as to the adequacy and extent of the dust control program and prosecution of the work shall be final. The dust control in the powerhouse shall be considered as incidental to the work and no separate payment will be made therefore.

#### **1.31.2 Dust Control Program**

All necessary measures shall be taken to effect maximum control of all dust and welding fumes created by operations under this contract. To the maximum extent possible, all dust and dirt shall be removed by vacuum cleaning, unless otherwise approved. Prior to commencement of such operations, the proposed dust control program shall be submitted. Part of the required dust control program shall include the following:

- (1) Provision of exhaust ducts which shall discharge outside the powerhouse structure where mechanical ventilation is used.
- (2) Controlled operation of power-driven tools.
- (3) Furnishing and removing of oiled sawdust or other approved dust preventatives in areas which cannot be properly rendered free from excessive dusting by vacuum cleaning or other methods.
- (4) Vacuum cleaning (or other acceptable method) of spaces within the powerhouse where dust accumulates.
- (5) Gasoline or diesel-engine equipment may not be used inside the powerhouse. Air, electrical, propane, or battery-driven equipment may be used inside the powerhouse.

- (6) The powerhouse is pressurized to prevent dust infiltration from the outside. All doors will be kept closed when not being used.

### **1.32 COOPERATION WITH OTHERS**

The Government will perform maintenance work and will make every effort to have the area clear. The Contractor shall cooperate with other Contractors and the Government in using the area.

### **1.33 CARE OF DRAINS**

Existing powerhouse drains shall not be used for disposal of any solid material or any liquids other than clear water. Drains obstructed by the Contractor shall be cleaned by the Contractor. All costs incurred in the cleaning and clearing of plugged drains, shall be borne by the Contractor.

### **1.34 NOISE CONTROL**

Noise control and noise levels shall conform to requirements set forth in the appropriate regulations, including EM 385-1-1, Section 05.C, 29 CFR 1910.95, 29 CFR 1926.52 and 29 CFR 1926.101. The most stringent requirement shall govern.

### **1.35 FIRE CONTROL**

All fire fighting equipment, supplies, and personnel shall be supplied in accordance with EM-385-1-1. Delays due to fire will not be acceptable as the basis of a claim for additional compensation.

### **1.36 QUALITY CONTROL AT THE JOB SITE/POWERHOUSE**

The Contractor shall maintain an effective quality control system in accordance with SECTION 01451. The Contractor's system shall encompass all actions involving selection of construction material sources and suppliers, on-site and off-site fabrication of Contractor-furnished items to be included in the work, on-site and off-site production of construction materials, work placement procedures, workmanship, inspection, and testing. The system shall provide the necessary supervision, inspection, and tests of all items of work, including that of its suppliers and subcontractors, that will assure the compliance of all work with applicable specifications and drawings in respect to the Contractor furnished equipment, materials, workmanship, construction, finish, functional performance, and identification. The Contractor's system shall encompass all management and supervisory actions taken by its staff that affect quality of the finished construction work, including all inspection controls and tests required for compliance with the contract, except for those inspections and tests specifically reserved to be accomplished by the Government.

## **1.37 DRAWINGS AND MANUALS**

Existing drawings and manuals required for the work will be available for viewing upon request during normal project day shift working hours. Drawings and manuals shall not be removed from the office; however two copies of available technical data and drawings not included in the reference drawings will be made at no cost to the Contractor within five calendar days, excluding weekends, after the request for such copies has been made.

## **1.38 CONTRACTOR'S AGENT, WORK SUPERVISOR, AND PERSONNEL**

### **1.38.1 Contractor's Agent(s)**

The Contractor shall give personal attention to the faithful execution and completion of this work and shall be present either in person or by duly authorized representative(s) on the site of the work continually during its progress. The agent shall be fluent in the spoken and written English language. The agent's qualifications and identification shall be provided. The agent shall be fully authorized to act for the Contractor and to receive such orders as may be given for the proper continuance of the work. Written notice to do any work, to alter any work, or to cease work which the Contractor is obligated to do, or concerning any imperfections in work or any material furnished, when given to the agent shall be considered as notice to the Contractor. A daily log shall be made of the accomplished work, and shall be submitted at the completion of the contract. The agent shall have been engaged in similar work at a minimum of two different powerhouses. A verifying contact, with name and phone number, shall be provided for at least two such facilities.

### **1.38.2 Generator Rewind Work Supervisor(s)**

At least one full-time employee of the generator rewind Contractor shall be available at the work site anytime other rewind Contractor personnel are working on the site to supervise and direct the work specified herein. The Contractor's Agent and Generator Rewind Work Supervisor can be the same person, provided that all qualifications are met. The supervisor(s) shall be fluent in the spoken and written English language. The supervisor shall be technically qualified to supervise the unit disassembly; stator rewind; unit reassembly; commissioning and all other aspects related to completing this work. The supervisor shall report immediately in writing to the Government any work not in accordance with the manufacturer's recommendations, or any special conditions which may result in an unsatisfactory job. A daily log shall be made of the accomplished work, and shall be submitted at the completion of the contract.

The supervisor shall have been engaged in similar work at a minimum of two different powerhouses. A verifying contact, with name and phone number, shall be provided for at least two such facilities.

### **1.38.3 Contractor's General Personnel**

1.38.3.1 General. The Contractor shall prepare and keep updated, as a minimum weekly, a project organization chart reflecting at least those positions described herein and defining their

work relationships, etc. All personnel employed by the Contractor shall be fully qualified in their respective fields to render the services necessary.

1.38.3.2 Identification of Contractor's Employees. The Contractor shall be responsible for furnishing to each employee at the powerhouse and for requiring each employee at the powerhouse to display such identification as approved and specified below. All Contractor personnel, prior to engaging in work on project premises, shall either be issued an identification card by the Contractors or agree to provide their driver's license as identification upon request. If the Contractor so decides to furnish identification cards to all employees, the card must include the following information:

- Name of Contractor
- Name of Employee
- Birth date
- Weight
- Hair color
- Eye color
- Recent photo

All prescribed identifications shall be returned immediately to the Contractor upon release of any employee. The Contractor shall supply a complete listing of all personnel and their titles who will be working on the project. This listing shall be revised at a minimum of once weekly and revisions provided. When required, the Contractor shall obtain and submit fingerprints of all persons employed by it or to be employed at the powerhouse.

#### **1.38.4 Non English Speaking Personnel**

Pursuant to the requirements of EM 385-1-1, Para. 01.A.04 and 01.A.05, the Contractor will provide a bilingual foreman that is fluent in the language of the workers, for each work group that has employees that do not speak English. The Contractor will implement the requirements of EM 385-1-1, Para. 01.B.01, and 01.B.03 through these foremen.

#### **1.39 PAYMENT**

Separate or direct payment will not be made for compliance with this section. All costs thereof are incidental to and included in the contract price and payment for the various items listed in the bid schedule.

#### **PART 2 PRODUCTS (Not Used)**

#### **PART 3 EXECUTION (Not Used)**

**END OF SECTION 01010**

**SECTION 01270**  
**MEASUREMENT AND PAYMENT**

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## **SECTION 01270**

### **MEASUREMENT AND PAYMENT**

#### **PART 1 GENERAL**

##### **1.1 GENERAL INFORMATION**

In each instance, the contract price for an item will constitute full compensation as herein specified, as shown, or as otherwise approved. The contract price and payment will also constitute full compensation for all work incidental to completion of the item, unless such work is otherwise specifically mentioned for separate payment under another bid item. In the event any work is required by the specification sections or by the drawings and not specifically mentioned in the measurement and payment paragraphs, separate or direct payment will not be made, and all costs thereof are incidental to, and included in, the contract prices and payment for all items listed in the bid schedule.

##### **1.2 MEASUREMENT**

Items measured as a job will be measured for payment as a complete job in the locations indicated. This measurement includes all incidental work and materials such as fittings, fasteners, electrical materials, and O&M manuals that are necessary to make a complete job. Unless the payment item paragraph makes a specific exception of any item, incidental items will not be measured under any other item even though there is another listing for the work or material.

##### **1.3 PAYMENT**

Payment for all work specified, shown or incidental to complete the work will be made as follows:

###### **1.3.1 Base Items**

###### **1.3.1.1 Mobilization and Preparatory Work**

Site mobilization and preparatory work will be paid for under the contract lump sum price for "Mobilization and Preparatory Work." Payment will be made as described in contract clause 252.236-7003 PAYMENT FOR MOBILIZATION AND PREPARATORY WORK.

###### **1.3.1.2 Generator Unit 4 Disassembly and Reassembly**

Disassembly and reassembly of generator unit 4, as described in SECTION 15991, will be paid for under the contract lump sum price for "Disassemble and Reassemble Generator Unit 4."

### **1.3.1.3 Parts and Materials Unit 4**

The Contractor will be reimbursed for the actual cost of these items, as described in SECTION 15991, plus 15 percent under the contract lump sum price for “Parts and Materials Generator Unit 4.” Invoices and signed purchase orders for parts and materials, including shipping charges, shall be prepared and submitted for payment. The total cost of items covered shall not exceed the amount shown on the Bid Schedule.

### **1.3.1.4 Stator Winding and Supplies, Unit 4**

Furnishing the stator winding and supplies for Unit 4 will be paid for under the contract lump sum price for “Complete Set of Stator Coils Including All Supplies, Accessories, and Testing, Unit 4.” This work shall include the furnishing of a complete set of stator coils, including all supplies and accessories to make up a complete new winding, including factory testing as specified in SECTION 16210.

### **1.3.1.5 Prototype Stator Coils**

Furnishing and testing the prototype coils will be paid for under the contract lump sum price for “Prototype Stator Coils.” This work shall include furnishing and testing prototype stator coils, identical to coils to be supplied, and having them tested by an independent testing laboratory as specified in SECTION 16210

### **1.3.1.6 Spare Parts, Unit 4**

Furnishing the spare parts for unit 4 will be paid for under the contract lump sum price for “Furnish Spare Parts, Unit 4.” Payment shall include the furnishing of all spare parts as specified in SECTION 16210.

### **1.3.1.7 Furnish Stator Core Materials and Accessories, Unit 4**

Furnishing the stator core materials and accessories for Unit 4 will be paid for under the contract lump sum price for “Stator Core Materials and Accessories, Unit 4” Payment shall include the furnishing of all stator core materials and accessories, for Unit 4, as specified in SECTION 16210.

### **1.3.1.8 Removal of Stator Winding and Stator Core, Unit 4**

Removal of the stator winding and stator coil for Unit 4 will be paid for under the contract lump sum price for “Remove Stator Winding and Stator Core, Unit 4.” Payment shall include the removal of the stator winding and stator core for Unit 4 as specified in SECTION 16210.

### **1.3.1.9 Install Stator Core, Unit 4**

Installing the stator core for Unit 4 will be paid for under the contract lump sum price for “Install Stator Core, Unit 4.” Payment shall include the installation of the stator core at Unit 4 as specified in SECTION 16210.

### **1.3.1.10 Inspect, Clean and Test Rotor, Unit 4**

Inspecting , cleaning, and testing the rotor for Unit 4 will be paid for under the contract lump sum price for “Inspect, Clean, and Test Rotor, Unit 4.” Payment shall include performing rotor inspection, cleaning and testing for Unit 4 as specified in SECTION 16210.

### **1.3.1.11 Install and Test Stator Winding, Unit 4**

Installing and testing the stator winding for Unit 4 will be paid for under the contract lump sum price for “Install and Test Stator Winding, Unit 4.” Payment shall include the installation and testing of the new stator winding, together with all accessories for Unit 4, as specified in SECTION 16210.

### **1.3.1.12 Perform Special Field Tests, Unit 4**

Performing the special field tests for Unit 4 will be paid for under the contract lump sum price for “Perform Special Field Tests, Unit 4.” Payment shall include performing all special field testing as specified in SECTION 16210.

## **1.3.2 Option Items**

### **1.3.2.1 Generator Unit 6 Disassembly and Reassembly**

Disassembly and reassembly of generator unit 6, as described in SECTION 15991, will be paid for under the contract lump sum price for “Disassemble and Reassemble Generator Unit 6.”

### **1.3.2.2 Parts and Materials Unit 6**

The Contractor will be reimbursed for the actual cost of these items, as described in SECTION 15991, plus 15 percent under the contract lump sum price for “Parts and Materials Generator Unit 6.” Invoices and signed purchase orders for parts and materials, including shipping charges, shall be prepared and submitted for payment. The total cost of items covered shall not exceed the amount shown on the Bid Schedule.

### **1.3.2.3 Stator Winding and Supplies, Unit 6**

Furnishing the stator winding and supplies for Unit 6 will be paid for under the contract lump sum price for “Complete Set of Stator Coils Including All Supplies, Accessories, and Testing, Unit 6.” This work shall include the furnishing of a complete set of stator coils, including all supplies and accessories to make up a complete new winding, including factory testing as specified in SECTION 16210.

#### **1.3.2.4 Spare Parts, Unit 6**

Furnishing the spare parts for unit 6 will be paid for under the contract lump sum price for “Furnish Spare Parts, Unit 6.” Payment shall include the furnishing of all spare parts as specified in SECTION 16210.

#### **1.3.2.5 Furnish Stator Core Materials and Accessories, Unit 6**

Furnishing the stator core materials and accessories for Unit 6 will be paid for under the contract lump sum price for “Stator Core Materials and Accessories, Unit 6” Payment shall include the furnishing of all stator core materials and accessories, for Unit 6, as specified in SECTION 16210.

#### **1.3.2.6 Removal of Stator Winding and Stator Core, Unit 6**

Removal of the stator winding and stator coil for Unit 6 will be paid for under the contract lump sum price for “Remove Stator Winding and Stator Core, Unit 6.” Payment shall include the removal of the stator winding and stator core for Unit 6 as specified in SECTION 16210.

#### **1.3.2.7 Install Stator Core, Unit 6**

Installing the stator core for Unit 6 will be paid for under the contract lump sum price for “Install Stator Core, Unit 6.” Payment shall include the installation of the stator core at Unit 6 as specified in SECTION 16210.

#### **1.3.2.8 Inspect, Clean and Test Rotor, Unit 6**

Inspecting , cleaning, and testing the rotor for Unit 6 will be paid for under the contract lump sum price for “Inspect, Clean, and Test Rotor, Unit 6.” Payment shall include performing rotor inspection, cleaning and testing for Unit 6 as specified in SECTION 16210.

#### **1.3.2.9 Install and Test Stator Winding, Unit 6**

Installing and testing the stator winding for Unit 6 will be paid for under the contract lump sum price for “Install and Test Stator Winding, Unit 6.” Payment shall include the installation and testing of the new stator winding, together with all accessories for Unit 6, as specified in SECTION 16210.

#### **1.3.2.10 Perform Special Field Tests, Unit 6**

Performing the special field tests for Unit 6 will be paid for under the contract lump sum price for “Perform Special Field Tests, Unit 6.” Payment shall include performing all special field testing as specified in SECTION 16210.

**PART 2 PRODUCTS (Not Used)**

**PART 3 EXECUTION (Not Used)**

**END OF SECTION 01270**

**SECTION 01312**  
**QUALITY CONTROL SYSTEM (QCS)**

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## SECTION 01312

### QUALITY CONTROL SYSTEM (QCS)

#### PART 1 GENERAL

##### 1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

##### 1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

##### 1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Contract Section, "SUBMITTAL PROCEDURES", and Contract Section, "CONTRACTOR QUALITY CONTROL", which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

##### 1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor

shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on 3-1/2 inch high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

### **1.3 SYSTEM REQUIREMENTS**

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

#### **1.3.1 Hardware**

IBM-compatible PC with 500 MHz Pentium or higher processor

128+ MB RAM for workstation / 256+ MB RAM for server

1 GB hard drive disk space for sole use by the QCS system

3 1/2 inch high-density floppy drive

Compact disk (CD) Reader, 8x speed or higher

SVGA or higher resolution monitor (1024 x 768, 256 colors)

Mouse or other pointing device

Windows compatible printer (Laser printer must have 4+ MB of RAM)

Connection to the Internet, minimum 56k modem

#### **1.3.2 Software**

MS Windows 98, ME, NT, or 2000

Word Processing software compatible with MS Word 97 or newer

Latest version of : Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher

Electronic mail (E-mail), MAPI compatible

Virus protection software that is regularly upgraded with all issued manufacturer's updates

## **1.4 RELATED INFORMATION**

### **1.4.1 QCS User Guide**

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

### **1.4.2 Contractor Quality Control (CQC) Training**

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

## **1.5 CONTRACT DATABASE**

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

## **1.6 DATABASE MAINTENANCE**

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

### **1.6.1 Administration**

#### **1.6.1.1 Contractor Information**

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

#### **1.6.1.2 Subcontractor Information**

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code,

provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

### **1.6.1.3 Correspondence**

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

### **1.6.1.4 Equipment**

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

### **1.6.1.5 Management Reporting**

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

## **1.6.2 Finances**

### **1.6.2.1 Pay Activity Data**

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

### **1.6.2.2 Payment Requests**

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

### **1.6.3 Quality Control (QC)**

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in the contract section titled CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

#### **1.6.3.1 Daily Contractor Quality Control (CQC) Reports.**

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by the contract section titled CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

#### **1.6.3.2 Deficiency Tracking**

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

#### **1.6.3.3 Three-Phase Control Meetings**

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

#### **1.6.3.4 Accident/Safety Tracking**

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any

accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

#### **1.6.3.5 Features of Work**

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

#### **1.6.3.6 QC Requirements**

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

#### **1.6.4 Submittal Management**

The Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

#### **1.6.5 Schedule**

The Contractor shall develop a construction schedule consisting of pay activities in accordance with Contract Clause "Schedules for Construction Contracts". This schedule shall be input and maintained in the QCS database. The updated schedule data shall be included with each pay request submitted by the Contractor.

#### **1.6.6 Import/Export of Data**

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data.

### **1.7 IMPLEMENTATION**

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

## **1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM**

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

### **1.8.1 File Medium**

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

### **1.8.2 Disk or CD-ROM Labels**

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

### **1.8.3 File Names**

The Government will provide the file names to be used by the Contractor with the QCS software.

## **1.9 MONTHLY COORDINATION MEETING**

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

## **1.10 NOTIFICATION OF NONCOMPLIANCE**

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

**PART 2      PRODUCTS (Not Applicable)**

**PART 3      EXECUTION (Not Applicable)**

**END OF SECTION 01312**

## SECTION 01330

### SUBMITTAL PROCEDURES

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### ATTACHED FORMS

|               |   |         |
|---------------|---|---------|
| ENG Form 4025 | Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance (Submittal Form) | 2 pages |
| ENG Form 4288 | Submittal Register  | 6 pages |

## SECTION 01330

### SUBMITTAL PROCEDURES

#### PART 1 GENERAL

##### 1.1 SUBMITTAL DESCRIPTIONS

The submittals described below are those required and are further described in other sections of the specifications. Submittals required by the CONTRACT CLAUSES and other nontechnical parts of the contract are not included in this section.

**SD-01 Data.** Submittals which provide calculations, descriptions, or documentation regarding the work.

**SD-04 Drawings.** Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work. All drawings shall be submitted in both paper and electronic formats.

**SD-06 Instructions.** Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedance's, hazards, and safety precautions. Operation and maintenance manuals are considered deliverables under the contract and not submittals; however, when necessary to review information to be included in the final manuals such information to be included in the final manuals should be called for under this submittal description.

**SD-07 Schedules.** Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

**SD-08 Statements.** A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

**SD-09 Reports.** Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

**SD-13 Certificates.** Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

**SD-14 Samples.** Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

**SD-18 Records.** Documentation to record compliance with technical or administrative requirements.

**SD-19 Operation and Maintenance Manuals.** Data which forms a part of an operation and maintenance manual.

## 1.2 REFERENCES

Refer to the Transmittal Form (ENG Form 4025, Attachment 3 located at back of specifications package) or the Submittal Register (ENG Form 4288, Attachment 2) for further information on terms discussed in this section.

## 1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

(1) Government-Approved.

(a) Extension of design which require Government approval such as Contractor's, manufacturer's, or fabricator's drawings; descriptive literature included but not limited to catalog cuts, diagrams; operating charts or curves; critical materials; test cylinders; samples; warranties; deviations; equipment whose compatibility with the entire system must be checked will be listed on the ENG Form 4288. Within the terms of SECTION 00700, Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, these submittals are also considered to be "shop drawings."

(b) Other items (such as environmental plans, safety plans, Contractor Quality Control (CQC) plans, etc.) designated in the requirements in the technical sections be "submitted for approval" which do not fall under the definitions in paragraph 1.3(1)(a) will not be listed on ENG Form 4288, but will be transmitted as instructed.

(2) Information Only. Any submittals on ENG Form 4288 not requiring Government approval (such as certifications and test results, etc.) will be submitted for "information only." See paragraph 3.8 for further information on certificates and test reports. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to at the end of paragraph 1.3(1)(a).

## 1.4 APPROVED SUBMITTALS

All submittals for Government approval shall be Contractor-approved first and stamped as shown in paragraph 3.7. The approval of submittals by the Government shall not be construed as

a complete check, but will indicate only that the general method of construction, materials, detailing, and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the CQC requirements of this contract is responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work. After submittals have been Government-approved no resubmittal for the purpose of substituting materials or equipment will be given consideration unless accompanied by an explanation as to why a substitution is necessary.

## **1.5 DISAPPROVED SUBMITTALS**

The Contractor shall make all corrections required and promptly furnish a corrected submittal in the form and number of copies as specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, notice as required under SECTION 00700, Clause CHANGES, shall be given promptly to the Government.

## **1.6 WITHHOLDING OF PAYMENTS**

Payments for materials incorporated in the work will not be made if required approvals have not been obtained.

## **PART 2 PRODUCTS (Not Applicable)**

## **PART 3 EXECUTION**

### **3.1 ENG FORMS 4288 AND 4025 (Attached)**

#### **3.1.1 General**

All items listed on ENG Form 4288 (Attachment 2) shall be submitted using ENG Form 4025 (Attachment 3). The Government may request submittals in addition to those listed or specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control Representative (CQCR), and each respective transmittal item shall be stamped, signed, and dated by the CQCR, as shown in paragraph 3.7, certifying that the accompanying submittal complies with the contract requirements. Proposed deviations from the contract requirements shall be clearly identified as stated in paragraph 3.3.2. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby.

### **3.1.2 Submittal Register (ENG Form 4288)**

See Attachment 2 for one set of ENG Form 4288 listing both "Government-Approved" and "information only" items. Columns "c" through "o" have been completed by the Government. The Contractor shall complete columns "a," "b," and "p" through "u" and return two completed copies for approval within 30 calendar days after Notice to Proceed. The approved submittal register will become the scheduling document and will be used to control submittals to the items described in paragraph 1.3(1)(a) throughout the life of the contract. The list is not all inclusive and additional submittals may be required by other parts of the contract. This register and the progress schedules shall be coordinated.

### **3.1.3 Transmittal Form (ENG Form 4025)**

See Attachment 3 for ENG Form 4025 to be used for submitting both "Government approved" and "information only" submittals listed on ENG Form 4288. These forms will be furnished to the Contractor. Each submission of drawings by the Contractor must be accompanied by Transmittal Form 4025 containing a list of drawings giving titles and numbers. Transmittals containing one of the black and white copies of drawings and a copy of the Transmittal Form 4025 shall be addressed to "District Engineer, U.S. Army Corps of Engineers, Nashville District". Two black and white copies of drawings and a copy of the Transmittal Form 4025 shall be sent to "U.S. Army Corps of Engineers, Nashville District". Action on these drawings will be in accordance with the instructions on the reverse side of ENG Form 4025. See paragraph 3.5 for Government approval of submittals.

## **3.2 SCHEDULING**

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications in accordance with paragraph 3.8, to be submitted with the pertinent drawings shall be so scheduled.

## **3.3 SUBMITTAL PROCEDURE**

### **3.3.1 "Shop Drawing" Procedures**

(See paragraph 1.3(1)(a) for definition of "shop drawing.")

3.3.1.1 General. The procedure for "shop drawings" shall be as follows:

(1) "Shop Drawings" Approved by Contractor. All "shop drawings" submittals shall be reviewed and corrected to make them complete and in accordance with the contract. Approval shall be indicated on each drawing by an "Approved" stamp as shown in paragraph 3.7. Names and titles of individuals authorized by the Contractor to approve drawings shall be provided prior to any submission. All shop drawings shall be submitted as indicated herein. Submittals which are not required to be approved by the Government ("information only") will be monitored and

spot-checks will be made. When such checks indicate noncompliance, the Contractor will be notified by the same method used for Government approvals.

(2) "Shop Drawings" Approved by the Government. Before submission the Contractor shall review and approve all "shop drawings" prepared by subcontractors, suppliers, and the Contractor for completeness and compliance with plans and specifications, and shall so certify by stamp on each drawing or item of printed material. (Red markings are reserved for the Government.) Suppliers or subcontractors certifications are not acceptable as meeting this requirement. Submittals will be reviewed and processed as follows (the following action codes are to further define only the referenced codes on the reverse side of ENG Form 4025):

(a) Action Code A (Approved as Submitted). Shop drawings which can be approved without correction will be stamped "Approved" and one print or copy of catalog and other printed data, will be returned to the Contractor.

(b) Action Code B (Approved, Except as Noted, Resubmission Not Required). Shop drawings which have only minor discrepancies will be corrected and stamped "Approved as Corrected" or "Except as Noted." Corrections will be identified and one print or one copy of catalog or other printed data will be returned to the Contractor.

(c) Action Code C (Approved, Except as Noted, Resubmission Required). Shop drawings which are incomplete or require more than minor corrections will be marked in red to indicate necessary corrections. One print or one copy of catalog and other printed data will be returned to the Contractor stamped "Approved Except as Noted".

(d) Action Code E (Disapproved). One print of shop drawings which are fundamentally in error, cover wrong equipment or construction, or require extensive corrections will be returned to the Contractor stamped "Disapproved." An explanation will be furnished on the print or on ENG Form 4025 indicating reason for disapproval.

(3) Resubmittal. Resubmittal will not be required for drawings with Action Code A or B unless subsequent changes are made by the Contractor or by a contract modification. For drawings with Action Code C or E, corrections required shall be made, any changes shall be noted by dating the revisions to correspond with the change request date, and the drawings shall be promptly resubmitted for review. Government costs incurred after the first resubmittal will be charged to the Contractor.

### 3.3.1.2 "Shop Drawings" Submittal

3.3.1.2.1 General. ENG Form 4025 shall be in two copies used for transmitting "shop drawings" submittals. Five prints shall be submitted for each drawing submitted. CD-ROMs containing the electronic drawing files shall be submitted with each submittal. Four copies of all shop drawings will be retained by the Contracting Officer, and one copy will be returned to the Contractor. The CD-ROMs will be retained by the Contracting Officer.

#### 3.3.1.2.2 Drawings.

Each drawing shall be 28 inches high by 40 inches wide, with a title block in the lower right-hand corner and a 3- by 4-inch clear area adjacent. The title block shall contain the subcontractor's or fabricator's name, contract number, description of item(s), bid item number, and a revision block. A blank margin of  $\frac{3}{4}$  inch at bottom, 2 inches at left, and  $\frac{1}{2}$  inch at top and right shall be provided. Where drawings are submitted for assemblies of more than one piece of equipment or systems of components dependent on each other for compatible characteristics, complete information shall be submitted on all such related components at the same time. The information shall be complete and the sequence of drawing submittal shall be such that all information is available for reviewing each drawing. Drawings for all items and equipment, of special manufacture or fabrication, shall consist of complete assembly and detail drawings. All revisions after initial submittal shall be shown by number, date, and subject in revision block. Any drawing or electronic drawing file submitted that is not of satisfactory quality will be returned without action.

#### 3.3.1.3 Computer Aided Design/Drawing Drawings

(1) Approved CADD Drawings. The Nashville District CADD system utilizes Microsoft Windows-based PC's running MicroStation PC software. "Approved" CADD drawing files are those that utilize file formats that are fully compatible with this CADD system. This system includes MicroStation vector DGN files and/or raster files.

(2) CADD Drawing Standards. Electronic drawing files shall contain no information outside the borders. All drawing files shall be 3D. Each drawing file shall be set up with two views showing when entering the file. View 1 will contain a full view of the drawing and view 2 will contain the title block with adequate size so all title block information is legible. All drawing files will be submitted on CD ROMs.

### **3.3.2 Deviations**

For submittals which include proposed deviations requested, the column "variation" of ENG Form 4025 shall be checked. The reason for any deviations shall be set forth in writing and such deviations annotated on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

### **3.3.3 Other Submittals**

All requirements for "shop drawings" under paragraphs 3.3.1.1 and 3.3.1.2 shall apply to catalog cuts, illustrations, printed specifications, or other data submitted except that five copies for Government approval and three copies for information only shall be submitted. Submittals shall be made on 8 1/2- by 11-inch paper. Inapplicable portions shall be marked out and applicable items such as model numbers, sizes, and accessories shall be indicated. Decisions on these other submittals will be given in accordance with paragraph 3.5.

### **3.4 CONTROL OF SUBMITTALS**

The Contractor's procurement operations shall be carefully controlled to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved ENG Form 4288.

### **3.5 "GOVERNMENT-APPROVED" SUBMITTALS**

Decisions on the submittals will be given by letter. Within 30 calendar days after receipt, one copy will be returned to the Contractor marked "Approved," "Approved, Except as Noted," "Disapproved," or "Returned for Correction." The notations "Approved" and "Approved, Except as Noted" authorize the Contractor to proceed with the work covered by such drawings, subject to the corrections if any, indicated thereon or described in the letter of transmittal. When prints of drawings have been "Returned for Correction," the Contractor shall make the necessary revisions on the drawings and shall resubmit five copies for approval in the same routine as before. CD-ROMs containing the electronic drawing files shall be submitted with each revision. Every revision made during the life of the contract shall be shown by number, date, and subject in a revision block and a notation shall be made in the drawing margin to permit rapid location of the revision. The time consumed by the Contractor in submitting and obtaining approval of assembly and shop drawings shall be included in the time allowed for completion of the contract.

### **3.6 "INFORMATION ONLY" SUBMITTALS**

Normally submittals for "information only" will not be returned. Government approval is not required on information only submittals. These submittals will be used for information purposes. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the Contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications and will not prevent the Government from requiring removal and replacement if nonconforming material is incorporated in the work. This does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

### 3.7 STAMPS

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

|   |
|---|
| CONTRACTOR<br>(Firm Name)   |
| <input type="checkbox"/> Approved   |
| <input type="checkbox"/> Approved with corrections as noted on submittal data and/or attached sheet(s). |
| SIGNATURE:  |
| TITLE:  |
| DATE:   |

### 3.8 CERTIFICATES OF COMPLIANCE

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

### 3.9 CONTRACTOR'S FILES

"Approved" and "Approved as Corrected" (Action Codes A and B) drawing files shall be maintained in fabrication shops and at field sites for Government use.

**END OF SECTION 01330**



## INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

### THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

- |      |  |       |   |
|------|--|-------|---|
| A -- | Approved as submitted.   | E --  | Disapproved (See attached).   |
| B -- | Approved, except as noted on drawings.   | F --  | Receipt acknowledged.   |
| C -- | Approved, except as noted on drawings.<br>Refer to attached sheet resubmission required. | FX -- | Receipt acknowledged, does not comply<br>as noted with contract requirements. |
| D -- | Will be returned by separate correspondence.   | G --  | Other (Specify)   |
10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.













## SECTION 01350

### ENVIRONMENTAL PROTECTION

| <u>Para. No.</u> | <u>Paragraph</u>            | <u>Page No.</u> |
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| 1.3              | SUBMITTALS                  | 01350-1         |
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| <b>PART 2</b>    | <b>PRODUCTS</b>             |                 |
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| <b>PART 3</b>    | <b>EXECUTION</b>            |                 |
| 3.1              | IMPLEMENTATION              | 01350-2         |
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| 3.3              | DISPOSAL OF HAZARDOUS WASTE | 01350-4         |

## **SECTION 01350**

### **ENVIRONMENTAL PROTECTION**

#### **PART 1 GENERAL**

##### **1.1 GENERAL INFORMATION**

This section covers preventing environmental pollution and minimizing environmental degradation during and as a result of operations, required for the rehabilitation of the bridge crane. The requirements of SECTION 02081 shall be in conjunction with this section in addition to other sections which may contain environmental protection requirements.

##### **1.2 APPLICABLE REGULATIONS**

All environmental pollution shall be prevented, abated, and controlled and environmental degradation arising from construction activities shall be minimized by complying with all applicable Federal, State, and local laws and regulations, as well as specific requirements of this contract. Where conflicting or duplicate regulations apply, the most stringent requirement shall govern. Contractor shall comply with the following list of environmental regulations where applicable. This list is not inclusive of all environmental requirements, but represents the Federal regulations most likely to apply to work under this contract.

- (1) Clean Air Act - 40 CFR 61: Emission Standards for Hazardous Air Pollutants
- (2) Solid Waste Disposal Act - 40 CFR 241: Land Disposal - 40 CFR 245: Resource Recovery
- (3) Resource Conservation and Recovery Act - 40 CFR 260-272: Hazardous Waste Management
- (4) Comprehensive Environmental Response , Compensation and Liability Act - 40 CFR 300-302: National Oil and Hazardous Substances Contingency Plan for hazardous substance spills and cleanup
- (5) Clean Water Act - 40 CFR 110-117 122 : Point source discharges into U.S. waters
- (6) Executive Order 12856 - Federal Compliance Order with the Emergency Planning and Community Right-to-Know Act and the Pollution Prevention Act
- (7) 49 CFR 100-177 Hazardous Materials Transportation Regulations

##### **1.3 SUBMITTALS**

Submittals required by this section of the Technical Specifications shall be for Government approval (GA) or for information only (FIO), and shall be submitted as stated below in accordance with SECTION 01330. The time of submittal shall be as indicated below.

### **1.3.1 Environmental Protection Plan (GA; SD-01 Data)**

Provide the environmental protection plan within 20 calendar days following notice to proceed (see paragraph 3.1.1.)

## **1.4 NONCOMPLIANCE**

An order stopping all or part of the work may be issued for failure to comply with the provisions of this section until corrective action has been taken. No time lost due to such stop orders or stop orders issued by any appropriate Federal, State or local environmental protection agency shall be the subject of a claim for extension of time or for costs or damages unless it is later determined that the Contractor was in compliance.

## **1.5 SUBCONTRACTORS**

Compliance with this section by subcontractors will be the responsibility of the Contractor.

## **PART 2 PRODUCTS (NOT APPLICABLE)**

## **PART 3 EXECUTION**

### **3.1 IMPLEMENTATION**

#### **3.1.1 Planning**

The approved Environmental Protection Plan including proposals for implementing this section for environmental protection will be checked for completeness and compliance. If satisfactory it will be approved and one copy will be returned. If unsatisfactory it will be returned for resubmission. No physical work at the site shall be started until this plan has been approved or specific authorization is obtained to start a phase of the work. Preparation and submittal of supplemental plans may be required if additional environmental protection planning is found necessary for later phases of work. As a minimum the plan shall include the sections indicated below:

3.1.1.1 Contamination-Prevention Section. A contamination-prevention section listing all potentially hazardous petroleum products and hazardous and toxic materials used by the Contractor in the performance of his work or in his equipment at the powerhouse and corresponding provisions to be taken to prevent accidental or intentional introduction of such materials into any waterway. This section is to include plans for preventing polluted run-off from plant, equipment parking and maintenance areas from entering local water bodies.

3.1.1.2 Containment and Cleanup Section. A containment and cleanup section including the procedures, instructions, and reports to be used in the event of an unforeseen oil, hazardous material, or chemical spill. This section shall include as a minimum:

(1) The name of the individual who will be responsible for implementing and supervising the containment and cleanup.

(2b) Material and equipment for cleanup work shall be tailored to the potential hazards involved.

(3) The names and locations of suppliers of containment materials and names and locations of additional fuel oil recovery, cleanup, restoration, and disposal equipment available in case of an unforeseen spill emergency.

(4) The methods and procedures to be used for expeditious cleanup.

(5) The name of the individual who will report any spills and who will follow up with complete documentation.

### **3.1.2 Coordination**

Prior to the work, a meeting shall be held with the Government to develop mutual understandings relative to the administration of the environmental protection program.

### **3.1.3 Surveillance**

During the work, all activities, including those of subcontractors, shall be supervised to assure compliance with the intent and details of the Plan. Training courses shall be conducted by the Contractor for himself and his subcontractors to assure that all personnel working at the site are familiar with the environmental protection provisions. All equipment and materials for environmental protection shall be inspected periodically to assure that they are in proper order and have not deteriorated.

### **3.1.4 Completion**

Before this contract is completed, all restoration, cleanup and other work required to leave the site in an acceptable condition shall have been completed. Final payment will not be made until the environmental protection requirements have been met.

### **3.1.5 Protection of Water Resources**

No water courses shall be polluted or have existing pollution contributed to with any petroleum products, oils, lubrications, or other toxic materials harmful to life. Chemical emulsifiers, dispersants, coagulants or other cleanup compounds shall not be used without prior written approval. Compliance with State water quality standards and conditions of any permits and clearances obtained for the work is the Contractor's responsibility.

## **3.2 ENVIRONMENTAL LITIGATION**

### **3.2.1 General**

If the performance of all or any part of the work is suspended, delayed, or interrupted due to an order of a court of competent jurisdiction as a result of environmental litigation, as defined below, the Government at the request of the Contractor will determine whether the order is due in any part to the acts or omission of the Contractor or a subcontractor at any tier not required by the terms of this contract. If it is determined that the order is not due in any part to the acts or omissions of the Contractor or a subcontractor at any tier other than as required by the terms of this contract, such suspension, delay, or interruption shall be considered as if ordered by the Government in the administration of this contract under the terms of SECTION 00700 Clause SUSPENSION OF WORK. The period of such suspension, delay, or interruption shall be considered unreasonable, and an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) as provided in that clause, subject to all the provision thereof.

### **3.2.2 Definition**

The term "environmental litigation," as used herein, means a lawsuit alleging that the work will have an adverse effect on the environment or that the Government has not duly considered, either substantively or procedurally, the effect of the work on the environment.

## **3.3 DISPOSAL OF HAZARDOUS WASTE**

The following shall apply to disposal of any hazardous waste:

### **3.3.1 Environmentally Friendly Materials**

The Contractor, where possible, will use or propose for use materials which may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment.

### **3.3.2 Documentation**

Documentation for analysis, sampling, transportation, and disposal of all hazardous waste streams generated during this contract shall be in accordance with 40 CFR parts 260 through 272 and 49 CFR 100-177.

### **3.3.3 Hazardous Waste Determinations, Sample Results, and Shipping Manifests**

A copy of all hazardous waste determinations, sample results, and shipping manifests shall be furnished to the Government Quality Assurance Representative (GQAR) to verify compliance with Federal, State, and local regulations.

### **3.3.4 Packaging, Labeling, Marking, and Storing**

All hazardous wastes shall be removed from the Project for proper disposal within 90 days of waste generation. All hazardous waste shall be packaged, labeled, and marked in accordance with 40 CFR 172 and 173. All hazardous waste shall be stored in accordance with 40 CFR 264.

### **3.3.5 Certificates of Destruction and Disposal Certificates**

Certificates of Destruction or Disposal Certificates shall be submitted for all hazardous wastes within 14 days of actual disposal.

### **3.3.6 Contractor's EPA Identification Number**

The Contractor's EPA identification number shall be used to dispose of all hazardous wastes generated by the Contractor and its subcontractors under this contract. This is construed to mean all hazardous wastes the Contractor or subcontractors generate from materials brought on the site for the purpose of performing work under the terms of the contract.

### **3.3.7 Government's EPA Identification Number**

The Government's EPA identification number shall be used to dispose of all hazardous waste generated from Government-owned facilities on the project. This is construed to mean hazardous wastes generated from the repair, demolition, or removal of any existing materials and buildings from Government facilities and is not intended to include any wastes generated by the Contractor in the performance of its work.

### **3.3.8 Hazardous Waste Manifests**

It is the responsibility of the Contractor to prepare all hazardous waste manifests. The Contractor shall prepare manifests for Government signature when the Government's EPA identification number is used. The manifest shall be submitted 48 hours in advance of the waste being removed. The ECC will review and sign the manifest when the transporter arrives.

### **3.3.9 Recycling Hazardous and Dangerous Waste**

Hazardous or dangerous waste shall be recycled to the maximum extent possible. Placing hazardous or dangerous waste in a permitted hazardous waste landfill shall be the last resort. If such facility is necessary, the Contractor shall dispose of it in compliance with Federal, State and local requirements.

**END OF SECTION 01350**

**SECTION 01420**

**SOURCES FOR REFERENCED PUBLICATIONS**

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| 1.2              | ORDERING INFORMATION | 01420-1         |

**PART 2 PRODUCTS**

(NOT USED)

**PART 3 EXECUTION**

(NOT USED)

## SECTION 01420

### SOURCES FOR REFERENCED PUBLICATIONS

#### PART 1 GENERAL

##### 1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

##### 1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

American Conference of Governmental (ACGIH)  
Industrial Hygienists  
1330 Camper Meadow Dr  
Cincinnati, OH 45240

American National Standards Institute, Inc. (ANSI)  
11 West 42nd Street  
New York, NY 10036

American Society of Mechanical Engineers (ASME)  
22 Law Dr., P.O. Box 2300  
Fairfield, NJ 07007-2300

American Society for Testing and Materials (ASTM)  
1916 Race Street  
Philadelphia, PA 19103-1187

American Welding Society Inc. (AWS)  
P.O. Box 351040  
Miami, FL 33135

Bureau of Reclamation (USBR)  
Attn D-7923A  
P.O. Box 25007  
Denver Federal Center  
Denver CO 80225-0007

Canadian Electrical Association (CEA)  
Suite 1600  
1 Wesmount Square  
Montreal, Quebec, Canada H3Z 2P9

Code of Federal Regulations (CFR)  
Order From:  
Government Printing Office  
Washington, DC 20402

Defense Federal Acquisition Regulations (DFAR)  
Order From:  
Government Printing Office  
Washington, DC 20402

Environmental Protection Agency (EPA)  
Order from:  
Superintendent of Documents  
Government Printing Office  
Washington, DC 20402-9325

Federal Acquisition Regulations (FAR)  
Order From:  
Government Printing Office  
Washington, DC 20402

Federal Highway Administration (FHWA)  
Order from:  
Superintendent of Documents  
U. S. Government Printing Office  
732 North Capitol Street, NW  
Mailstop: SDE  
Washington, DC 20401  
Ph: 866-512-1800 or 202-512-1800  
Fax: 202-512-2250  
Internet: <http://www.gpo.gov>

Institute of Electrical and Electronics Engineers (IEEE)  
445 Hoes Ln., P.O. Box 1331  
Piscataway, NJ 08855-1331

National Electrical Manufacturers Association (NEMA)  
Order Department  
2101 L Street, N.W., Suite 300  
Washington, DC 20037-1536

US Department of Labor Occupational (OSHA)  
Safety and Health Administration  
4676 Columbia Parkway  
Cincinnati, OH 45226

U.S. Army Corps of Engineers (USACE)  
Order Documents from:  
USACE Publications Depot  
Attn: CEIM-SP-D  
2803 52nd Avenue  
Hyattsville, MD 20781-1102  
Ph: 301-394-0081  
Fax: 301-394-0084  
Internet: <http://www.usace.army.mil/publications>  
or <http://www.hnd.usace.army.mil/techinfo/index.htm>

**PART 2      PRODUCTS**

(NOT USED)

**PART 3      EXECUTION**

(NOT USED)

**END OF SECTION 01420**

**SECTION 01451**  
**CONTRACTOR QUALITY CONTROL**

| <u>Para. No.</u> | <u>Paragraph</u>                              | <u>Page No.</u> |
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| 1.1              | GENERAL INFORMATION                           | 01451-1         |
| 1.2              | QUALITY CONTROL SYSTEM (QCS)                  | 01451-1         |
| 1.3              | AS-BUILT DRAWINGS                             | 01451-1         |
| 1.4              | REFERENCES                                    | 01451-1         |
| 1.5              | SUBMITTALS                                    | 01451-1         |
| <br>             |   |                 |
| <b>PART 2</b>    | <b>PRODUCTS</b>                               |                 |
| 2.1              | QUALITY CONTROL PLAN                          | 01451-2         |
| <br>             |   |                 |
| <b>PART 3</b>    | <b>EXECUTION</b>                              |                 |
| 3.1              | COORDINATION MEETING                          | 01451-3         |
| 3.2              | QUALITY CONTROL ORGANIZATION                  | 01451-4         |
| 3.3              | CQC CONTROLS                                  | 01451-4         |
| 3.4              | COMPLETION INSPECTION                         | 01451-6         |
| 3.5              | DOCUMENTATION                                 | 01451-7         |
| 3.6              | NOTIFICATION OF NONCOMPLIANCE                 | 01451-8         |
| 3.7              | TECHNICAL SPECIFICATIONS SECTION REQUIREMENTS | 01451-8         |
| 3.8              | PROGRESS & WORK PHOTOGRAPHS                   | 01451-8         |
| 3.9              | DEFICIENCY TRACKING SYSTEM                    | 01451-9         |

## **SECTION 01451**

### **CONTRACTOR QUALITY CONTROL**

#### **PART 1 GENERAL**

##### **1.1 GENERAL INFORMATION**

A Contractor's Quality Control (CQC) system shall be established and maintained in compliance with SECTION 00700, Clause INSPECTION OF CONSTRUCTION. The CQC system shall include but not be limited to plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The CQC system shall cover both on-site and off-site construction operations, and shall be keyed to the proposed construction sequence.

##### **1.2 QUALITY CONTROL SYSTEM (QCS)**

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period as required by SECTION 01312 QUALITY CONTROL SYSTEM (QCS.)

##### **1.3 AS-BUILT DRAWINGS**

During the progress of the job, the Contractor shall keep a set of as-builts that documents all changes and corrections from the original layouts, as required by SECTION 01785 AS-BUILT DRAWINGS.

##### **1.4 REFERENCES**

###### **1.4.1 American Society for Testing and Materials (ASTM)**

ASTM E329 (2001) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

##### **1.5 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330. The time of submittal shall be in accordance with SECTION 01330, unless otherwise indicated below.

### **1.5.1 Quality Control Plan (GA; SD-01 Data)**

Provide the CQC plan, which is proposed to implement the requirements of paragraph 2.1.2, not later than 10 days after receipt of Notice to Proceed. Other submittals shall be as specified elsewhere in the technical sections of DIVISIONS 1 through 16. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

## **PART 2 PRODUCTS**

### **2.1 QUALITY CONTROL PLAN**

#### **2.1.1 General**

The plan shall identify personnel, procedures, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

#### **2.1.2 The Contractor's Quality Control (CQC) Plan**

The CQC plan shall include, as a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers and purchasing agents:

2.1.2.1 A description of the CQC organization, including a chart showing the lines of authority and acknowledgment that the CQC staff known as Contractor Quality Control Representatives (CQCR's) shall implement the three-phase control system for all aspects of the contract work. The staff shall include a CQC system manager who shall report to the project manager or someone higher in the Contractor's organization. Project manager shall mean the individual with responsibility for the overall management of the project including quality and production.

2.1.2.2 The name, qualifications (in résumé format), duties, responsibilities, and authorities of each person assigned a CQC function.

2.1.2.3 A copy of the letter to the CQC system manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC system manager including authority to stop work which is not in compliance with the contract. The CQC system manager shall issue letters of direction to all other quality control representatives outlining duties, authorities and responsibilities. Copies of these letters shall be furnished to the Government.

2.1.2.4 Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers and purchasing agents.

2.1.2.5 Control, verification and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test.

2.1.2.6 Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

2.1.2.7 Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

2.1.2.8 Reporting procedures, including proposed reporting formats.

2.1.2.9 A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

### **2.1.3 Acceptance of Plan**

Acceptance of the CQC plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in the CQC plan and operations including removal of personnel, as necessary, to obtain conformance with contract requirements.

### **2.1.4 Notification of Changes**

After acceptance of the CQC plan, any proposed changes shall be submitted for acceptance a minimum of 7 calendar days prior to implementing any proposed change.

## **PART 3 EXECUTION**

### **3.1 COORDINATION MEETING**

After the pre-construction conference and before the start of construction, the Government and the Contractor shall meet to discuss and develop a mutual understanding of the CQC system in detail, and the interrelationship of Contractor's management and control with the Government's quality assurance. Minutes of the meeting, that will be prepared by the Government and shall be signed by both the Contractor and the Government, shall become a part of the contract file. There may also be occasions when subsequent conferences will be called by either party to

reconfirm mutual understandings, and/or address deficiencies in the CQC system or procedures that may require corrective action by the Contractor.

## **3.2 QUALITY CONTROL ORGANIZATION**

### **3.2.1 General**

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization that shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

### **3.2.2 CQC System Manager**

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer or a graduate of construction management, with a minimum of 3 years construction experience on construction similar to this contract, or a technician with 5 years construction quality management experience. This CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. The CQC System Manager may also have duties as project manager in addition to quality control.

### **3.2.3 Additional Requirement**

In addition to the above experience and education requirements, and within ninety (90) days of his appointment, the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors" or shall have a certificate of this training within the last 5 years. This course is periodically offered by the Government.

### **3.2.4 Alternate CQC System Manager**

An alternate for the CQC System Manager will be identified in the plan to serve in the event of the system manager's absence. Period of absence may not exceed 3 weeks at any one time, and not more than 40 workdays during a calendar year. The requirements for the alternate will be the same as for the designated CQC manager.

## **3.3 CQC CONTROLS**

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The controls shall be adequate to cover all construction operations, including both on-site and off-site fabrication, and will be keyed to the proposed construction sequence. The controls shall include at least three phases of control to be conducted by the CQC system manager for all definable features of work, as follows:

### **3.3.1 Preparatory Phase**

This phase shall be performed prior to beginning work on each definable feature of work and shall include:

- (a) A review of each paragraph of applicable specifications.
- (b) A review of the contract plans.
- (c) A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- (d) A check to assure that required control inspection and testing are provided.
- (e) Examination of the work area to assure that all required previous work has been completed and is in compliance with the contract.
- (f) A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawing or submitted data, and are stored as specified.
- (g) A review of the appropriate activity hazard analysis to assure that safety requirements are met.
- (h) Discussion of procedures for the work features including but not limited to tolerances and workmanship standards for that phase of work.
- (i) A check to ensure that the portion of the plan for the work to be performed has been submitted and accepted.
- (j) The Government shall be notified at least 48 hours in advance of beginning any of the required action of the preparatory phase. This phase shall include a meeting conducted by the CQC system manager and attended by the superintendent, other CQC personnel (as applicable), and the individual responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC system manager and attached to the daily CQC report. The applicable workers shall be informed as to the acceptable level of workmanship required in order to meet contract specifications prior to the start of the actual work.

### **3.3.2 Initial Phase**

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

(a) A check of preparatory phase work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.

(b) Verification of full contract compliance. Verify required control inspection and testing.

(c) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with sample panels is appropriate.

(d) Resolve all differences.

(e) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

(f) The Government shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC system manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

(g) The initial phase should be repeated for each new crew to work on-site, or any time specified quality standards are not being met.

### **3.3.3 Follow-up Phase**

Daily checks shall be performed on the ongoing work to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

### **3.3.4 Additional Preparatory and Initial Phases**

Additional preparatory and initial phases may be conducted on the same definable features of work as determined by the Government if the quality of on-going work is unacceptable; or if there are changes in the applicable CQC staff or in the on-site production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

## **3.4 COMPLETION INSPECTION**

At the completion of all work or any increment thereof established by a completion time stated elsewhere in the specifications, the CQC manager shall conduct an inspection of the work and develop a "punch list" of items which are incomplete and/or do not conform to the approved plans and specifications. Such a list shall be included in the CQC documentation, as required by paragraph 3.5, and shall include the estimated date by which the deficiencies will be corrected.

The CQC system manager or staff shall make a second inspection jointly with the GQAR to ascertain that all deficiencies have been corrected and submit a record of the inspection to the GQAR. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time stated for completion of the entire work or any particular increment thereof, if the project is divided into increments by separate completion dates.

### **3.5 DOCUMENTATION**

Current records of CQC operations, activities, and tests performed shall be maintained including the work of subcontractors and suppliers. These records shall be on an approved form and shall include factual evidence that required quality control activities and/or tests have been performed including but not limited to the following:

- (1) Contractor/subcontractor and their area of responsibility.
- (2) Operating plant/equipment with hours worked, idle, or down for repair.
- (3) Work performed today, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- (4) Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
- (5) Material received with statement as to its acceptability and storage.
- (6) Identify submittals reviewed, with contract reference, by whom, and action taken.
- (7) Off-site surveillance activities, including actions taken.
- (8) Job safety and environmental protection evaluations stating what was checked, results, and instructions or corrective actions.
- (9) List instructions given/received and conflicts in plans and/or specifications.
- (10) Contractor's verification statement.
- (11) These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. All calendar days shall be accounted for throughout the life of the contract. Reports shall be signed and dated by the CQC

system manager. The report from the CQC system manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

### **3.6 NOTIFICATION OF NONCOMPLIANCE**

If the Contractor fails or refuses to comply with the contract requirements promptly, the Government may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

### **3.7 OTHER TECHNICAL SPECIFICATIONS REQUIREMENTS**

CQC inspections, tests, assurances, reports, etc., called for in other technical sections (DIVISIONS 1 through 16) are to be considered to be requirements under this section. The CQC system manager is responsible to assure that all aspects of the work are in full compliance with the requirements of the Technical Specifications, and shall conduct all required CQC inspections, tests, and all other required CQC actions. All inspections and tests shall be recorded in the daily CQC report required in paragraph 3.5.

### **3.8 PROGRESS AND WORK PHOTOGRAPHS**

#### **3.8.1 General**

The Contractor shall, during the progress of the project, furnish the Government monthly progress photographs to depict progress and work conditions of the site construction. Work photographs shall be submitted with the monthly progress photographs and shall be taken at the following stages of work:

- a. Project initiation;
- b. Additional generator disassembly;
- c. Condition of the stator, rotor and exciter after disassembly, but prior to any cleaning;
- d. Rotor cleaned;
- e. Core removal;
- f. Core installation at 25%, 75% and 100% completion;
- g. Installation of the new coil system at 25%, 75% and 100% completion;
- h. Installation of the PDA system and new components at about 25% and 100% completion;
- i. Generator reassembly - show handling of major generator components such as exciter assembly, upper bracket, rotor, etc.;
- j. Unit operational testing;
- k. Special Field Testing;
- l. Completed installation.

### **3.8.2 Photographs**

Photographs depicting progress shall be delivered to the Government along with each request for payment. Photographs depicting specific work, as specified above, shall be submitted with the monthly request for payment in the month which the work took place. The progress photographs shall be taken from not less than two positions for each work area. They shall show, inasmuch as practical, work accomplished since the previous photographs. Project initiation photographs shall be taken from the same location and angle as the project completion photographs. The photographs shall be high resolution digital images saved as JPEG (Joint Photographic Experts Group) files, or other acceptable compressed format. The resolution shall be no less than 1024 x 768 pixels. Each photograph shall be identified by the date and number of exposure, plus a brief description of the work photographed. The photographs shall be furnished to the Government in a 3-1/2" HD floppy diskette, or other acceptable media, by the time stipulated above. No separate payment shall be made for these services and all costs in connection thereto shall be considered incidental to costs of the representative work area.

### **3.8.3 Delinquent Photographs**

For each month the Contractor fails to submit progress and work photographs, the Contracting Officer may retain \$200.00 or 10 percent of the progress payment, whichever is greater, in accordance with Contract Clause PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS. Also, in accordance with Clause INSPECTION OF CONSTRUCTION, the Contracting Officer may, by contract or otherwise, have the progress and work photographs taken and modify the contract amount to reflect the charges for these photographs.

### **3.9 DEFICIENCY TRACKING SYSTEM**

The Contractor shall maintain a cumulative list of deficiencies identified for the duration of the project. Deficiencies to be listed include those identified by the Contractor's Quality Control observations, test failures, Government oral observations and Notifications of Noncompliance. As a minimum, the list shall include the information contained in the Deficiency List attached at the end of this section. A current copy of the list shall be maintained at the project site at all times and shall be made available for review by Government personnel. Copies of updated listings shall be submitted to the Contracting Officer at least every 30 days. Payment will be withheld for deficient work until it has been corrected.

**END OF SECTION 01451**

|   |  |  |
|---|--|--|
| <b>CONTRACTOR'S QUALITY CONTROL REPORT (QCR)</b><br>(ER 1180-1-6)   | <b>DATE:</b>                                 | <b>REPORT NO.</b>  |
| <b>CONTRACT NUMBER AND NAME OF CONTRACTOR:</b>  | <b>DESCRIPTION AND LOCATION OF THE WORK:</b> |  |
| <b>WEATHER CLASSIFICATION:</b><br>CLASS A No interruptions of any kind from weather conditions occurring on this or previous shifts.<br>CLASS B Weather occurred during this shift that caused a complete stoppage of all work.<br>CLASS C Weather occurred during this shift that caused a partial stoppage of work.<br>CLASS D Weather overhead excellent or suitable during shift. Work completely stopped due to previous adverse weather.<br>CLASS E Weather overhead excellent or suitable during shift but work partially stopped due to previous adverse weather.<br>OTHER Explain. |  | <b>CLASSIFICATION:</b><br>CLASS _____<br>TEMPERATURE:<br>MAX _____ MIN _____<br>PRECIPITATION:<br>INCHES _____ |
| <b>CONTRACTOR/SUBCONTRACTORS AND AREA OF RESPONSIBILITY FOR WORK PERFORMED TODAY:</b><br>(Attach list of items of equipment either idle or working as appropriate.)   |  |  |
| a. _____<br>b. _____<br>c. _____<br>d. _____<br>e. _____<br>f. _____<br>g. _____  |  |  |
| <b>1. WORK PERFORMED TODAY:</b> (Indicate location and description of work performed. Refer to work performed by prime and/or subcontractors by letter in Table above.)   |  |  |
| <b>2. TYPE AND RESULTS OF INSPECTION:</b> (Indicate wether: P-Preparatory, I-Initial, or F-Follow-up and include satisfactory work completed or deficiencies with action to be taken.)  |  |  |
| <b>3. TESTS REQUIRED BY PLANS AND/OR SPECIFICATIONS PERFORMED AND RESULTS OF TESTS:</b>   |  |  |

4. VERBAL INSTRUCTIONS RECEIVED:(List any instruction given by the Government personnel on construction deficiencies, retesting required, etc., with action to be taken.)

5. REMARKS: Cover any conflicts in plans, specifications or instructions: acceptability of incoming materials; offsite surveillance activities; progress of work, delays, causes and extent thereof; days of no work with reasons for same.)

6. SAFETY: Include any infractions of approved safety plan, safety manual or instruction from Government personnel. Specify corrective action taken.)

SAFETY INSPECTOR

7. CONTRACTOR'S CERTIFICATION: I certify that the above report is complete and correct and that all material and equipment used, work performed and tests conducted during this reporting period were in strict compliance with the contract plans and specifications except as noted above.

CONTRACTOR QUALITY CONTROL SYSTEM MANAGER



**SECTION 01525  
SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS**

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## **SECTION 01525**

### **SAFETY AND OCCUPATIONAL HEALTH 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 NATIONAL STANDARDS INSTITUTE (ANSI)**

ANSI Z359.1 (1999) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

#### **ASME INTERNATIONAL (ASME)**

ASME B30.3 (1996) Construction Tower Cranes

ASME B30.5 (2000) Mobile and Locomotive Cranes

ASME B30.8 (2000) Floating Cranes and Floating Derricks

ASME B30.22 (2000) Articulating Boom Cranes

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

29 CFR 1910 Occupational Safety and Health Standards for General Industry

29 CFR 1910.94 Ventilation

29 CFR 1910.120 Hazardous Waste Operations and Emergency Response

29 CFR 1910.146 Permit-required Confined Spaces

29 CFR 1915 Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment

29 CFR 1919 Gear Certification

29 CFR 1926 Safety and Health Regulations for Construction

29 CFR 1926.62 Lead in Construction

29 CFR 1926.65 Hazardous Waste Operations and Emergency Response

|                  |                 |
|------------------|-----------------|
| 29 CFR 1926.450  | Scaffolds       |
| 29 CFR 1926.500  | Fall Protection |
| 29 CFR 1926.1101 | Asbestos        |

**U. S. ARMY CORPS OF ENGINEERS (USACE)**

|            |  |
|------------|--|
| EM 385-1-1 | (2003) Safety and Health Requirements Manual |
|------------|--|

**NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

|          |   |
|----------|---|
| NFPA 10  | (1998) Portable Fire Extinguishers                                      |
| NFPA 51B | (2003) Fire Prevention During Welding, Cutting, and Other Hot Work      |
| NFPA 70  | (2002) National Electrical Code   |
| NFPA 241 | (2000) Safeguarding Construction, Alteration, and Demolition Operations |

**1.2 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. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

**SD-01 Preconstruction Submittals**

- Accident Prevention Plan (APP); G
- Activity Hazard Analysis (AHA); G
- Crane Critical Lift Plan; G
- Crane Work Plan; G
- Proof of qualification for Crane Operators; G

**SD-06 Test Reports**

- Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."

Accident Reports

Monthly Exposure Reports

Regulatory Citations and Violations

Crane Reports

### **SD-07 Certificates**

Confined Space Entry Permit

Certificate of Compliance (Crane)

Submit one copy of each permit attached to each Daily Quality Control Report.

## **1.3 DEFINITIONS**

- a. **Competent Person for Fall Protection.** A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.
- b. **High Visibility Accident.** Any mishap which may generate publicity and/or high visibility.
- c. **Low-slope roof.** A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).
- d. **Medical Treatment.** Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.
- e. **Multi-Employer Work Site (MEWS).** A multi-employer work site, as defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.
- f. **Operating Envelope.** The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

g. **Qualified Person for Fall Protection.** A person with a recognized degree or professional certificate, extensive knowledge, training and experience in the field of fall protection who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

h. **Recordable Injuries or Illnesses.** Any work-related injury or illness that results in:

- (1) Death, regardless of the time between the injury and death, or the length of the illness;
- (2) Days away from work;
- (3) Restricted work;
- (4) Transfer to another job;
- (5) Medical treatment beyond first aid;
- (6) Loss of consciousness; or
- (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

i. **Site Safety and Health Officer (SSHO).** The superintendent or other qualified or competent person who is responsible for the on-site safety and health required for the project. The Contractor quality control (QC) person can be the SSHO on this project.

j. **Steep roof.** A roof having a slope greater than 4 in 12 (vertical to horizontal).

k. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

l. **Weight Handling Equipment (WHE) Accident.** A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

## **1.4 REGULATORY REQUIREMENTS**

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, and the following federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

## **1.5 DRUG PREVENTION PROGRAM**

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

## **1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS**

### **1.6.1 Personnel Qualifications**

#### **1.6.1.1 Site Safety and Health Officer (SSHO)**

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The SSHO shall meet the following requirements:

- A minimum of 5 years safety work on similar projects.
- 30-hour OSHA construction safety class or equivalent within the last 5 years.
- An average of at least 24 hours of formal safety training each year for the past 5 years.

#### **1.6.1.2 Competent Person for Confined Space Entry**

Provide a competent person meeting the requirements of EM 385-1-1 who is assigned in writing by the Designated Authority to assess confined spaces and who possesses demonstrated knowledge, skill and ability to:

- a. Identify the structure, location, and designation of confined and permit-required confined spaces where work is done;
- b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;

- c. Perform all required tests and inspections specified in 29 CFR 1910.146 and 29 CFR 1915 Subpart B;
- d. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;
- e. Determine ventilation requirements for confined space entries and operations;
- f. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and,
- g. Maintain records required.

#### 1.6.1.3 Competent Person for the Health Hazard Control and Respiratory Protection Program

Provide a competent person meeting the requirements of EM 385-1-1 who is:

- a. Capable by education, specialized training and/or experience of anticipating, recognizing, and evaluating employee exposure to hazardous chemical, physical and biological agents in accordance with USACE EM 385-1-1, Section 6.
- b. Capable of specifying necessary controls and protective actions to ensure worker health.

#### 1.6.1.4 Crane Operators

Crane operators shall meet the requirements in USACE EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, crane operators shall be designated as qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Proof of current qualification shall be provided.

### 1.6.2 Personnel Duties

#### 1.6.2.1 Site Safety and Health Officer (SSHO)/Superintendent

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily quality control report.
- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.

- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.
- f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.
- g. Ensure sub-contractor compliance with safety and health requirements.

Failure to perform the above duties will result in dismissal of the superintendent and/or SSSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

### **1.6.3 Meetings**

#### **1.6.3.1 Preconstruction Conference**

- a. The Contractor will be informed, in writing, of the date of the preconstruction conference. The purpose of the preconstruction conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project's Accident Prevention Plan (APP) before the initiation of work.
- b. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
- c. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.
- d. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

e. The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

### 1.6.3.2 Weekly Safety Meetings

Conduct weekly safety meetings at the project site for all employees. The Contracting Officer will be informed of the meeting in advance and be allowed attendance. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

### 1.6.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls.

## 1.7 TRAINING

### 1.7.1 New Employee Indoctrination

New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

### 1.7.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

### 1.7.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

## 1.8 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Preparation of Accident Prevention Plan". Where a paragraph or subparagraph element is not applicable to the work to be performed indicate "Not Applicable" next to the heading. Specific requirements for some of the APP elements are described below at paragraph 1.8.1. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element

and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. The Contracting Officer reviews and comments on the Contractor's submitted APP and accepts it when it meets the requirements of the contract provisions.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any unforeseen hazard become evident during the performance of work, the project superintendent shall inform the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site. The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

### **1.8.1 EM 385-1-1 Contents**

In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

- a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used. The duties of each position shall be specified.
- b. Qualifications of competent and of qualified persons. As a minimum, competent persons shall be designated and qualifications submitted for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.

c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

d. Health Hazard Control Program. The Contractor shall designate a competent and qualified person to establish and oversee a Health Hazard Control Program in accordance with USACE EM 385-1-1, Section 6. The program shall ensure that employees, on-site Government representatives, and others, are not adversely exposed to chemical, physical and biological agents and that necessary controls and protective actions are instituted to ensure health.

e. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. The plan shall be submitted 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.c.18. and the following:

(1) For lifts of personnel, the plan shall demonstrate compliance with the requirements of 29 CFR 1926.550(g).

(2) For barge mounted mobile cranes, barge stability calculations identifying barge list and trim based on anticipated loading; and load charts based on calculated list and trim. The amount of list and trim shall be within the crane manufacturer's requirements.

f. Alcohol and Drug Abuse Plan

(1) Describe plan for random checks and testing with pre-employment screening in accordance with the DFAR Clause subpart 252.223-7004, "Drug Free Work Force."

(2) Description of the on-site prevention program

g. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 1.8 m (6 feet). A qualified person for fall protection shall prepare and sign the plan. The plan shall include fall protection and prevention

systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Fall Protection and Prevention Plan shall be for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project. The Fall Protection and Prevention Plan shall be included in the Accident Prevention Plan (APP).

h. Training Records and Requirements. List of mandatory training and certifications which are applicable to this project (e.g. explosive actuated tools, confined space entry, fall protection, crane operation, vehicle operator, forklift operators, personal protective equipment); list of requirements for periodic retraining/certification; outline requirements for supervisory and employee safety meetings.

i. Site Safety and Health Plan. The safety and health aspects prepared in accordance with the specifications.

j. Excavation Plan. The safety and health aspects prepared in accordance with this specification.

k. Crane Work Plan. The contractor shall provide a crane work plan to the Contracting Officer for acceptance. The crane work plan shall include the specific model of each crane and a drawing identifying their locations (exact), the dimensions, wheel sizes, number of wheels, wheel spacing, tire pressure(s), number of axles, axle spacing, minimum wheel load to be exerted during operations and maximum outrigger load to be exerted during operations. The Contractor shall allow at least 10 working days for acceptance/non-acceptance of the crane work plan. No crane operations shall begin prior to written acceptance of the crane work plan by the Government.

## **1.9 ACTIVITY HAZARD ANALYSIS (AHA)**

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHA as amendments to the APP. An AHA will be developed by the Contractor for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. The analysis must identify and evaluate hazards and outline the proposed methods and techniques for the safe completion of each phase of work. At a minimum, define activity being performed, sequence of work, specific safety and health hazards anticipated, control measures (to include personal protective equipment) to eliminate or reduce each hazard to acceptable levels, equipment to be used, inspection requirements, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall protection methods used. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include requirements for safeguarding excavations. An activity requiring an AHA shall not proceed until the AHA has been accepted by

the Contracting Officer's representative and a meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activity, including on-site Government representatives. The Contractor shall document meeting attendance at the preparatory, initial, and follow-up phases of quality control inspection. The AHA shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

Activity hazard analyses shall be updated as necessary to provide an effective response to changing work conditions and activities. The on-site superintendent, site safety and health officer and competent persons used to develop the AHAs, including updates, shall sign and date the AHAs before they are implemented.

### **1.10 DISPLAY OF SAFETY INFORMATION**

Within 1 calendar days after commencement of work, erect a safety bulletin board at the job site. The following information shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal:

- a. Map denoting the route to the nearest emergency care facility.
- b. Emergency phone numbers.
- c. Copy of the most up-to-date APP.
- d. Current AHA(s).
- e. OSHA 300A Form.
- f. OSHA Safety and Health Protection-On-The-Job Poster.
- g. Confined space entry permit.
- h. A sign indicating the number of hours worked since last lost workday accident.
- i. Safety and Health Warning Posters.

### **1.11 SITE SAFETY REFERENCE MATERIALS**

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

## **1.12 EMERGENCY MEDICAL TREATMENT**

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

## **1.13 REPORTS**

### **1.13.1 Accident Reports**

- a. For recordable injuries and illnesses, and property damage accidents resulting in at least \$2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 1 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.
- b. For any weight handling equipment accident (including rigging gear accidents) the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Crane operations shall not proceed until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

### **1.13.2 Accident Notification**

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$2,000, or any weight handling equipment accident. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

### **1.13.3 Monthly Exposure Reports**

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

### **1.13.4 Regulatory Citations and Violations**

Contact the Contracting Officer immediately of any OSHA or other regulatory agency inspection or visit, and provide the Contracting Officer with a copy of each citation, report, and contractor

response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

### **1.13.5 Crane Reports**

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

### **1.13.6 Certificate of Compliance**

The Contractor shall provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). Certificate shall state that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance shall comply with 29 CFR 1926 and USACE EM 385-1-1 section 16 and Appendix H. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. The Contractor shall also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). These certifications shall be posted on the crane.

## **PART 2 PRODUCTS**

### **2.1 CONFINED SPACE SIGNAGE**

The Contractor shall provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 25 mm (one inch) in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 1.52 m (5 feet).

### **2.2 FALL PROTECTION ANCHORAGE**

Fall protection anchorage, conforming to ANSI Z359.1, installed under the supervision of a qualified person in fall protection, shall be left in place for continued customer use and so identified by signage stating the capacity of the anchorage (strength and number of persons who may be tied-off to it at any one time).

## **PART 3 EXECUTION**

### **3.1 CONSTRUCTION AND/OR OTHER WORK**

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard shall prevail.

### **3.1.1 Hazardous Material Use**

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material. Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

### **3.1.2 Hazardous Material Exclusions**

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE 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 are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

### **3.1.3 Unforeseen Hazardous Material**

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. The Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

## **3.2 PRE-OUTAGE COORDINATION MEETING**

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

### **3.3 FALL HAZARD PROTECTION AND PREVENTION PROGRAM**

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and escape procedures.

#### **3.3.1 Training**

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

#### **3.3.2 Fall Protection Equipment**

The Contractor shall enforce use of the fall protection equipment designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is on a surface 1.8 m(6 feet) or more above lower levels. Fall protection systems such as guardrails, personnel fall arrest system, safety nets, etc., are required when working within 1.8m (6 feet) of any leading edge. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.I. and 05.J. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M and USACE EM 385-1-1.

##### **3.3.2.1 Personal Fall Arrest Equipment**

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m (6 feet). The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

### **3.3.3 Fall Protection for Roofing Work**

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

#### **a. Low Sloped Roofs:**

(1) For work within 1.8 m (6 feet) of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets.

(2) For work greater than 1.8 m (6 feet) from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

**b. Steep Roofs:** Work on steep roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

### **3.3.4 Safety Nets**

If safety nets are used as the selected fall protection system on the project, they shall be provided at unguarded work places, leading edge work or when working over water, machinery, dangerous operations or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, fall arrest systems or restraint/positioning systems are impractical. Safety nets shall be tested immediately after installation with a drop test of 181.4 kg (400 pounds) dropped from the same elevation a person might fall, and every six months thereafter.

### **3.3.5 Existing Anchorage**

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ANSI Z359.1. Existing horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

### **3.3.6 Horizontal Lifelines**

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

### **3.3.7 Guardrail Systems**

Guardrails shall consist of top and mid-rails, post and toe boards. The top edge height of standard railing must be 42 inches plus or minus 3 inches above the walking/working level.

When mid-rails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking/working level. Posts shall be placed no more than 8 feet apart (29 CFR 1926.500 and USACE EM 385-1-1).

### **3.3.8 Rescue and Evacuation Procedures**

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. A Rescue and Evacuation Plan shall be prepared by the contractor and 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. The Rescue and Evacuation Plan shall be included in 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).

## **3.4 SCAFFOLDING**

Employees shall be provided 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. Access to scaffold platforms greater than 6 m (20 feet) in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 6 m (20 feet) in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

### **3.4.1 Stilts**

The use of stilts for gaining additional height in construction, renovation, repair or maintenance work is prohibited.

## **3.5 EQUIPMENT**

### **3.5.1 Material Handling Equipment**

- a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.
- c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

### **3.5.2 Weight Handling Equipment**

- a. Cranes must be equipped with:
  - (1) Load indicating devices (LIDs) and a boom angle or radius indicator,
  - (2) or load moment indicating devices (LMIs).
  - (3) Anti-two block prevention devices.
  - (4) Boom hoist hydraulic relief valve, disconnect, or shutoff (stops hoist when boom reaches a predetermined high angle).
  - (5) Boom length indicator (for telescoping booms).
  - (6) Device to prevent uncontrolled lowering of a telescoping hydraulic boom.
  - (7) Device to prevent uncontrolled retraction of a telescoping hydraulic boom.
  - (8) Wind indicating device.
  - (9) Drum rotation indicator.
  - (10) Barge mounted mobile cranes shall be equipped with a load indicating device, a wind indicating device and a marine type list and trim indicator readable in one-half degree increments.
- b. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.

- c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.
- d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.
- e. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful working conditions received in writing from contractor employees, federal civilian employees, or military personnel.
- f. Each load shall be rigged/attached independently to the hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Christmas-tree lifting (multiple rigged materials) is not allowed.
- g. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.
- h. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.
- i. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.
- j. A fire extinguisher having a minimum rating of 10BC and a minimum nominal capacity of 5lb of extinguishing agent shall be available at all operator stations or crane cabs. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.
- k. All employees shall be kept clear of loads about to be lifted and of suspended loads.
- l. A weight handling equipment operator shall not leave his position at the controls while a load is suspended.
- m. The Contractor shall use cribbing when performing lifts on outriggers.
- n. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

- o. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.
- p. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto the crane cab in a location allowing easy reading by the operator while seated in the control station.
- q. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.
- r. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.
- s. The Contractor shall certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

### **3.5.3 Equipment and Mechanized Equipment**

- a. Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review.
- b. Manufacture specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.
- c. Equipment and mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operation by a competent person prior to being placed into use.
- d. Daily checks or tests shall be conducted and documented on equipment and mechanized equipment by designated competent persons.

## **3.6 EXCAVATIONS**

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly. The competent person shall perform soil classification in accordance with 29 CFR 1926.

### **3.6.1 Utility Locations**

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

### **3.6.2 Utility Location Verification**

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 0.061 m (2 feet) of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 30.5 m (100 feet) if parallel within 1.5 m (5 feet) of the excavation.

### **3.6.3 Utilities with Concrete Slabs**

Utilities located within concrete slabs or pier decks, bridges, and the like are extremely difficult to identify. The location must be coordinated with station utility departments in addition to a private locating service. Outages on system utilities shall be used in circumstances where concrete chipping, saw cutting, or core drilling is required and utilities are unable to be completely identified.

### **3.6.4 Shoring Systems**

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

### **3.6.5 Trenching Machinery**

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

## **3.7 ELECTRICAL**

### **3.7.1 Conduct of Electrical Work**

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each

cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

### **3.7.2 Portable Extension Cords**

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

## **3.8 WORK IN CONFINED SPACES**

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. Any potential for a hazard in the confined space requires a permit system to be used.

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.05 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.
- c. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m (5 feet) in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.
- d. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.

f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

### **3.9 HOUSEKEEPING**

#### **3.9.1 Clean-Up**

All debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location, however garbage accumulation must be removed each day.

#### **3.9.2 Falling Object Protection**

All areas must be barricaded to safeguard employees. When working overhead, Barricade the area below to prevent entry by unauthorized employees. Construction warning tape and signs shall be posted so they are clearly visible from all possible access points. When employees are working overhead all tools and equipment shall be secured so that they will not fall. When using guardrail as falling object protection, all openings shall be small enough to prevent passage of potential falling objects.

**END OF SECTION 01525**



**US Army Corps  
of Engineers®**  
Nashville District

ORNP 385-1-2  
May 1986

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## **Contractor Guidelines For:**

- 1. The Preparation of the  
Accident Prevention  
Proposal (Safety Plan)**
- 2. The Preparation of the  
Activity Hazard Analysis**

APPENDIX A  
HELPFUL HINTS FOR THE PREPARATION OF THE  
CONTRACTOR'S  
ACCIDENT PREVENTION PROPOSAL

1. The following are minimum considerations for developing the Contractor's Accident Prevention Proposal. These helpful hints raise a number of basic questions that need to be answered for the Contractor's safety plan to be an effective management tool for use by on-site supervision. This plan shall be specific for this job.

a. Time Of Submittal. The safety plan and the activity hazard analysis for the first phases of the job shall be acceptable prior to start of work. The plan and analysis shall be submitted for review within ten (10) calendar days after notice of award so that discussion can take place at the pre-construction conference. Job hazard analysis for later phases of work shall be acceptable prior to the start of that phase. It is recommended that the activity hazard analysis for the next phase of work be submitted twenty days before scheduled phase start in order to give ample time for review. The safety plan shall contain a list of the phases to complete the works. Each phase shall have an anticipated start date. On short jobs one submittal covering the total job will be sufficient.

b. Responsible Individual(s). Who will be responsible for enforcing the safety program and what are the basic duties? How will this person be held accountable? Include a statement that there will be compliance with pertinent provisions of the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1.

c. Subcontractor Supervision. What procedures will be followed to assure that Subcontractor activities are fully integrated into the project safety plan and activity hazards analysis?

d. Indoctrination of New Employees Before Start of Work. Every employee is required to receive an initial safety briefing prior to starting work. The safety plan shall establish the procedure for ensuring the following items are covered:

- (1) General safety policy and pertinent provisions of EM-385-1-1.
- (2) Requirements for employee and project safety.
- (3) Employee's responsibilities for property and safety of others.
- (4) Employee's responsibilities for reporting all accidents.
- (5) Medical facilities and required treatment.
- (6) Procedures for reporting or correcting unsafe conditions or practices.

- (7) Safe clearance procedures.
- (8) Fire fighting and other emergency procedures.
- (9) Activity hazard analysis.
- (10) Personal protective equipment.

e. On-the Job Safety Meetings.

- (1) When and where will monthly safety meetings for all supervisors be held? Who will conduct the meetings and what will be covered?
- (2) How will the weekly "tool box" meetings be conducted?

f. Accident Reporting. The contract requires prompt reporting of injuries, fire, and property damage. Initial reports must be made immediately to the on-site Government representative and written reports shall be submitted within one to four working days. How does the safety plan reflect responsibilities assigned for immediate oral reporting, accident investigation, determining proper corrective action, and preparation of reports?

g. Sanitary Facilities. What toilet facilities will be provided considering the number and distribution of employees? What other considerations are planned for drinking water and washing facilities?

h. First Aid and Medical. Describe first aid facilities and qualifications of attendant. List telephone numbers of physician, ambulance, and hospital.

i. Housekeeping. How will access ways to work areas be maintained during work hours? What procedures will be followed to assure daily cleanup?

j. Fire Protection. Considering the availability of existing fire protection, what general types and size of extinguishers and fire barrels will be required to protect buildings, shops, and storage areas as well as to deal with special hazards such as welding and flammable liquids? Name the local professional fire fighters. List their telephone number.

k. Machinery and Mechanized Equipment. How will inspection of cranes, trucks, and other mechanical equipment be accomplished? Frequency, by whom, what type of records will be kept?

2. Posters, contests, safety awards help develop positive attitudes toward safety rules. What methods, if any, will be used on this project? Most accidents are preventable by well thought out and executed safety plans.

APPENDIX B  
GUIDELINES FOR THE PREPARATION OF  
ACTIVITY HAZARDS ANALYSIS

1. Activity Hazards Analysis Development. Before starting any major phase of work an activity hazards analysis shall be developed and reviewed with the Government representative. This analysis will evaluate anticipated hazards and outline the proposed methods and techniques which will be utilized to accomplish the work in a safe manner.

2. Phases of Work. Listed are examples of major phases of work, but this list is not all inclusive. Phases of work shall be tailored to the specific characteristics of the contract.

- Clearing and Grubbing
- Earthwork
- Trench Excavation
- Blasting
- Concrete Placement
- Steel Erection
- Masonry
- Electrical Work, Exterior
- Mechanical Work
- Carpentry

3. Sample Activity Hazards Analysis. The enclosed sample shows a possible format for a phase safety plan that might be submitted on a representative project. This sample incorporates a phase of work, the safety hazards that may be encountered, and precautionary actions that will be taken to overcome these hazards. Each safety hazard identified in the third vertical column must be accompanied by the appropriate paragraph reference number from EM 385-1-1. If none exists in EM 385-1-1, so state in the third vertical column of the Activity Hazard Analysis.

4. Indoctrination. Employees performing the work must be made aware of the activity hazard analysis. For this reason, an important part of any phase plan is the indoctrination of all employees who will be performing the work.

SAMPLE

| <b>ACTIVITY HAZARD ANALYSIS</b>         |   |   |
|---|---|---|
| <b>Contract No.</b><br>DACW62-96-C-0000 | <b>Project</b><br>Install Water and Sewer Lines                           | <b>Facility</b><br>Blue Heron Recreational Area   |
| <b>Date</b><br>1 October 1996           | <b>Location</b><br>Big South Fork   | <b>Estimated Start Date</b><br>19 November 1996   |
| <b>Item</b><br>1                        | <b>Phase of Work</b><br>Trench Excavation                                 | <b>Precautionary Actions to be taken</b>  |
|   | <p>Hitting Existing Utilities<br/>(par. 25.A.10)</p> <p>Safety Hazard</p> | <ol style="list-style-type: none"> <li>1. Find and mark existing utilities before excavating.</li> <li>2. Use care while excavating.</li> <li>3. Shore existing utilities crossing trench.</li> <li>4. Instruct operator.</li> <li>5. Watch for overhead electrical lines.</li> </ol>   |
|   | <p>Cave-Ins<br/>(pars. 25.B.03, 25.C.01 and 25.D.05)</p>                  | <ol style="list-style-type: none"> <li>1. Slope sides, depending on depth and soil type.</li> <li>2. Shoring when necessary.</li> <li>3. Lay back material at least 2 ft. from edge depending on depth &amp; soil type.</li> <li>4. Have access ladder or steps in other than shallow trenches.</li> <li>5. Backfill as soon as possible.</li> <li>6. Instruct workmen as to cave-ins hazards and precautions.</li> </ol> |
|   | <p>Head injuries from falling rocks or clods<br/>(par. 25.A.07)</p>       | <ol style="list-style-type: none"> <li>1. Wear hardhats.</li> <li>2. Scale potential fuels from sides.</li> </ol>   |
|   | <p>Backing over workmen<br/>(par. 16.B.01 and 25.A.09)</p>                | <ol style="list-style-type: none"> <li>1. Back-up alarms on equipment.</li> <li>2. Have helper to guide operator while backing.</li> <li>3. Instruct workmen not to stand or walk behind equipment.</li> </ol>  |
|   | <p>Pedestrian Accidents<br/>(pars. 25.B.01 and 25.B.03)</p>               | <ol style="list-style-type: none"> <li>1. Rope off or fence trench.</li> <li>2. Mark clearly.</li> <li>3. Backfill as soon as possible.</li> </ol>  |
|   | <p>Back Injuries<br/>(par. 14.A.01)</p>                                   | <ol style="list-style-type: none"> <li>1. Instruct workmen how to lift materials.</li> <li>2. Instruct workmen to get help and/or to use lifting equipment.</li> </ol>  |
|   | <p>Falling<br/>"(pars. 25.B.01 and 25.B.03)</p>                           | <ol style="list-style-type: none"> <li>1. Maintain employee alertness in and around trenches.</li> </ol>  |

**SECTION 01785  
AS-BUILT DRAWINGS**

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**SECTION 01785**  
**AS-BUILT DRAWINGS**

**PART 1 GENERAL**

**1.1 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

**1.1.1 As-Built Drawings; [GA]**

Drawings showing final as-built conditions of the project shall be submitted. The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format.

**1.2 PROJECT RECORD DOCUMENTS**

**1.2.1 As-Built Drawings**

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings which are revised to be used for final as-built drawings.

**1.2.1.1 Government Furnished Materials**

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference.

**1.2.1.2 Working As-Built and Final As-Built Drawings**

The Contractor shall revise 1 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a weekly basis and shall be available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final as-built drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final as-built

drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. The working and final as-built drawings shall show, but shall not be limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures.

(1) Directions in the modification for posting descriptive changes shall be followed.

- (2) A Modification Circle shall be placed at the location of each deletion.
- (3) For new details or sections which are added to a drawing, a Modification Circle shall be placed by the detail or section title.
- (4) For minor changes, a Modification Circle shall be placed by the area changed on the drawing (each location).
- (5) For major changes to a drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.
- (6) For changes to schedules or drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.
- (7) The Modification Circle size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

### **1.2.1.3 Drawing Preparation**

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

Color code for changes shall be as follows:

- (1) Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.
- (2) Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.
- (3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

### **1.2.1.4 Computer Aided Design and Drafting (CADD) Drawings**

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are

required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The Contractor will be furnished Microstation (.dgn) electronic vector files. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

a. The Contract Drawing files shall be renamed in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Marked-up changes shall be made only to those renamed files. All changes shall be made on the layer/level as the original item. Special notes shall be on layer #63.

b. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 3/16 inch high. All other contract drawings shall be marked either "AS-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

c. Within 20 days after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final CADD as-built drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days the Contractor shall revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of one set of Microstation (.dgn) electronic vector files on compact disc, read-only memory (CD-ROM), and one set of the approved working as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

#### **1.2.1.5 Payment**

No separate payment will be made for as-built drawings required under this contract, and all costs accrued in connection with such drawings shall be considered a subsidiary obligation of the Contractor.

### **1.2.3 Final Approved Shop Drawings**

The Contractor shall furnish final approved project shop drawings 30 days after transfer of the completed facility.

### **1.2.4 Construction Contract Specifications**

The Contractor shall furnish final as-built construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION (NOT USED)**

**END OF SECTION 01785**

**SECTION 02081**  
**HAZARDOUS MATERIALS**

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## SECTION 02081

### HAZARDOUS MATERIALS

#### PART 1 GENERAL

##### 1.1 GENERAL INFORMATION

This Section covers general requirements and regulations for hazardous materials relating to site operations under this contract. The specific requirements of SECTION 01350 shall be in conjunction with this section in addition to other sections which may contain hazardous material requirements.

##### 1.2 REFERENCES

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

###### 1.2.1 Code of Federal Regulations (CFR)

|            |   |
|------------|---|
| 40 CFR 261 | Identification and Listing of Hazardous Waste                                       |
| 40 CFR 262 | Generators of Hazardous Waste   |
| 40 CFR 263 | Transporters of Hazardous Waste   |
| 40 CFR 264 | Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities |
| 49 CFR 178 | Shipping Container Specification  |

###### 1.2.2 U.S. Army Corps of Engineers Publications (USACE)

|                  |  |
|------------------|--|
| USACE EM 385-1-1 | (2003) Safety and Health Requirements Manual |
|------------------|--|

##### 1.3 DEFINITION OF HAZARDOUS MATERIALS

For the purpose of this contract a material will be considered hazardous if that material has any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity in accordance with 40 CFR part 261, subpart C, "Characteristics of Hazardous Wastes.

## **1.4 SUBMITTALS**

Submittals required by this section of the Technical Specifications shall be for Government approval (GA) or for information only (FIO), and shall be submitted as stated below in accordance with SECTION 01330.

### **1.4.1 Hazardous Waste Determinations (GA; SD-01 Data)**

Provide hazardous waste determinations, sample plans, sample results, disposal plans, disposal restrictions and shipping manifests, prior to shipment of any hazardous waste off site.

### **1.4.2 Shipping Manifest (FIO; SD-01 Data)**

Provide shipping manifest, signed by an authorized representative of the disposal facility, within 30 days after shipment from the Project, showing that the hazardous waste was accepted at the approved disposal facility.

### **1.4.3 Safe Storage Plan (GA; SD-01 Data)**

As part of the hazardous communication program a plan for safe storage of hazardous waste shall be submitted (see paragraph 3.1.3.)

## **PART 2 PRODUCTS**

(NOT USED)

## **PART 3 EXECUTION**

### **3.1 DISPOSITION OF HAZARDOUS WASTE**

#### **3.1.1 Hazardous Waste Generated by the Contractor**

All hazardous waste generated by the Contractor shall become the property and responsibility of the Contractor. All hazardous waste disposal shall be in accordance with applicable Federal, State and Local regulations. The Contractor is required to provide all labor, equipment, materials and documentation for analysis, sampling, transportation and disposal of all hazardous waste streams, in accordance with 40 CFR part 260 through 272, generated during this contract. Hazardous waste shall not be allowed to accumulate on site for more than 90 days.

#### **3.1.2 Other Hazardous Materials**

If the Contractor discovers, or comes into contact with hazardous materials other than those identified in these specifications, the Contractor shall immediately notify the Government, and the Government will make a determination as to the course of action.

### **3.1.3 Hazardous Communication Program**

A hazardous communication program shall be implemented, and Material Safety Data Sheets shall be used in accordance with EM 385-1-1 Para. 01.B.06. Prior to bringing any hazardous material or material that will generate a hazardous waste in excess of the reportable quantity as defined by Federal, State or Local laws, it shall be the Contractor's responsibility to inform the Contracting Officers Representative in writing and submit for approval all plans for safe storage, labeling, use of emergency procedures and disposal.

**END OF SECTION 02081**

## SECTION 15991

### DISASSEMBLY AND REASSEMBLY OF EACH GENERATOR UNIT

#### **PART 1 GENERAL**

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#### **PART 2 PRODUCTS**

(NOT USED)

#### **PART 3 EXECUTION**

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## SECTION 15991

### DISASSEMBLY AND REASSEMBLY OF EACH GENERATOR UNIT

#### PART 1 GENERAL

##### 1.1 GENERAL INFORMATION

###### 1.1.1 Unit Description

There are six hydro-generating units at Wolf Creek. The turbines are vertical-shaft, Francis type rated at 62,500 horsepower, 105.9 RPM at 160 feet net head. The generators are rated 50,000 kVA, 0.90 power factor, 3-phase, 105.9 RPM, 13,800 volts. The generator is capable of continuous operation at 115%. The turbines were manufactured by Baldwin-Lima-Hamilton Corporation. The generators were manufactured by General Electric Company. The units began full operation in 1952.

###### 1.1.2 Unit Access

The Government will secure the unit for safe access as specified in SECTION 01010. The Government will unwater the unit in coordination with the generator repair work. Following pre-disassembly alignment checks and within 5 calendar days, excluding weekends, after receipt of request to remove thrust bearing oil, the Government will remove the oil and so notify the Contractor. The Contractor shall be responsible for handling and removal of all necessary residual oil from the unit as required. Access equipment furnished by the Contractor will remain the property of the Contractor.

###### 1.1.3 Description of Work

The work includes furnishing and installing all required scaffolding, tools, lifting, and handling devices not otherwise furnished by the Government. The disassembly and reassembly of the generator shall include removing and reinstalling all interferences and any auxiliary mechanical and electrical equipment. **This section covers work for units 4 and 6. All work for Unit 6 is to be considered optional.**

###### 1.1.4 Access to Contractor's Reports

Whenever written records of examinations, measurements, tests, checks, etc. are required, a copy of each shall be kept in a separate file in the Contractor's field office for access and examination by the Government. Copies of records that are required for submittal shall be included as well as those not requiring submittal.

## **1.2 REFERENCES**

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

### **1.2.1 American Society of Mechanical Engineers (ASME)**

ASME B30.2B (1992) Overhead and Gantry Cranes

### **1.2.2 Bureau of Reclamation**

Facilities Instructions, Standards, and Techniques Volume 2-1

Alignment of Vertical Shaft Hydro Units

### **1.2.3 Institute of Electrical and Electronics Engineers (IEEE)**

IEEE 1095 (1989) Guide for Installation of Vertical Generators and Generator/Motors for Hydroelectric Applications

## **1.3 SUBMITTALS**

Submittals required by this section shall be for Government approval (GA) or for information only (FIO), and shall be submitted as stated below, in accordance with SECTION 01330, SUBMITTAL PROCEDURES.

### **1.3.1 Disassembly and Reassembly Procedures (GA; SD-01 Data)**

Provide the disassembly and reassembly procedures, as required and described in paragraphs 3.1.2 and 3.3.2, a minimum of 90 calendar days prior to commencing the work. Any proposed deviations from the procedures shall be submitted at this time.

### **1.3.2 Method of Holding Fasteners (GA; SD-01 Data)**

Provide the method of holding fasteners used in major connections in position a minimum of 60 calendar days before site work commences (see paragraph 3.3.2.5.)

### **1.3.3 Design Values (GA; SD-01 Data)**

Provide the design values and a record of torque or elongation readings of all major bolted connections within 7 calendar days after completing the connections (see paragraph 3.3.3.) A copy of the readings shall be given the Government at the site immediately after the data is recorded for any given day's work.

#### **1.3.4 Reassembly Testing (GA; SD-01 Data)**

Provide reassembly testing data within 2 calendar days, excluding weekends, after completing each test segment under paragraph 3.4. Copies of the data shall be furnished to the Government at the site when each test segment is completed, or at the end of the working day.

#### **1.3.5 Date of Disassembly (FIO; SD-08 Statements)**

Notification of date of disassembly shall be provided 7 calendar days prior to commencement of disassembly (see paragraph 3.1.1.)

#### **1.3.6 Date of Disassembly Investigations and Inspections (FIO; SD-08 Statements)**

Provide notification 7 calendar days prior to the disassembly investigations and inspections (see paragraph 3.1.)

#### **1.3.7 Date of Finding Damaged or Defective Parts (FIO; SD-08 Statements)**

Notification shall be provided immediately when finding damaged or defective parts, followed up in writing within 3 calendar days (see paragraph 3.1.1.)

#### **1.3.8 Date of Inspection of Optional Repair or Replacement (FIO; SD-08 Statements)**

Notification shall be provided 7 calendar days prior to inspection of items specified for optional repair or replacement (see paragraph 3.2.1)

#### **1.3.9 Date of Reassembly of Major Generator Components (FIO; SD-08 Statements)**

Provide notification 7 calendar days prior to the reassembly of major generator components (see paragraph 3.3.1.)

#### **1.3.10 Date of Major Bolted Connections (FIO; SD-08 Statements)**

Provide notification 7 calendar days prior to making up major bolted connections (see paragraph 3.3.3.)

#### **1.3.11 Date of Reassembly Dimension, Alignment and Runout Checks (FIO; SD-08 Statements)**

Notification shall be provided 7 calendar days prior to the commencement of reassembly dimension, alignment and runout checks (see paragraph 3.3.4.)

#### **1.3.12 Dates of Reassembly Test Segments (FIO; SD-08 Statements)**

Notification shall be provided 7 calendar days prior to the commencement of each reassembly test segment (see paragraph 3.4.1.)

### **1.3.13 Pre-assembly Alignment Checks (GA; SD-09 Reports)**

Provide pre-disassembly alignment checks and measurement data, including certificate(s) of instrumentation calibration, within 5 calendar days after the checks and measurements are completed. Copies of the completed data sheets shall be given to the inspector the day they are completed (see paragraphs 3.1.2.2 and 3.1.2.3.)

### **1.3.14 Record of Unbolting Torque Readings (GA; SD-09 Reports)**

Within 5 calendar days, excluding weekends, following the disassembly of the unit, a record of unbolting torque readings of all major bolted connections shall be submitted (see paragraph 3.1.2.5.)

### **1.3.15 Examination Report (GA; SD-09 Reports)**

An examination report of all accessible generator components for wear, damage, etc. and recommendations for replacement or rehabilitation shall be submitted within 20 calendar days of removing the generator rotor from the unit (see paragraph 3.2.)

### **1.3.16 Reassembly Alignment Checks (GA; SD-09 Reports)**

Reassembly alignment checks, measurement and comparison data, with measuring instrumentation calibration, shall be submitted within 48 hours of completing work (see paragraph 3.3.4.) Copies of the data shall also be furnished to the Government at the site when the checks, measurements and comparisons have been completed.

## **PART 2 PRODUCTS**

(NOT USED)

## **PART 3 EXECUTION**

### **3.1 DISASSEMBLY**

#### **3.1.1 General**

Although the rotor has been removed from the unit, some disassembly may be required. All investigations, inspections and required submittal measurement data shall be coordinated with and witnessed by the Government, and required notice shall be given prior to such activities. The Contractor shall provide written notification of disassembly. All measured and recorded data shall be available for review and/or copying, and shall be submitted as required. During any additional disassembly, the Contractor shall identify all of the generator parts, noting the matchmarks and making new matchmarks where needed. The Contractor shall immediately

notify the Government when finding any damaged or defective part or subpart to allow maximum lead time for procurement of replacement parts. Any damage not reported in writing, shall be corrected by the Contractor at no additional cost to the Government.

### **3.1.2 Procedure**

3.1.2.1 General. The Contractor shall submit a disassembly/reassembly procedure, as specified in paragraph 1.3. Disassembly of the unit shall include all related parts as required for the specified replacement, rehabilitation and modification, and shall follow the Contractor's approved work schedule and disassembly/reassembly procedure.

3.1.2.2 Pre-Disassembly Alignment Checks. Prior to disassembly and after unwatering, the unit shall be checked for shaft-plumb, straightness, coupling offset, and runout, and reference alignment and position measurements recorded. Readings of dimension, alignment, and runout check shall be recorded. A reference centerline shall be established. The Contractor shall make and record the designated "as found" measurements on the generator and turbine. These measurements shall be to the nearest 0.001 inch. Plumbness of the generator and the turbine shaft in the "as found" condition should be established by the Contractor and the Contracting Officer, and recorded. The "as found" measurements shall include but not be limited to the following:

- Main exciter air gap readings at each pole
- Generator rotor air gap at each pole (top and bottom)
- Generator guide bearing to shaft readings at center of each shoe
- Vapor guards over generator and turbine guide bearings, measure the gap between the vapor guard and the shaft in four equally spaced locations u/s, d/s, left, and right
- Turbine guide bearing to shaft readings at the above four locations
- Runner upper and lower seal ring clearances

Checks and measurements shall be taken and recorded in accordance with appropriate paragraphs of IEEE 1095, and Power O&M Bulletin No. 2, Bureau of Reclamation Pub. "Alignment of Vertical Shaft Hydro Units" and as described below:

- (1) Remove interferences to expose the generator guide bearing and remove any other items (e.g., slip ring brushes) in the generator area that may interfere with obtaining accurate alignment data.
- (2) Install and locate two dial indicators at 90 degrees to each other at the turbine guide bearing journal.
- (3) Remove packing from turbine packing box and any interferences that would preclude the shaft from hanging free.
- (4) Jack rotor to establish an oil film between the thrust runner and thrust shoe.
- (5) Release brake/jacks.

(6) Position shaft in center of generator guide bearing and hold in position by adjusting four shoe segments of bearing at 90 degree spacings and position, as is practicable, on the unit's upstream (U/S), downstream (D/S), left (L) and right (R) centerlines. Left and right directions are to be determined when facing upstream. Shoes should just touch shaft. Verify center position with previously set dial indicators. After shaft is centered, reset the dial indicators to zero. With a micrometer, measure and record distances between ID of generator guide bearing housing and journal at 4 locations (U/S, D/S, L and R). Mark journal and housing measuring points and other clearance points selected. Permanently mark the selected measuring point location on the housing and stamp the measurement in a visible location near the mark.

(7) Measure and record the following clearances:

- turbine guide bearing
- minimum blade clearance
- packing box to shaft
- generator air gap at the four quadrant locations described in (6) above, one measurement per position

(8) Perform shaft plumb, straightness, coupling offset and thrust runner to shaft perpendicularity checks. Use 4-wire method. Fabricate brackets to suspend the plumb lines as near to the rotor as possible, to allow one measurement on the journal above the guide bearing. Make non-identical marks on the shaft at four points 90 degrees apart on the unit's upstream, downstream, left and right centerlines at positions along the shaft to be measured. Take at least two measurements on each shaft preferably on the areas machined for the shop shaft alignment check (a minimum of at least four mutually agreed upon measuring elevations). Determine shaft plumbness and straightness, coupling offset, and thrust bearing runner to shaft perpendicularity. Check to see that generator guide bearing is not affecting plumb readings.

(9) If necessary, jack the rotor to establish the oil film between the thrust runner and thrust shoes.

(10) Perform shaft runout check. Use 4-wire method. Install and locate two dial indicators at 90 degrees to each other at the turbine guide bearing journal. Take measurements near each of the guide bearings and adjacent to each shaft coupling. Rotate the shaft at 90 degree intervals through 360 degrees. Stop at each 90 degree position, take and record readings. Wait 5 minutes before taking readings, after rotating shaft. Rotate the shaft continuously and read the dial indicators. Record findings. Determine center of rotation.

(11) Position shaft in a plumb condition using pipe jacks if necessary.

(12) Check the clearance between the shaft and ID surface on the intermediate head cover. Determine centerline and record results.

(13) Remove pipe jacks, if applicable.

(14) At this time, all records shall be reviewed by the Government and Contractor. The Contractor shall evaluate the data and submit a proposed reference centerline location, with supporting information to substantiate the choice. The reference centerline should be the position which optimizes the rotor air gap and bearing clearance, while maintaining alignment of the turbine guide bearing housing and inner head cover bolt holes. Match mark relative measuring points.

(15) Position generator shaft on reference centerline.

Any additional measurements the Contractor deems necessary to enable him to reassemble the generator shall be taken. Partial disassembly may be necessary before some measurements can be taken.

3.1.2.3 Recorded Measurements. All measurements taken shall be recorded and records shall be submitted, as specified in paragraph 1.3. All measurements shall be taken to the nearest 0.001 inch, using calibrated instruments. Certification of calibration shall be submitted with measurements. All shaft-plumb, straightness and runout readings, and alignment and position measurements shall be defined in the Contractor's Quality Control Plan. Copies of the measurements shall be given to the Government at the completion of work. All readings, measurements and the established reference center line location shall be recorded and signed off by the Government prior to commencing further unit disassembly.

3.1.2.4 Commencement of Disassembly. The Contractor shall commence disassembly by removing such preliminary subassemblies as exciter, exciter support, turbine packing, temperature devices, piping, etc. All opened oil pipes, including those removed, shall be capped.

3.1.2.5 Torque Readings. Record unbolting torque readings of all major bolted connections as specified in paragraph 1.3.

3.1.2.6 Disassemble Generator. Remove the rotor-to-shaft attaching stud nuts and jam nuts and key retaining wedges. Attach lifting beam to rotor and remove rotor assembly. Heat shall not be applied in the vicinity of the thrust bearing or guide bearing. Position rotor assembly on rotor erection pedestal for the rewind work.

3.1.2.7 Disassemble Individual Components. Disassemble generator assemblies and components as required to perform the specified replacement, rehabilitation and modifications. Any burrs, sharp edges, nicks or gouges found on mating components shall be removed.

3.1.2.8 Placement of Major Components. Major components shall be placed only in approved storage or work areas.

## 3.2 INSPECTION AND REPORTS

Make a thorough examination of all accessible generator assemblies and components for wear, physical damage or other abnormal conditions, note and report same in writing, and include recommendations for replacement, modification, or rehabilitation for items and items of work not specified herein. As each of the equipment items specified for optional repair or replacement becomes available for inspection, the Contractor shall inform the Government.

## 3.3 REASSEMBLY

### 3.3.1 General

The Government shall be notified in writing prior to reassembly of major generator components, as specified in paragraph 1.3.

### 3.3.2 Procedure

Upon completion of all specified repairs, the unit shall be reassembled basically in reverse order of the disassembly procedure. All disturbed components and parts shall be thoroughly cleaned prior to reassembly. The Contractor shall reassemble the generator unit as required to provide a satisfactorily operating unit. The reassembly shall follow the approved schedule and procedures.

Unless otherwise specified or directed, all generator and excitation system reassembly procedures shall be in accordance with those outlined in IEEE 1095.

3.3.2.1 Adjustments and Measurements. The Contractor shall make all adjustments, level, align, check, rebalance, and torque as specified, required, or approved.

3.3.2.2 Miscellaneous Parts. The Contractor shall provide all new expendable or consumable and miscellaneous parts such as, but not limited to, keys, shims, spacers, O-rings, gaskets, seals, packing, electrical insulating gaskets, washers and bolt sleeves. Existing items contained in the preceding list shall not be reused, except for Government-approved keys and shims. Also, furnish and install new replacements for all nuts, bolts and washers damaged during disassembly.

3.3.2.3 Sealing Between Mating Surfaces. The Contractor shall provide O-ring seals between mating surfaces, that are exposed to liquids, for all replacement items furnished, unless otherwise approved. For reassembled existing items, with mating surfaces that are exposed to liquids and that do not have gaskets or seals, the Contractor shall use Loctite Gasket Eliminator No. 504 or equal on the mating surfaces, unless otherwise approved.

3.3.2.4 Surface Cleanup. Remove all Contractor installed lifting eyes. Grind and polish off any minor worn areas or scuff marks, minor pitting, or corrosion. Items disassembled by removal of weldments shall be repaired by an approved welding method prior to reassembly.

3.3.2.5 Major Connections. Fasteners used in major connections on existing, rehabilitated, and replacement items, where applicable, shall be tightened or preloaded using a hydraulic tensioner, heating rod or hydraulic torquing device. Fasteners shall be preloaded to 80 percent of material

yield strength, unless Contractor-provided calculations demonstrate otherwise. To the maximum practicable extent, fastener elongation shall be measured to verify tension. Nuts and heads of bolts of fasteners for major connections shall be held in place by a suitable approved lockbars, tack welded to the item being fastened. Method of holding fasteners in place shall be submitted for approval. The use of "Loctite" or similar materials will not be permitted. Do not tack weld to the nut or head of the bolt.

### 3.3.2.6 Replacement Parts

3.3.2.6.1 General. Replacement parts for parts that were removed or disassembled by the Contractor and found to be in need of replacement may be furnished by the Government if spare parts are held in Government possession. Parts not available in spare parts may be purchased by the Contractor under Bid Items "Part and Materials, Generator Unit 4" and "Part and Materials, Generator Unit 6."

3.3.2.6.2 Parts and Materials. Any bolts, nuts, studs, washers, or other standard or special fasteners that require replacement due to service-incurred damage, as determined by the Government, shall be replaced. All replacement fasteners will be of the same material, grade, temper, size, shape, etc. as the original, unless otherwise approved or directed. Square head replacement fasteners shall not be used. Standard fasteners shall be defined as fasteners which are available as shelf items from suppliers. Special fasteners shall be defined as fasteners other than standard fasteners. Repairs which are specifically directed in writing may require parts and materials which can only be determined after disassembly and inspection. Examples are bronze bushings, materials for replacement components, standard ball bearings, etc. Repairs may also require the transportation of items to a repair facility.

### 3.3.3 Fastener Torque or Elongation Check

Measure and record in writing all torque values for fasteners 3/4 inch in diameter and greater or elongation readings (including intermediate settings) of all the major bolted connections during assembly. Proposed torque or elongation for each fastener of a major connection shall be submitted. Fasteners 3/4 inch in diameter and greater shall be preloaded to 80 percent of the material yield strength, unless Contractor provided calculation demonstrate otherwise. The Government shall be notified in writing prior to bolting of major connections.

### 3.3.4 Dimension, Alignment, and Runout Check

Prior to the initial start of the unit after reassembly and prior to waterup, the contractor shall perform all the previously conducted shaft-plumb, straightness and runout checks, and alignment and position measurements specified in paragraph 3.1.2.2. Prior to unit watering all measurements are to be taken and recorded as previously done and submitted. The turbine shaft's packing shall not be installed during these checks. It is essential that an oil film be established on the thrust bearing running surfaces prior to any shaft rotation or lateral movement of the shaft. The Government shall be notified in writing prior to commencement of alignment checks. All alignment checks shall be performed in the presence of and witnessed by the

Government, unless waived in writing. The Contractor shall submit his findings, including a comparison of before and after conditions where possible.

### **3.4 TESTS TO BE CONDUCTED DURING AND AFTER REASSEMBLY**

#### **3.4.1 General**

The Contractor shall provide all personnel, equipment, and instruments necessary to make the tests, except that the Government will provide one (1) powerhouse operator to operate the unit. Suitable records shall be kept of all investigations and tests for approval. The Government shall be notified in writing prior to commencement of tests. All tests will be witnessed by the Government, unless waived in writing. Any item failing a test shall be adjusted, repaired, or replaced and retested until all tests are passed.

#### **3.4.2 System and Component Tests**

Upon completion of reassembly, the Contractor shall submit written notice to the Contracting Officer so that he can thoroughly examine the work and so that operational tests can be performed. The Government, with the assistance of the Contractor, will test operate and evaluate the unit, including all auxiliary systems and the Contractor shall correct all deficiencies associated with work performed. The Government will provide personnel to assist with required adjustments and settings, but not with deficiency corrections.

#### **3.4.3 Cable Test**

3.4.3.1 General. Test records shall list cable designation and actual test values obtained for all cables disturbed during disassembly.

3.4.3.2 "Megger" Test. After installation, but just prior to terminal connection, each conductor shall be "Megger" tested as follows: A 1000-volt "Megger" test shall be performed with all other conductors in each conduit or cable grounded. The final insulation resistance of each conductor shall not be less than one mega-ohm.

3.4.3.3 Continuity Test. Each conductor in every cable shall be given a continuity test from terminal to terminal.

3.4.3.4 Wire Check. A point-by-point wire check shall be made of all connections disturbed during the performance of this Contract. All errors shall be corrected before the circuits are energized.

#### **3.4.4 Limited Commercial Operational Test**

After all tests specified under paragraphs 3.4.2 and 3.4.3 above are satisfactorily completed and the equipment is determined to be in satisfactory operating condition by both the Contractor and Government, the unit will be given a 72-hour operational test. The Contractor will be given written notification of the date and time of the start of the test. The Contractor may witness the

start or any portion of the test, and sign-off, with the Government, that the test has commenced. The test will be considered successful after 72 hours of satisfactory continuous operation without requiring modifications, adjustments, or stoppage of oil leaks, and the Contractor so notified in writing.

### **3.5 PAINTING**

Painting of surfaces damaged by the Contractor during the course of the contract shall be restored to its original condition and shall match the existing color or colors.

**END OF SECTION 15991**

**SECTION 16210**  
**GENERATOR REWIND**

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**SECTION 16210**  
**GENERATOR REWIND**

**PART 1 GENERAL**

**1.1 GENERAL**

This section covers supplying new stator windings for units 4 and 6, all accessories specified herein, and spare parts; supplying new stator cores; removing the old windings and stator cores; installing the new stator cores; and installing the new stator windings and accessories. All associated testing is included. **All work for Unit 6 is to be considered optional.**

**1.2 REFERENCES**

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

**1.2.1 American National Standards Institute (ANSI)**

- |             |  |
|-------------|--|
| ANSI C50.10 | (1990) General Requirements for Synchronous Machines (rescinded)   |
| ANSI C50.12 | (1982; R1989) Requirements for Salient-Pole Synchronous Generators and Generator/Motors for Hydraulic Turbine Applications |

**1.2.2 American Society For Testing And Materials (ASTM)**

- |             |   |
|-------------|---|
| ASTM A 343  | (1997) 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 A 717  | (2001) Standard Test Method for Surface Insulation Resistivity of Single-Strip Specimens  |
| ASTM A 720  | (1997) standard Test Method for Ductility of non-oriented electrical sheet steel  |
| ASTM D 1868 | (1998) Standard Test Method for Detection and Measurement of Partial Discharge (Corona) Pulses in Evaluation of Insulation Systems  |

**1.2.3 American Welding Society, Inc. (AWS)**

- |          |  |
|----------|--|
| AWS A5.8 | (1992) Specification for Filler Metals for Brazing |
|----------|--|

- AWS B2.1 (2000) Welding Procedure and Performance Qualification
- AWS D1.1 (2002) Structural Welding Code
- AWS QC1 (1996) Standard for AWS Certification of Welding Inspectors

#### **1.2.4 Canadian Electrical Association (CEA)**

CEA RTP-76-17-DB Diagnostic Testing of Generator Insulation, Part 3: Partial Discharge Analyzer Coupling Systems

Hydroelectric Turbine-Generator Units Guide for Erection Tolerances and Shaft System Alignment Part I – Definitions

Hydroelectric Turbine-Generator Units Guide for Erection Tolerances and Shaft System Alignment Part II – Vertical Shaft Units with Francis Turbines or Reversible Pump-Turbines.

#### **1.2.5 Institute of Electrical and Electronics Engineers (IEEE)**

- IEEE 43 (1974; R2000) Recommended Practice for Testing Insulation Resistance of Rotating Machinery
- IEEE 56 (1977; R1991) Guide for Insulation Maintenance of Large Alternating-Current Rotating Machinery
- IEEE 95 (1977; R2002) Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Direct Voltage
- IEEE 115 (1995) Guide: Test Procedure for Synchronous Machines
- IEEE 286 (1975; R2000) Recommended Practice for Measurement of Power-Factor Tip-Up of Rotating Machinery Stator Coil Insulation (Rev. 1981) (Withdrawn)
- IEEE 522 (1992) Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating-Current Rotating Electric Machines
- IEEE 1043 (1996) Recommended Practice for Voltage-Endurance Testing of Form-Wound Bars and Coils
- IEEE 1095 (1989) Guide for Installation of Vertical Generators and Generator/Motors for Hydroelectric Applications

## **1.2.6 National Electrical Manufacturers Association (NEMA)**

NEMA LI 1 (1998) Industrial Laminated Thermosetting Products

## **1.3 SUBMITTALS**

Government approval is required for all submittals with a “GA” designation; submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with SECTION 01330.

### **1.3.1 Transposition Description (GA; SD-01 Data)**

Provide a description of the transposition within each stator coil and/or in external coil-to-coil connections. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.2 Coil Insulation System (GA; SD-01 Data)**

Provide a description of the coil insulation system, including processes and materials employed to meet specification requirements. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.3 Outline & Description of Test Methods (GA; SD-01 Data)**

Provide an outline and description of the test methods and equipment to be employed in the factory tests for the stator coils including all required test values. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.4 Test Facility for Prototype (GA; SD-01 Data)**

Provide the name and address of the facility proposed to perform the accelerated life testing of the prototype coils and the production run coils. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.5 Stator Lamination Procedure (GA; SD-01 Data)**

Provide the stator lamination fabrication procedure including production tolerances. Provide information on insulating varnish. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.6 Test Methods for Epstein Test (GA; SD-01 Data)**

Provide an outline and description of the test methods and equipment to be employed in the Epstein test for the stator core laminations including all required test values and acceptance criteria. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.7 Test Methods for Franklin Tests (GA; SD-01 Data)**

Provide an outline and description of the test methods and equipment to be employed in the Franklin test for the stator core laminations including all required test values and acceptance criteria. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.8 Calculations & Metallurgical Data on Vent Duct Spacers (GA; SD-01 Data)**

Provide calculations & metallurgical data on vent duct spacers. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.9 Stator dc I<sup>2</sup>R (copper) Losses, Design Calculations (GA; SD-01 Data)**

Provide detailed design calculations illustrating how the stator dc I<sup>2</sup>R (copper) losses are determined at 75°C. Calculations shall illustrate the composition of the various portions of winding circuit resistance, including number of coils in series and parallel connections, end connections, circuit rings, etc. Submit within 90 calendar days after date of receipt of written notice of award.

### **1.3.10 Stray Load Loss Calculations (GA; SD-01 Data)**

Provide detailed calculations showing how the stray load loss is determined. Submit within 90 calendar days after date of receipt of written notice of award.

### **1.3.11 Maximum Temperature Rises for New Windings; GA; SD-01 Data**

Provide the maximum temperature rises of the new windings above 40°C ambient at rated load, voltage, and power factor. Submit within 90 calendar days after date of receipt of written notice of award.

### **1.3.12 Stator Winding Temperatures (GA; SD-01 Data)**

Provide the calculated stator winding temperature rise as indicated by embedded temperature detectors and calculated stator winding hot spot temperature at rated load, voltage, and power factor. The relationship between the operating "hot spot" temperature of the stator coils shall be demonstrable by direct measurement or by recognized methods of calculation which have been correlated to special factory tests on a basically similar machine. Submit within 90 calendar days after date of receipt of written notice of award.

### **1.3.13 Maximum Radial Force on Coils (GA; SD-01 Data)**

Provide the calculated maximum radial force on each coil side in slots where both coil sides are in the same phase and in slots where the coils are in different phases. Forces shall be calculated at rated load, voltage, and power factor and at worst fault condition. Submit within 90 calendar days after date of receipt of written notice of award.

#### **1.3.14 Deflection of Slot Wedging (GA; SD-01 Data)**

Provide the initial deflection of slot wedging spring-type filler and radial pressure applied to stator coils in slot portions. Submit within 90 calendar days after date of receipt of written notice of award.

#### **1.3.15 Minimum Acceptable Deflection of Slot Wedging (GA; SD-01 Data)**

Provide the minimum acceptable deflection of the slot wedging spring-type filler after extended operation, and the radial pressure applied to stator coils at the minimum acceptable deflection. Include calculations to show that the radial pressure wedging system forces will exceed the non-fault-condition forces throughout the life of the winding. Submit within 90 calendar days after date of receipt of written notice of award.

#### **1.3.16 Procedures for Stacking the Stator Core (GA; SD-01 Data)**

Provide the detailed procedures for stacking the stator core including stacking tolerances. Submit within 90 calendar days after date of receipt of written notice of award.

#### **1.3.17 Installation Procedures for New Winding (GA; SD-01 Data)**

Provide the Installation procedures for the new winding. These shall include a description of the brazing methods for winding connections and the quality control checks to be used in those operations. They shall also include method of maximizing bar-to-bar clearances (tolerance on level of bars). Submit within 90 calendar days after date of receipt of written notice of award.

#### **1.3.18 Description of Materials for Assembly (GA; SD-01 Data)**

Provide a description of the materials for the assembly of the stator coils into the generator stator. This includes all wedging, filler, and bracing materials. Submit within 90 calendar days after date of receipt of written notice of award.

#### **1.3.19 Technical Details of the Interlaminar Insulation Test (GA; SD-01 Data)**

Provide technical details of the interlaminar insulation test including power requirements. Submit within 120 calendar days after date of receipt of written notice of award.

#### **1.3.20 Description of Test Methods- Field Tests (GA; SD-01 Data)**

Provide an outline and description of the test methods and equipment to be employed in the field tests for the completed winding. Submit within 120 calendar days after date of receipt of written notice of award.

### **1.3.21 Description of Test Methods – Special Field Tests (GA; SD-01 Data)**

Provide an outline and description of the test methods and equipment to be employed in the special field tests for the completed winding. Submit within 120 calendar days after date of receipt of written notice of award.

### **1.3.22 Assembly and Disassembly Procedures (GA; SD-01 Data)**

Provide assembly and disassembly procedures. These shall include alignment, centering, and balancing procedures and procedures for recentering the guide bearings. Submit within 120 calendar days after date of receipt of written notice of award.

### **1.3.23 Procedures for Removal of the Existing Stator Winding (GA; SD-01 Data)**

Provide the procedures for removal of the existing stator winding. Submit within 120 calendar days after date of receipt of written notice of award.

### **1.3.24 Procedures for Removing the Existing Stator Core (GA; SD-01 Data)**

Provide the procedures for removing the existing stator core. Submit within 120 calendar days after date of receipt of written notice of award.

### **1.3.25 Procedures for Cleaning, Inspecting and Testing Rotor (GA; SD-01 Data)**

Provide the procedures for cleaning, inspecting and testing the rotor. Test procedure shall contain acceptance/rejection criteria. Submit within 120 calendar days after date of receipt of written notice of award.

### **1.3.26 Cross Section of Proposed Stator Coils (GA; SD-04 Drawings)**

Provide a cross-sectional view of the proposed stator coils in a stator slot, describing the stranding arrangement, strand dimensions, copper cross-sectional area, strand and conductor insulation details (including insulating material types and thicknesses), slot fillers, wedging details, and partial discharge suppressive treatments. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.27 Exterior Dimensions of the Stator Coils (GA; SD-04 Drawings)**

Provide the exterior dimensions of the stator coils. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.28 Dimensions and Details of the Wedges and Fillers (GA; SD-04 Drawings)**

Provide the exterior dimensions and details of the wedges and fillers. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.29 Circuit Ring Configuration and Dimensions (GA; SD-04 Drawings)**

Provide the circuit ring configuration and dimensions. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.30 Details of the Connections (GA; SD-04 Drawings)**

Provide details of the connections. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.31 Details of the Main and Neutral Leads (GA; SD-04 Drawings)**

Provide details of the main and neutral leads. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.32 Bracing Configuration for the Winding (GA; SD-04 Drawings)**

Provide the bracing configuration for the winding. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.33 Winding Diagram (GA; SD-04 Drawings)**

Provide the winding diagrams showing three-phases in different colors and showing PDA and RTD locations. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.34 Details of PDA (GA; SD-04 Drawings)**

Provide the details of the partial discharge analysis (PDA) system and installation, including coupling capacitor details, coupling capacitor location, termination panel details, termination panel location, and coaxial cable routing. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.35 Details of New Nameplates (GA; SD-04 Drawings)**

Provide the dimensions, materials and arrangement of information for the new nameplates. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.36 Details of Stator Laminations and Vent Duct Spacers (GA; SD-04 Drawings)**

Provide the dimensions, materials and tolerances for stator laminations and vent duct spacers. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.37 Details of the Completed Stator Core (GA; SD-04 Drawings)**

Provide the dimensions and tolerances for the completed stator core. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.38 Stator Core Clamping System (GA; SD-04 Drawings)**

Provide the stator core clamping system. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.39 Stator Lamination Die (GA; SD-04 Drawings)**

Provide details of the die set including dimensions, dimensional tolerances, material, methods of securing die set to a press, identification of fasteners, and operating instructions. Submit within 60 calendar days after date of receipt of written notice of award.

### **1.3.40 Test Reports (GA; SD-09 Test Reports)**

Test reports for all tests shall be submitted for approval. The equipment will not be accepted prior to approval of the submittals.

### **1.3.41 Coil Test Record (FIO; SD-19 Records)**

Each coil shall be given a unique identification, and a permanent record of each coil shall be kept. The test results for all coils, whether included in the winding or rejected as a result of any test, shall be included in this record. This record shall be submitted at the time of delivery of the coils. The Contractor shall include the slot number where each coil has been installed in this record. The record shall be submitted at the completion of the rewind.

### **1.3.42 Stator Frame Support Pad Procedure (GA; SD-01 Data)**

The stator frame support pad grout removal and replacement procedure shall be submitted for approval 60 calendar days after date of receipt of written notice of award.

## **1.4 EXISTING GENERATOR INFORMATION**

### **1.4.1 Unit Identification and Nameplate**

Units 6 and 4 at Wolf Creek Powerplant are air-cooled, vertical hydro-generators, manufactured by General Electric Company. The units were brought on line in 1952

### **1.4.2 Description of Generator**

The generator is designed for star connection of the stator winding with each phase consisting of four parallel paths of 38 three-turn coils, for a total of 456 coils and slots. There are sixteen strands per turn. Coil insulation is of the asphalt-mica type.

Generator ratings, as defined by the nameplate stamping information are as follows:

50,000 kVA  
 0.9 Power Factor  
 13,800 V  
 3-phase  
 60 Hz  
 105.9 RPM  
 115 percent overload capability

### 1.4.3 Test Report Data

The following information is from the test report:

(a) Operating Temperature Degrees Centigrade (°C).

|   | Maximum |
|---|---------|
| Stator Winding by RTD   | 80      |
| Temperature of air entering generator<br>(discharge side of cooler) | 39.5    |
| Stator Winding temperature rise                                     | 40.5    |

(b) Losses in Kilowatts.

(1) Load of (at 13.8 kV and 0.9 power factor).

|                           | 57,500 | 50,000 | 37,500 | 25,000 | 12,500 |
|---------------------------|--------|--------|--------|--------|--------|
|                           | kVA    | kVA    | kVA    | kVA    | kVA    |
|                           | 115%   | 100%   | 75%    | 50%    | 25%    |
|                           | rated  | rated  | rated  | rated  | rated  |
| Friction and Windage      | 186    | 186    | 186    | 186    | 186    |
| Core                      | 367    | 367    | 367    | 367    | 367    |
| Stray-Load                | 231    | 163    | 90     | 50     | 22     |
| Armature I <sup>2</sup> R | 263    | 199    | 111.8  | 50.2   | 12.4   |
| Rotor I <sup>2</sup> R    | 194    | 164    | 122.3  | 91.2   | 67.8   |
| TOTAL *                   | 1241   | 1079   | 877.1  | 744.4  | 655.2  |

\*Does not include exciter losses.

(2) Load of (at 13.8 kV and 1.0 power factor).

| 57,500 | 50,000 | 37,500 | 25,000 | 12,500 |
|--------|--------|--------|--------|--------|
| kVA    | kVA    | kVA    | kVA    | kVA    |
| 115%   | 100%   | 75%    | 50%    | 25%    |
| rated  | rated  | rated  | rated  | rated  |

|                           |      |        |       |       |       |
|---------------------------|------|--------|-------|-------|-------|
| Friction and Windage      | 186  | 186    | 186   | 186   | 186   |
| Core                      | 367  | 367    | 367   | 367   | 367   |
| Stray-Load                | 231  | 163    | 90    | 50    | 22    |
| Armature I <sup>2</sup> R | 263  | 199    | 111.8 | 50.2  | 12.4  |
| Rotor I <sup>2</sup> R    | 112  | 98.5   | 78.1  | 64.3  | 49.4  |
| TOTAL *                   | 1159 | 1013.5 | 832.9 | 717.5 | 636.8 |

\*Does not include exciter losses.

(c) Resistance Values.

Armature resistance (L-N) at 25°C is 0.0127 ohm.

Rotor resistance at 25°C is 0.1463 ohm.

(d) Telephone-Influence Factors.

No-load, balanced = 9.69 (L-L).

#### 1.4.4 Existing Damage to the Generator

Unit 6 has sustained several coil failures over the years. It currently has four coils cut out of the same phase. Unit 4 has also sustained several coil failures. Iron damage has occurred in both units.

#### 1.4.5 Inspection By Contractor

The government will make Unit 6 generator available at the Contractor's request to permit the Contractor to inspect the generator and obtain dimensions required to design the winding replacement. The inspection schedule shall be coordinated with the Contracting Officer. The generator rotor will not be removed for this inspection. The Contractor shall be responsible for obtaining and verifying dimensions and other information, including information contained in this specification, that may be required to design a replacement stator winding. Measurements shall be made on the generator as necessary to ensure that all materials supplied under this contract will meet all contract requirements. A spare coil is available at the powerhouse for measurement by the Contractor. However, the Government will not assume any responsibility for the accuracy of the dimensions of the coil. The Contractor shall be responsible for developing the necessary information required for design. Any discrepancies between information given in this document and information developed shall be brought to the attention of the Government before proceeding.

## PART 2 PRODUCTS

### 2.1 MATERIALS

All materials shall conform to the applicable specifications and standards listed and to the additional requirements specified herein. Any materials required in the work, but not covered by the specifications, shall be approved for the purpose intended prior to their incorporation.

Reference to any equipment, article or catalog number shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may use any equipment, material, or article which in the judgment of the Contracting Officer is equal to that named.

## **2.2 PROTOTYPE STATOR COILS**

Prior to manufacture of the stator winding four prototype coils, plus any additional coils which may be required because of failure, shall be manufactured for accelerated life testing. The coils shall be identical to those manufactured under paragraph 2.4, and they shall have passed all the factory tests specified in paragraph 3.3. The testing procedure shall be as stated in paragraph 3.2.

## **2.3 WINDING RATING AND INSULATION CLASS**

The new stator winding shall be rated at 75,000 kVA. The stator coils and winding installation materials shall operate within Class F temperature limits as defined in ANSI C50.12. Stator winding temperature rise shall not exceed 75<sup>0</sup>C above a cooler discharge air temperature at 40<sup>0</sup> C when operated at 75,000 kVA.

## **2.4 NEW STATOR COILS**

### **2.4.1 General**

The new stator coils to be supplied under this specification shall incorporate modern practice in design, material, and workmanship. Coils shall be of the hard, multi-turn type designed to minimize eddy current loss. The strands shall be annealed copper, free from splinters, flaws, rough spots, or short radius bends. All finished outside edges of each coil shall be rounded with a minimum radius of 1/16 inch. The narrow side of the slot portion of each stator coil shall have a flat bearing surface of at least 3/8 inch. Coil leads shall not be cut or tailored for any particular slot and shall be designed for use in any slot.

### **2.4.2 Conductor Strands**

Strands shall be continuous (splice free) within the entire mean turn length of each coil and shall be insulated with continuous filament glass or Dacron-glass fibers, or mica tape, bonded to the copper with a suitable bonding agent. A brick type construction may be used in which alternate strands are insulated with continuous filament glass or Dacron-glass, with the remaining strands insulated with a high temperature enamel. The enamel-insulated strands shall be smaller than the other strands, or a separator strip shall be provided in the center of the turn, so that the corners of the enamel-insulated strands are not able to touch. Conductor strands shall be sized and arranged to minimize eddy and circulating current losses.

### **2.4.3 Turns**

The slot and end winding portions of the assembled strands shall be bonded into a homogenous structure of controlled size using heat and pressure. Strand bonding resins shall have properties

and characteristics to prevent bond failure due to the mechanical, thermal, and chemical effects associated with thermal cycling while operating within the Class F temperature limits for which the winding is to be designed. The turns shall be insulated with multiple layers of mica tape in combination with suitable backing materials.

#### **2.4.4 Ground Insulation**

2.4.4.1 General. Ground insulation shall consist of multiple overlapped layers of mica splitting and/or mica flake tapes applied continuously and of equal thickness throughout the entire length of the coil. In coils that are machine-wound in the slot section, a scarf joint will be allowed between the machine-wound slot section and the hand-wound end turn. The entire scarf joint shall be at least four inches above the slot paint or conductive slot tape. The mica splitting tape, if used, shall consist of large white mica splittings, NEMA Grade C or better. All mica tapes shall be constructed with a glass or polyester fabric backing material. A suitable protective covering tape shall be applied over the ground insulation mica tape.

2.4.4.2 Drying. After the application of all insulation, the coils shall be given appropriate drying treatments to remove absorbed or trapped moisture and gases from the insulation system.

2.4.4.3 Resin Impregnation and Curing. After drying treatments, the coil insulation shall be completely filled with a solventless polyester or epoxy resin using a vacuum-pressure or mechanical impregnation process. After impregnation, the coil insulation system shall be cured by the application of heat and pressure to the slot and end winding portions of the coils. Slot portions shall be sized to closely controlled dimensions and end portions shall be restrained with suitable pressure devices to assure a well compacted insulation structure. The insulation in the slot portion and under the grading paint shall be free of internal voids visible, when dissected, to the naked eye.

2.4.4.4 Alternate Construction. B-stage or loaded tapes may be used in lieu of the resin impregnation process described in paragraph 2.4.4.3. After the drying treatments, the coils shall be formed by heat and pressure in the same manner described in paragraph 2.4.4.3. The fill and void-free requirements given in paragraph 2.4.4.3 must be met.

#### **2.4.5 Finish and Partial Discharge (Corona) Suppression Treatments**

Slot portions of the stator coils, and a suitable distance beyond, shall be treated with a semiconducting compound capable of giving positive electrical contact between the treated portions of the coil surface and the entire length of the core slot walls. This semiconducting treatment shall be designed to eliminate corona discharges between coil and slot surfaces and between top and bottom coil sides.

#### **2.4.6 Graded Suppression Treatment**

A voltage grading semiconducting compound shall be applied to a suitable portion of the stator coil surface extending outward from the semiconducting treatment. This voltage grading semiconducting treatment shall be of a length and resistivity to limit coil surface voltage

gradients to levels well below surface discharge (corona) onset levels under normal operating voltage stresses. The semiconducting treatment shall be exposed and accessible for inspection and possible repair. The winding shall exhibit no visible corona during a black-out test of up to 10 kV (see paragraph 3.21(4)). Coil surfaces beyond the discharge suppressive treatments shall be treated with a finish capable of resisting exposure to dampness, attack by oil vapors, Contractor-recommended cleaning solvents, or other materials to which the winding may be exposed during its operating life.

#### **2.4.7 Testing**

The new coils shall all be subjected to the tests listed in paragraph 3.3.

#### **2.4.8 Coil Identification and Record**

Each coil shall be given a unique identification. A permanent record for each coil shall be kept whether the coil is included in the finished winding or not. The record shall include the results of all coil tests.

#### **2.4.9 Quantity**

Sufficient coils to make up a complete winding shall be supplied. In addition, the six production run coils, plus any which may be additionally required because of failure, shall be supplied for the accelerated life testing specified in paragraph 3.2. None of the coils subjected to accelerated life tests will be permitted to be used in the final winding. The spare coils listed in paragraph 2.13.2 shall also be supplied.

### **2.5 RESISTANCE TEMPERATURE DETECTORS**

Twenty four (24) standard resistance temperature detectors (RTD's), of 10 ohms at 25°C plus or minus 0.2°C shall be supplied for installation in the stator winding. The detectors and their location shall be in accordance with paragraph 5.2 of ANSI C50.10. The Contractor shall replace all existing RTD cable with insulated cable designed to withstand a minimum insulation operating temperature of 120°C. Each detector shall be supplied with three connecting leads of sufficient length for installation to existing terminal blocks in the generator accessory lead terminal box. Leads may be solder-spliced; mechanically spliced leads shall not be used. The portion of the temperature detector in the slot shall have a semiconducting coating.

### **2.6 NEW CIRCUIT RINGS**

#### **2.6.1 General**

New circuit rings, complete with all necessary connections, taps, adapters, braces, supports, and materials for making the necessary line and neutral connections between the windings, the terminals of the phase buses, and the terminals of the neutral current transformer bus assembly shall be supplied for installation.

## **2.6.2 Electrical Configuration**

The stator winding shall be wye-connected. Each phase of the stator winding shall consist of multi-turn coils, with the circuits per phase connected to give two parallel paths, as nearly equal as feasible, with neutral leads and the common main lead brought out within the generator housing at an approved location. The individual coils in each of the two parallel paths which are connected to the circuit rings, shall be connected in locations such that the differential protection of the winding will not be adversely affected by circulating currents between the parallel paths caused by misalignment of the rotor with respect to the stator. False tripping of differential relays due to circulating currents shall be considered an adverse effect. Readjustment of relay restraint settings to correct such a condition will not be permitted.

## **2.6.3 Physical Construction**

The new circuit rings, supports, and connecting leads shall be designed for installation in the same general location as the existing equipment, without alteration of the air baffling system or modification of structural parts. Each circuit ring shall be made up of not more than twelve pieces. All factory joints shall be brazed in accordance with the requirements of AWS A5.8. The arrangement of the leads shall be such that the main leads and the neutral leads can be readily interchanged by changing their connections to the circuit ring buses without the need to braze or solder.

## **2.6.4 Insulation**

The circuit rings and connections shall be insulated for 15 kV with full Class F insulation or better composed of mica or glass tapes.

## **2.6.5 Neutral Current Transformers**

The existing winding has multi-turn coils with the circuits per phase connected to provide two equal parallel paths, with 1500:5 ratio, 15 kV, Type JK-9 current transformers installed in the neutral end of one half winding in each phase. The current transformers are part of the generator split-phase differential relaying protective scheme which is to be retained. If a different current transformer is required as a result of a change in the circuit ring configuration, three new current transformers (one for each phase) of suitable rating for use in the differential protection scheme shall be supplied as part of the winding supplies.

## **2.7 FILLERS, WEDGES, TIES, AND BLOCKING MATERIALS**

### **2.7.1 General**

All material in the slot or used in bracing the winding shall be of an approved Class F or higher insulation.

## **2.7.2 Side Packing**

One of the following side packing systems shall be used. No systems will be approved which require non-spring-type side filler to be inserted in the slot after the coil has been inserted:

2.7.2.1 Multiple layers of conducting felt shall be used to completely fill the space between the coils and the sides of the slots.

2.7.2.2 A semiconducting silicone rubber compound shall be applied to the sides of the coils and cured before coil insertion. The silicone rubber shall form an interference fit with the sides of the slot.

2.7.2.3 A semiconductive coil wrapper used in conjunction with conducting putty shall be continuously applied throughout the length of the slot. The coil shall be inserted into the slot before the putty has cured.

2.7.2.4 A ripple spring shall be driven between one side of the coil and the slot to form an interference fit. Acceptable deflection of the spring shall be submitted in the installation procedure.

2.7.2.5 Other approved systems.

## **2.7.3 Center Filler and Bottom Filler**

All center filler and bottom filler shall be fabricated from semiconducting material. The semiconducting material shall be impregnated throughout and shall not be coated on top of an insulating backing. A center filler between the two coil sides in a slot shall be supplied of such a thickness as to prevent interference between the coils in the straight part extension. RTD's shall be installed in place of the center filler in specified slots. A bottom filler shall be used between the bottom coil side (furthest from the bore) and the bottom of the slot.

## **2.7.4 Spring-Type Filler Material**

Spring-type filler material, or other approved follow-up, shall be installed between the front filler and the wedge. Spring-type filler material shall pass the tests of paragraph 3.4.

## **2.7.5 Wedges and Top Fillers**

Stator slot wedges shall be manufactured from NEMA Standard LI1, Grade G11 material. The slot wedge cross sectional shape shall match the wedge groove shape of the stator laminations. Wedge width shall result in a snug, sliding fit when placed in position in the slot. Top fillers shall be furnished in a variety of thicknesses to ensure that a proper thickness combination is available to produce a satisfactory radial wedging pressure. A method for verifying spring type filler material at the three quarter points of the slot, as a minimum, shall be submitted for approval. End wedges shall be secured in place to prevent axial movement or migration of slot wedges or wedge fillers, but in no case shall epoxy be used to secure the wedges. Wedges shall

be furnished with cutbacks at the cooling air passages. These cutbacks shall be designed to enhance the air flow.

### **2.7.6 Two-Part Wedges**

If two-part wedges are used, the wedges and slides shall be assembled using a master slide to select the slide of correct thickness. Acceptable wedge deflection, after slide is driven, shall be specified. The slide shall neither project above the top of the wedge nor touch the wedge below. All wedges shall be installed so that all slides are driven from above. A locking system for restricting the possible vertical movement of the wedges shall be provided, but in no case shall epoxy be used to secure the wedges. All wedges shall be tight upon completion of the wedging.

### **2.7.7 End Winding Bracing and Blocking Material**

End winding bracing material shall be Class F and shall include resin-impregnated conforming material, blocks, and glass twine. The conforming material shall be dacron felt and shall be impregnated thoroughly with resin before use between the coils. The blocks shall be glass based and shall be used when the space cannot be filled with resin-impregnated dacron felt. After installation the ties are to be saturated with the resin.

## **2.8 NEW GROUT FOR THE STATOR FRAME SOLE PLATE AREA**

**The contractor shall furnish and install new non-shrink grout under the stator support frame sole plate area. Non-shrink grout shall be SIKAGROUT 212, high performance, cementitious grout or approved equal.**

## **2.9 NEW STATOR IRON**

The Contractor shall furnish the required number of new laminations to completely stack a new stator core. The laminations shall be made from high-grade nonaging silicon steel. The loss index shall be similar to, but not worse than, the original laminations. The thickness of the steel shall not be greater than the original steel. Each lamination shall be coated on both sides with an insulation varnish or other suitable material to minimize eddy current losses.

## **2.10 STATOR CORE VENT DUCT SPACERS**

The Contractor shall furnish the required number of new stator iron vent duct spacers to completely stack a new stator core.

## **2.11 NEW STATOR LAMINATION DIE**

The Contractor shall furnish to the Government a die for the new laminations. The die shall be of straight cut type, suitable for punching all the laminations needed for the work. The Contractor shall submit reports of the condition of the die, such as the number of sharpening the die can withstand and the number of laminations can be punched between sharpening. The die

shall be sharpened and packaged in clearly labeled box prior to being turned over to the Government.

## **2.12 NEW STATOR CLAMPING SYSTEM**

The Contractor can either reuse the existing clamping system or furnish a new system. A new system shall include clamping plates, fingers, through bolts and nuts.

## **2.13 PARTIAL DISCHARGE ANALYSIS SYSTEM**

### **2.13.1 General**

A complete Partial Discharge Analysis (PDA) system that is suitable for on-line testing of the generator stator winding shall be designed and furnished for installation. The system shall provide on-line partial discharge measurements as required to frequently and randomly monitor the condition of the stator winding without a service outage. The system shall include protective devices and circuitry as necessary to prevent circulating currents and unsafe voltages from appearing at the termination cabinet. All parts of the system shall be furnished. Reference CEA RPT-76-17-DB.

### **2.13.2 Coupling Capacitors**

2.13.2.1 General. Six coupling capacitors shall be furnished for permanent installation in the winding, two in each phase. The capacitors shall be potted mica-type. The type proposed must have been in use on at least two 10 MW or larger generators for at least 12 months as PDA coupling capacitors, two per phase. The capacitors shall be differentially connected to the coil jumpers of the circuit ring. The system shall withstand the dc and ac high potential generator tests.

2.13.2.2 Rating. The coupling capacitors shall be rated 80 or 100 pF  $\pm 5$  percent, 20,000 peak working volts, noise- and corona-free to a minimum of 15 kV ac rms and capable of withstanding 40 kV ac rms for one minute. They must withstand (with suitable bracing) vibration and shock levels typical of mounting locations on circuit rings, end turns, and coil-circuit ring connections.

2.13.2.3 Construction. The capacitors shall be the potted mica-type, equal or better than Iris EMC available from Iris Power Engineering Inc.

### **2.13.3 Leads**

Sufficient leads shall be furnished to go from the coupling capacitors to the termination panel. The leads shall be RG58A/U coaxial cable. Each lead shall be terminated with a BNC connector.

#### **2.13.4 Termination Panel**

The termination panel shall be sized to accommodate all coaxial cable leads, BNC connectors, terminal boards, and termination and protective devices. Each coaxial cable shall be terminated with a 1.5 kilo-ohm, 1 watt, non-inductive resistor and a gas discharge surge arrestor at the rear of the BNC.

#### **2.13.5 Analyzer**

A portable partial discharge analyzer, which is specifically designed and equipped for use with the permanently installed capacitive couplers, shall be provided. The analyzer unit furnished shall be an Iris Power Engineering Inc. model PDA-IV or approved equal. A second analyzer for the optional work on Unit 4 is not required. The analyzer shall provide printouts of the monitored activity. It shall include the following:

2.13.5.1 The PDA differential amplifier shall reject system noise and amplify the partial discharge pulses and sort them with respect to magnitude, polarity, and phase.

2.13.5.2 The analyzer shall provide printouts of the monitored activity.

2.13.5.3 The analyzer unit shall be equipped with a portable computer-based controller equipped with hard drive and a color VGA monitor, and shall be equipped with the latest software.

2.13.5.4 A printer shall be furnished which is compatible with the analyzer equipment, with color option and color ribbon installed; and with two spare color ribbons and two spare black ribbons.

2.13.5.5 A traveling case shall be furnished for the printer.

2.13.5.6 All cables and connectors required for connecting the analyzer with the BNC panel, and also with a high-speed oscilloscope, shall be provided.

2.13.5.7 The analyzer shall be provided with a partial discharge analyzer tester, a test guide for operating personnel, an instruction manual for maintenance personnel, a standard operating spares kit, and a transit case.

2.13.5.8 Bandwidth of no less than 350 MHz (at 3dB down).

2.13.5.9 Data display in 3-D (three axis) format.

2.13.5.10 Data format compatibility with MICAA expert system software, for direct input.

2.13.5.11 Equipment connected to all six connectors simultaneously.

2.13.5.12 An accessory to extend the dynamic range for testing individual coils.

## **2.14 SPARE PARTS**

### **2.14.1 General**

All spares shall be shipped to the powerplant when work begins at site.

### **2.14.2 Coils and Supplies**

A set of thirty (30) spare coils, including end connectors, shall be supplied, along with all non-deteriorating parts necessary for their installation, packing, and wedging. All spare coils supplied shall be interchangeable with, and shall be of the same material and workmanship as, those specified in paragraph 2.4.

### **2.14.3 RTD's**

Two (2) RTD's, identical to those provided under paragraph 2.5 shall be provided. All leads shall be equal to the longest provided under paragraph 2.5 and shall conform to the requirements of that paragraph.

### **2.14.4 Spare Laminations**

A set of one hundred (100) spare laminations shall be supplied. These laminations shall be identical to those specified in paragraph 2.8.

### **2.14.5 Spare Core Vent Duct Spacers**

A set of ten (10) spare core vent duct spacers shall be supplied. These spacers shall be identical to those specified in paragraph 2.9.

## **2.15 NEW NAMEPLATE**

A new nameplate shall be provided for the new winding, reflecting the new 100 percent rating as defined in ANSI C50.12. The nameplate shall be brass or stainless steel, similar in size and thickness to the original nameplate, and shall be cast, stamped, or engraved with the following information:

- (1) Winding manufacturer's name.
- (2) KVA rating.
- (3) Power factor.
- (4) Stator voltage.
- (5) Stator current.
- (6) Field voltage at rated kVA.
- (7) Field current at rated kVA.
- (8) Frequency.
- (9) Rotation speed.
- (10) Stator temperature rise.
- (11) Date of rewind.

## **PART 3 EXECUTION**

### **3.1 GENERAL TESTING REQUIREMENTS**

Equipment supplied under this contract shall be given the manufacturer's routine factory and field tests. Other tests shall be performed as specified. All tests required shall be witnessed by the Government Quality Assurance Representative (GQAR), unless waived in writing. No equipment shall be shipped until it has been approved for shipment. Only Contractor-furnished equipment shall be tested, and the tests shall be made in accordance with applicable requirements of ANSI C50.10 and C50.12, and IEEE 115, except as stated. The waiver of any test or witnessing of a test shall not relieve the Contractor of the responsibility of complying with these specifications. All necessary test equipment, instrument transformers, temporary installations, and personnel shall be furnished. All test equipment shall be calibrated prior to performing the specified test or group of tests. GQAR shall be notified in writing 15 days in advance for tests.

### **3.2 ACCELERATED LIFE TESTS**

The following accelerated life tests shall be performed as indicated below.

#### **3.2.1 Test Procedure**

The test shall consist of subjecting specified coils to a 60-Hz test voltage of 30 kV rms, at a steady-state surface temperature of 90°C, continuously to breakdown or to the test termination time of 400 hours. The test shall be performed in accordance with IEEE 1043. Failure outside of the conductive slot paint and grading paint portions of the coil will not be considered a failure under this test. In this event, the insulation shall be repaired and the test continued. At the conclusion of the tests, three slices of approximately 0.25 inch shall be cut from each tested coil side (one from the slot section, the grading paint section, and the area above the gradient paint) and delivered to the GQAR. The cut surfaces shall be polished, but shall not be coated in any way. None of the coils subjected to the accelerated life tests shall be used in the stator winding.

#### **3.2.2 Prototype Coils**

Accelerated life tests shall be performed on specified prototype coils (see paragraph 2.2). The tests shall be performed by an approved independent testing laboratory. During the test, no failure may occur before 200 hours. If a failure occurs between 200 and 400 hours, two additional coils shall be required to be added to the test sample and no further failures may occur before 400 hours. Failure to pass the accelerated life test shall require redesign of the coils or of the manufacturing process, subject to approval, and retesting of the coils according to this paragraph. Production of new stator coils may not begin until the prototype coils have passed accelerated life testing.

### **3.2.3 Production Run Coils**

Accelerated life tests shall be performed on specified production run coils (see paragraph 2.4.9), chosen by the Government at random from the production run. The tests shall be performed at an approved facility. If a failure occurs in any of these coils between 200 and 400 hours, two more coils will be picked at random from the production run and subjected to this test. If any further failures occur, or if any failures occur before 200 hours, the production shall be stopped and the cause of failure shall be determined and reported to the Government. The Government will subsequently decide what course of action needs to be taken to ensure an acceptable winding.

## **3.3 COIL TESTS AT FACTORY**

Each coil shall be subjected to the following tests, performed by the Contractor at his facilities. If more than one percent of the coils fail, production shall be stopped, the Government shall be notified, and the cause for failure shall be established and corrected. Certified test results of all factory tests shall be submitted for approval as required in paragraph 1.3. Approval shall be obtained prior to shipment of any coils from the factory.

### **3.3.1 Strand Continuity and Strand Insulation**

The continuity of each strand shall be established by a suitable test prior to checking the strand insulation. The insulation integrity between all strands within a conductor shall be tested by applying a minimum of 120 Vac rms between each strand and all other strands of the conductor.

### **3.3.2 Turn Insulation Dielectric Test**

The turn-to-turn insulation of each stator coil shall be tested by a high frequency turn-to-turn dielectric test (surge test) of 23 kV, per IEEE 522.

### **3.3.3 Ground Insulation Dielectric Test**

The ground insulation of each stator coil shall be subjected to a withstand test of 40 kV ac for one minute. Visible corona detected under typical factory lighting of 100 ft-c shall be grounds for rejection.

### **3.3.4 Power-Factor Tip-Up Tests**

Power-factor measurements shall be made on each coil in accordance with IEEE 286. Tests shall be made at 20 and 100 percent rated (line-to-ground) voltage. If the numerical difference between the two power factor measurements is greater than 0.9 percent, the coil will be rejected.

### **3.3.5 Dissipation Factor Test**

In addition to the power-factor tip-up test, every tenth coil produced shall be given a dissipation factor test. This test shall consist of subjecting the coil, using the same setup as the tip-up test, to

ac voltages of 20 through 200 percent of rated (line-to-ground) voltage. To compensate for occasional measurement anomalies, the averaging of a single step value not meeting the specified criteria with the next highest step will be permitted. Should the two steps have different acceptance criteria, these also may be averaged. For each coil that fails the dissipation factor test, four additional coils shall be tested. The dissipation factor shall be measured as a function of voltage at each 20 percent interval of rated voltage, i.e., 20, 40, 60, 80, 100, 120, 140, 160, 180, and 200 percent. Dissipation factors shall not exceed the values given in the following table:

| For each 20%<br>interval<br><u>between:</u> | <u>and:</u> | The dissipation factor<br>shall not increase by<br><u>more than:</u> |
|---|-------------|--|
| 20%   | 60%         | 0.0015   |
| 60%   | 120%        | 0.003  |
| 120%  | 200%        | 0.004  |

### **3.4 SPRING-TYPE FILLER MATERIAL TEST**

Representative samples of the spring material shall be subjected to the tests specified in this paragraph. Failure to pass these tests shall require the spring material to be redesigned and retested. The spring height is defined as the total height of the spring minus the material thickness (that is, the distance that the height of the spring can be compressed). Samples of each size to be used in the generator shall be tested. The force required for an 80 percent reduction in spring height shall be at least 110 psi. After this measurement, the test samples shall be conditioned by compressing them 100 percent (completely flat) between steel plates. They shall be kept in this position at 120°C for 168 hours. After conditioning, the force required for an 80 percent reduction in spring height shall be at least 65 percent of the preconditioning force. The uncompressed spring height shall have shrunk less than 20 percent. All test results shall be submitted at least 30 days prior to any shipment as required in paragraph 1.3.

### **3.5 RESISTANCE TEMPERATURE DETECTOR (RTD) TESTS AT FACTORY**

The following factory tests shall be performed on the RTD's:

#### **3.5.1 RTD Insulation Resistance**

The RTD ground insulation shall be tested at a potential of 1500 Vac rms. After this test, the RTD insulation resistance shall be measured at 500 Vdc. The insulation resistance measurements on each RTD shall be 100 mega-ohms minimum.

#### **3.5.2 RTD Element Resistance**

The resistance of each RTD shall be determined by subtracting the lead resistance (between the two common leads) from the total resistance measured (from each common lead to the third

lead). The values shall meet the requirements of paragraph 2.5. The values thus obtained shall be corrected to 25°C, recorded, and the report submitted as required in paragraph 1.3.

### **3.6 STATOR CORE PUNCHING TESTS**

Factory tests shall be performed on the laminations to confirm the integrity of the insulating material and steel. Tests shall be performed on a sample lot at three periods during the manufacturing of the laminations: (1) at the beginning of the manufacturing process with the first few laminations produced, (2) approximately in the middle of the manufacturing process, and (3) upon completion of the manufacturing of the laminations. A sufficient number of laminations shall be selected to adequately perform these tests during each test period. The following tests shall be performed:

#### **3.6.1 Epstein Test**

The Contractor shall perform an Epstein test as outlined in ASTM A 343 to determine core losses. The stator laminations are to be made from thermally stabilized electrical steel. Epstein loss values at 10,000 and 15,000 Gauss before and after a thermal stabilization test are to be within 5 percent of each other. Thermal stabilization consists of thermal aging of Epstein loss test samples at 150°C for 100 hours. The Contractor shall submit the following test data and calculations: (a) core loss values before and after thermal stabilization test, (b) weight of tested lamination, (c) calculations including formulae for determining the desired test induction and voltage, (d) calculations and formulae for determining specific core loss of the tested lamination, and (e) acceptable range of exciting current and ac permeability.

#### **3.6.2 Franklin Test**

The Contractor shall perform a potential test using a Franklin Tester, as outlined in ASTM A 717. Test shall be performed using 0.5 volt at a temperature of 150°C and a pressure of 750 psi. Maximum current shall not exceed 0.6 amperes. The average current shall not exceed 0.4 amperes. Readings shall be taken at the lamination teeth and core section. The Contractor shall submit: (a) insulation quality of the sample laminations, (b) electrical resistivity value of test lamination and (c) electrical current readings.

#### **3.6.3 Ductility Test**

The Contractor shall perform a ductility test per ASTM A 720. The test report shall include the number of specimens, the specimen dimensions, and the ductility expressed as the number of reversals until failure.

### **3.7 GENERATOR DISASSEMBLY**

The Contractor will disassemble the unit as specified in Section 15991.

### **3.8 REMOVAL OF EXISTING WINDING**

The existing stator winding shall be removed in a manner that will inflict no damage to components that are intended to be reused. Damage resulting from winding removal or during winding replacement shall be corrected at the Contractor's expense. The old stator windings shall become the property of the Contractor, but shall not be reused, and shall be removed from the job site as soon as possible after removal. The removal shall include the following:

#### **3.8.1 Marking**

Prior to removing the old winding, the stator frame shall be suitably marked to locate lead positions and resistance temperature detector locations.

#### **3.8.2 Surge (Bracing) Ring Removal**

The existing surge rings shall be removed and prepared for reuse. All old insulation shall be removed, surface burrs removed, and the rings thoroughly cleaned before reinsulation. The surge rings shall be reinsulated according to the Contractor's approved procedure. The Contractor may furnish new surge rings in lieu of reusing the existing ones.

#### **3.8.3 RTD Removal**

The existing resistance temperature detectors and cable leads shall be removed back to the nearest terminal block.

### **3.9 STATOR CORE REPLACEMENT**

#### **3.9.1 Unstack Stator Core**

The upper clamping plates shall be removed. All iron and vent duct spacers shall be removed from the core.

#### **3.9.2 Stator Frame Removal And Sole Plate Grout Removal And Replacement**

Remove all electrical equipment on stator frame. Remove all piping from the stator frame. Identify all sole plates and dowel pins. Remove all grout from sole plate area. Lifting of stator support frame may be required to accomplish this task. Once grout has been removed, level and plumb the stator support frame according to the contractor's approved procedure and install new non-shrink grout under the sole plate area. Replace piping and electrical equipment as required.

#### **3.9.3 Inspection**

Clamping plates shall be examined for cracks, broken welds and finger alignment. If new clamping plates are being furnished with the new core and winding, this examination is unnecessary. The stator support pad area, dowels, and jacking screws shall be examined for general condition and for evidence of abnormal movement.

### **3.9.4 Center and Round Stator**

The Contractor shall measure the circularity, verticality and level of the stator frame prior to restacking the core with new iron. The Contractor shall adjust as necessary to ensure compliance with Canadian Electrical Association Guide for Erection Tolerances and Shaft Systems Alignment Part II (CEA Guide). This may involve complete removal of the dovetail bars and welding new dovetail bars in the proper location. The stator shall be centered on the plumbed and centered turbine shaft. The generator soleplates shall be re-dowelled if necessary.

### **3.9.5 Restack Stator Iron**

The stator shall be restacked without splits using all new laminations and vent duct spacers. The Contractor shall press the iron in lifts not to exceed 15 inches. Hydraulic jacks shall be used to press the iron such that the fasteners for the stator clamping-bolts are not solely used to apply pressure. The Contractor shall install the necessary shims and continually check the stator core as it is being stacked to ensure that it will satisfy the requirements of CEA Guide.

### **3.9.6 Final Check**

At the completion of the restack, the Contractor shall measure the circularity and verticality to verify compliance with the CEA Guide. The core shall be corrected if measurements indicate it is out of tolerance.

### **3.9.7 Clamping and Locking System**

The tightening torque values of the stator core axial pressure bolts and the bolts supplying the tangential pressure at the splits shall be recorded. A locking system shall be provided.

## **3.10 STATOR CORE INTERLAMINAR INSULATION TEST**

### **3.10.1 General**

After completion of the restacking, the core shall be subjected to an interlaminar insulation test. Areas failing the requirements of the tests shall be repaired or replaced at the Contractor's expense. All repairs are subject to the approval of the Contracting Officer. After completion of repairs, the core shall be retested at the Contractor's expense.

### **3.10.2 Test Procedure**

The interlaminar insulation of the core shall be tested as outlined in paragraph 8.1.10 of IEEE 56. Power for this test shall be derived from an approved location. Another main generator will not be made available as a source of power. The Contractor's test procedure shall be submitted for approval in accordance with paragraph 1.3. This procedure shall include detailed calculations of the operating flux density, the magnetizing current, and the ampere turns required to bring the core density to the rated value, as well as cable installation and safety methods. The flux density

shall be determined by measuring the voltage developed in a one-turn search coil installed around the stator iron, but not adjacent to the magnetizing coil. The test shall be applied for at least 30 minutes. The magnetizing current must cause an average 1-1/2°C temperature rise in the core. Any hot spot exceeding 5°C above the temperature of the surrounding iron shall be reported to the Government. Core hot spot temperatures shall be measured by means of an infrared temperature scanning device. The temperature scanning device shall be capable of detecting temperature differences of 1/2°C and shall have provisions for making a video tape record of the temperature scan. A temperature scan survey video tape shall be taken of the whole core and included with the test report. During the interlaminar insulation test, the following temperatures shall be measured with thermocouples and recorded at ten minute intervals:

- (1) Ambient air temperature.
- (2) Core hot spot temperature and location.
- (3) Average core temperature around the core perimeter at the axial location of the hot spot temperature.
- (4) Average core temperature (ambient core temperature) and location where no apparent hot spots are detected.

### **3.11 APPLICATION OF EPOXY**

Following successful completion of the interlaminar insulation testing, two coats of capillary action epoxy shall be applied over the bore surface of the stator core. The epoxy shall be allowed to dry between applications.

### **3.12 APPLICATION OF VARNISH**

Following the application of the epoxy, one coat of semiconducting varnish shall be applied to the stator slots. The slots will be considered clean if the semiconducting varnish resistance to the core is 1,500 ohms or less. The varnish resistance to the core shall be measured and recorded at a minimum of 10 points per core packet on not less than one slot in 30 on a random basis. If the varnish resistance to the core in one slot is more than 1,500 ohms, two more slots will be randomly selected by the GQAR and the tests will be repeated. If one of the two additional slots shows a varnish resistance to core of more than 1,500 ohms, all slots shall be tested. Non-complying slots shall be cleaned and retested until the proper resistance is achieved.

### **3.13 INSTALLATION OF NEW STAT OR WINDING**

The new stator winding, circuit rings, and surge rings shall be installed, coil-to-circuit ring connections shall be made, and all work incidental to a complete rewind of the generator stator shall be performed. The work shall be performed in accordance with the Contractor's approved procedure. In general, it shall be as follows:

### **3.13.1 Slot Position Record**

During the winding of the stator, the slot position of each coil shall be recorded. This shall be recorded on the existing coil records, which shall be submitted upon completion of the rewind.

### **3.13.2 Preliminary Coil Inspection and Preparation**

Individual coils shall be thoroughly inspected after their removal from shipping crates. Coils shall be handled in a manner that prevents distortion or insulation damage. Coil surfaces shall be cleaned and the surface semiconducting treatments re-established where scuffed or otherwise affected by packaging, shipment, or removal from crates. Coil repairs involving ground insulation damage shall not be made, and no damaged coils shall be used in the winding assembly without the specific approval of the Contractor's installation supervisor and the Government. All necessary buffing, scraping, or filing of the leads shall be performed in an area remote from the stator core. Hacksaws or files shall not be used to cut strands when making connections after coils are installed.

### **3.13.3 Installing RTD's**

The RTD's shall be installed in the same slots as the existing RTD's. The leads shall be installed in the existing conduit or in new Contractor-furnished conduit. Leads shall be provided with identification tags to match existing tags and shall be properly terminated in the generator terminal cabinet. The new Contractor-furnished conduit shall be at no additional expense to the Government.

### **3.13.4 Coil Packing in Slot**

The coils shall be installed and wedged tightly in place in a manner which will ensure against damage to the insulation.

3.13.4.1 Bottoming of Coils. The coils shall be pressed firmly into place with a suitable jack. Each coil shall be checked for seating at each end. A 0.003 inch feeler gauge shall be inserted between the coil leg and the bottom filler, and again between the bottom filler and the slot. At one of these locations the feeler gauge shall not be able to enter the slot more than one inch, and at the other location it shall not be able to enter at all. The clearance between the coil and surge ring, when the coil is tightly seated at the bottom of the slot, shall be no greater than 0.5 inch but large enough to allow at least one piece of resin-saturated dacron felt to be inserted between the coil and surge ring. The coil to coil clearances shall be maximized by maintaining a uniform level of coils during installation.

3.13.4.2 Side Packing. The Contractor shall provide the procedure and checks for side packing the coils. Coil contact resistance shall be measured in accordance with paragraph 3.14.

3.13.4.3 Front Packing. Coil jacks shall be used to press the coils firmly in place before wedges are installed. Filler strips with a variety of thickness shall be provided to ensure that a proper thickness is available to completely fill the clearances in the coil slots and to provide for tightly

wedged coils. No more than two top filler strips may be combined to provide the proper thickness. Top fillers shall be placed in slots as required on top of the top coil. Spring-type filler material shall be placed between top filler and wedge unless otherwise approved. The initial deflection of the spring-type filler material shall be checked in the three verification locations in every slot and recorded for future use by government maintenance personnel. Filler next to spring material shall have a minimum thickness to protect the coil surface and be at least 9 inches long, and 12 inches long at the ends of the slot. Top fillers may be cemented together; however, fillers shall not be cemented to edge of the coil as any axial slippage should occur at this plane. No epoxy shall be used in the slot.

3.13.4.4 Two-Part Wedges. If two part wedges are used the wedges and slides shall be assembled using a master slide to select the slide or top filler of correct thickness. The slide shall neither project above the top of the wedge nor touch the wedge below. Wedges shall be installed such that all slides are driven from above. A locking system for restricting the possible vertical movement of the wedges shall be provided, but in no case shall epoxy be used to secure the wedges. All wedges shall be tight upon completion of the wedging.

3.13.4.5 Air Ducts. Air duct slots on the wedges shall be aligned with the core air ducts.

### **3.13.5 Connections**

The connections between coils and circuit rings shall be such that all strands are included in a common connection. The design of the end connections for multi-turn coils shall be subject to approval. All coil ends shall be cleaned prior to brazing. All connections shall be brazed with a suitable copper- or silver-based brazing alloy conforming to the requirements of AWS A5.8. All persons who will perform brazing shall be experienced and shall demonstrate their ability to the satisfaction of the Government. Induction brazing is preferred by the Government. Brazing tongs shall be used in all brazing and unbrazing. During brazing, coil, pole jumper, and circuit ring insulation shall be protected from overheating by use of appropriate heat sinks. Burned insulation or loss of bond between insulation and coil conductors will result in coil rejection. Affected coils shall be replaced at the Contractor's expense. All taps or connections shall be insulated for 15 kV.

### **3.13.6 Bracing**

The end portions of the coils and the connections shall be rigidly supported and braced to prevent vibration and distortion under stresses. The completed stator winding shall be capable of withstanding sudden 3-phase short circuits at the machine terminals in accordance with Section 6 of ANSI C50.12.

### **3.13.7 Circuit Ring Installation**

The circuit rings and all conductors, connectors, and terminals shall be installed. These connections shall be insulated for 15 kV, except the bolted connections to the main leads, which are inaccessible to personnel, shall be left uninsulated. All bolted connections shall be silver surfaced and shall be made using Belleville spring-type washers, or approved

equal, and silicon bronze fasteners. Calculations shall be submitted to demonstrate the adequacy of the loading of the spring-type washers.

### **3.13.8 Slot Numbers**

Prior to reinstallation of the rotor, every tenth stator slot shall be numbered with a non-tracking, temperature-resistant paint on the right and left core teeth at the upper and lower ends of the slot.

### **3.13.9 Final Inspection**

After the winding installation has been completed, the entire stator shall be cleaned and inspected for foreign objects.

### **3.13.10 Finish Treatment**

The entire stator winding shall be treated with two coats of an approved insulating varnish or enamel. The finish treatment shall be highly resistant to attack by oil, moisture, Contractor-recommended cleaning solvents, or other materials to which the winding will be exposed during future maintenance and normal operation.

## **3.14 COIL TESTS DURING WINDING INSTALLATION**

The following tests shall be performed on the stator winding during the course of installing the stator winding into the stator:

### **3.14.1 Turn-to-Turn Dielectric Tests**

The turn-to-turn insulation of each coil shall be tested by a high frequency turn-to-turn dielectric test (surge test) of 20 kV, per IEEE 522. The test shall be made before coil-to-coil connections are completed.

### **3.14.2 Test of Transposition Group Insulation**

In windings where coil conductors are divided into groups of strands and transposed in the coil-to-coil connection, the insulation between the groups shall be tested after all connections within each winding series circuit are completed, but before making the connection between the group leads and connection rings. The method of applying this test and the voltage employed shall be similar to the strand insulation test, paragraph 3.3(1).

### **3.14.3 Coil Surface to Slot Wall Contact Resistance**

The adequacy of the coil surface grounding to the slot walls shall be checked on all coils after their slot portions have been properly tightened widthwise. Contact resistance measurements shall be taken using an ohmmeter with one lead connected to the core and the other lead connected to an approved electrode placed on the coil's exposed surface in such a manner that it does not contact the core. Measurements shall be made at three locations: at each end of the

core and at the center axially. The acceptable range of contact resistance shall be stated. Values in excess of 5,000 ohms will not be accepted. Correction shall be made by improving contact. Final values shall be recorded and submitted as required in paragraph 1.3.

#### **3.14.4 Coil High Potential Tests**

Such preliminary high potential tests of the coils shall be made as will reasonably assure the Contractor that the coils will not fail the winding high potential tests of paragraph 3.24. The tests and test voltages shall be included in the installation procedure.

### **3.15 PARTIAL DISCHARGE ANALYSIS SYSTEM INSTALLATION**

#### **3.15.1 Coupling Capacitors**

The coupling capacitors shall be permanently installed, two in each phase. They shall be placed in pairs of closely matched capacitance in such a way that external noise is eliminated.

#### **3.15.2 Leads**

The leads shall be brought out and terminated in the termination panel. The coaxial cable leads for each pair of coupling capacitors shall be carefully adjusted (equalized) so that the total travel time of signals from the line terminal through the cables and coupling capacitor pair is balanced to within one nanosecond. The coaxial cable leads from the coupling capacitors to the termination panel shall be routed along a conductive grounded metal surface, such as the stator frame, or within rigid galvanized steel conduit. The cable leads shall be securely fastened to the ground plane to prevent movement, due to vibration or windage, which would affect their balanced response characteristic.

#### **3.15.3 Termination**

The termination panel shall be located on the outside of the generator barrel in an approved location that provides convenient access during PDA testing. The BNC panel connectors of the three phases shall be in vertical columns and the parallel circuit coupling capacitor pairs shall be in horizontal rows of two. Each connector shall be labeled with the location of the respective coupling capacitor and the associated coupling capacitor of the pair. The coaxial cable leads shall also be labeled to show associated coupling capacitors and connectors.

## **3.16 PARTIAL DISCHARGE ANALYSIS SYSTEM TESTS**

### **3.16.1 General**

The Partial Discharge Analysis (PDA) system shall be tested to determine that all requirements for system characteristics, performance, and ratings, as specified in paragraph 2.12 are met. The Contractor shall furnish test equipment, conduct tests, and provide a test report as specified. The tests shall be performed in accordance with instructions contained in ASTM D1868, except as otherwise specified.

### **3.16.2 Test Equipment**

All test equipment for performing the PDA testing shall be furnished for the test. This shall include the following:

- (1) Partial Discharge Analyzer
- (2) High Speed Oscilloscope  
Bandwidth: 300 MHz  
Sweep Speed: 1 nsec/division
- (3) Calibration Pulse Generator with trigger output  
Rise Time: 10 nsec  
Amplitude: 15 V peak
- (4) Insulation Tester, "Megger" or equivalent.
- (5) Calibration Capacitor  
Top Limit: 160 pF
- (6) Measuring Impedances, both inductive and resistive types.

### **3.16.3 PDA Tests**

The following tests shall be performed on the PDA System:

3.16.3.1 The coupling capacitors shall be tested for corona inception voltage and corona extinction voltage and shall have corona less than 2 picocoulombs at 15 kV ac rms. They shall also be capable of withstanding the final high-potential tests of paragraph 3.24.

3.16.3.2 The coupling capacitors shall be high-potential tested at 40 kV ac rms for one minute and shall pass this test prior to installation.

3.16.3.3 The coaxial cable leads shall be checked for shorts between the center conductor and braid with the insulation tester. The coaxial cable braid shall also be checked against ground to assure that no unwanted ground connections exist. To do this test, the connection between the termination panel and the station ground bus shall be removed and all braids tested in parallel. No shorts shall exist. To minimize installation work, this test shall be conducted prior to soldering wires to lugs on the BNC terminal panel.

3.16.3.4 Circuit sensitivity shall be measured per ASTM D1868, paragraphs X1.5 and X1.6. The determined circuit sensitivity shall not be used in calculation of the performance test results.

3.16.3.5 The arrangement of the coupling capacitor pairs shall be tested for balance in terms of matched capacitance and signal propagation travel time. The difference in propagation travel times of a pulse injected at the line terminals of a pair of coupling capacitors shall be less than 1 nsec as measured at the termination panel. For this test, the ground connection on the line terminal must be removed from each phase when it is tested, to permit injection of a signal from a pulse generator. This step shall be undertaken on all three phases in succession; the neutral connections can be left grounded. A temporary coaxial cable shall be run from the line terminal to the partial discharge analyzer termination panel to trigger the oscilloscope.

#### **3.16.4 PDA Test Report**

Upon completion of all tests, a test report shall be submitted as required in paragraph 1.3. The report shall be in accordance with ASTM D1868, paragraph 15, and include results of all required tests and measurements.

### **3.17 INITIAL ROTOR TEST**

Before cleaning, insulation resistance readings shall be taken between the winding and ground at 500 Vdc.

### **3.18 ROTOR CLEANING**

A shroud shall be placed around the rotor to contain dust. The rotor shall be blown down from the inside with high pressure air. The rotor shall then be vacuumed where necessary. The inside of the rotor shall be wiped with rags. The poles shall be wiped with rags saturated in a solvent that will not damage the insulating varnish on the field windings. The rotor shall be given a detailed inspection and record all items which are unacceptable for continued operation. Recommendations for repair shall be provided to the GQAR.

### **3.19 FINAL ROTOR TESTS**

#### **3.19.1 Post-Cleaning Insulation Resistance Test**

After cleaning, insulation resistance readings shall be taken between the winding and ground at 500 Vdc.

#### **3.19.2 Pole Drop Test**

After completion of the cleaning and insulation resistance testing, an ac voltage shall be applied across the slip rings and the voltage appearing across each coil measured and recorded. The proposed test voltage and allowable pole voltage drop variations shall be submitted for approval in accordance with paragraph 1.6.3. Any additional inspection and/or repair that is required based on this test shall be recommended.

#### **3.19.3 High Potential Tests**

The rotor winding shall be given a one minute high potential test of 2 kV ac.

### **3.20 ROTOR VARNISH**

Before the rotor is reinstalled, it shall be given a coat of insulating varnish over the surface of the coils and insulating materials. The minimum and maximum acceptable thickness of the coat shall be specified.

### **3.21 INITIAL ACCEPTANCE TESTS**

The following tests shall be performed following completion of winding installation:

#### **3.21.1 Stator Winding Resistance Measurements**

Accurate stator winding resistance measurements shall be made on each phase of the completed stator winding. Within one hour of these measurements, accurate temperature measurements shall be made from each of the stator winding embedded temperature detector readings. The average of the temperature detector readings shall be considered to be the stator ambient temperature at the time of the stator winding resistance measurements and shall be used to calculate the corrected stator winding resistance at 75°C.

#### **3.21.2 Insulation Resistance and Polarization Index Tests**

Insulation resistance and polarization index tests shall be made on each phase as described in IEEE 43, with the exceptions noted below. In all cases, the phases not under test shall be solidly grounded. Tests shall be made at or above 2,500 Vdc. Winding insulation resistance at one minute shall be not less than 100 mega-ohms, corrected to 40 °C. If it is greater than 1000 mega-ohms, corrected to 40 °C, the test shall be stopped. If it is less than 1000 mega-ohms, corrected

to 40 °C, the testing shall continue for 10 minutes and the polarization index shall be calculated, and it shall be greater than 2.

### **3.21.3 Partial Discharge (Corona Probe) Tests**

The intensity of partial discharges associated with the coils in each stator slot shall be measured. The test shall be made using equipment similar to that described in IEEE 56, paragraph 8.1.5.2. The equipment shall be subject to approval. The test shall be performed with at least 100 percent of rated operating line-to-ground voltage applied to all conductors of the stator winding. A soak period shall be observed to allow readings to stabilize. Measurements, in units of picocoulombs of apparent charge, shall be made at three locations axially for each slot. The cause of any abnormally high measurements shall be investigated and correction attempted by improving coil surface treatments and/or coil widthwise tightening. Acceptance criteria shall be specified subject to approval. Final readings shall be recorded and, along with pertinent identifying information for the corona probe instrument, submitted as required by paragraph 1.3.

### **3.21.4 Blackout Test**

After completion of the rewind, preliminary winding tests shall be made as will reasonably assure the Contractor that the generator is ready for reassembly. Once these tests have been completed, the blackout test shall be performed. Each phase shall be individually tested at 10 kV ac rms. During the testing, the other two phases shall be solidly grounded. The test shall be performed at night with the powerhouse darkened. No visible corona will be allowed.

## **3.22 GENERATOR REASSEMBLY**

Following approval of the initial acceptance test reports, the Contractor shall reassemble the unit as specified in Section 15991. THE GQAR shall be given a minimum of five working days notice prior to reassembly.

## **3.23 GENERATOR DRY-OUT**

Any necessary “dry-out” of the stator winding shall be performed after completion of the installation and reassembly of the generator.

## **3.24 FINAL ACCEPTANCE TESTS**

The following tests shall be performed following completion of generator reassembly:

### **3.24.1 Final Winding High Potential Test**

After the final shaft runout readings have been taken, the Government will operate the unit at rated speed, zero excitation for five minutes. After the unit has come to rest, each individual phase of the winding shall be high potential tested with the phases not being tested solidly connected to ground. The test shall be in accordance with ANSI C50.10 and IEEE 115. The test value shall be 28.6 kV ac rms for a period of one minute.

### **3.24.2 Controlled DC Overvoltage Test**

A controlled dc overvoltage test shall be performed on each phase of the winding to provide baseline data for future maintenance tests. The test shall be the step or ramp type at 30 kV dc. It shall be performed in accordance with IEEE 95.

### **3.24.3 Embedded Resistance Temperature Detector Tests**

Following all overvoltage testing, the following RTD tests shall be performed:

3.24.3.1 RTD AC Test. The RTD ground insulation shall be tested at a potential of 1500 Vac rms.

3.24.3.2 RTD Insulation Resistance. The RTD insulation resistance shall be measured at 500 Vdc. The insulation resistance measurements on each RTD shall be 100 mega-ohms minimum.

3.24.3.3 RTD Element Resistance. The resistance of each RTD shall be determined by subtracting the lead resistance (between the two common leads) from the total resistance measured (from each common lead to the third lead). The values thus obtained shall be corrected to 25°C, recorded, and included in the test report.

## **3.25 GENERATOR SPECIAL FIELD TESTS**

### **3.25.1 General**

Units 4 and 6 shall undergo the generator special field tests. Certificates of calibration for all Contractor-furnished test instruments shall be included in the associated test report.

### **3.25.2 Verification Tests**

The following special tests shall be performed to determine baseline data for further performance monitoring and to verify compliance with guaranteed dc  $I^2R$  losses, core losses, stray load losses and temperature limits.

3.25.2.1 Losses Tests. The generator shall be tested to determine the armature dc  $I^2R$  losses, core losses, stray load losses and friction and windage losses. Testing shall be in accordance with the requirements of IEEE 115 using the retardation method. The data collected during the stray load loss tests shall be accumulated by an automatic electronic data collection system. The curves derived from this data shall be made by a suitable curve-fitting algorithm; graphically derived curves will not be allowed. Two adjacent units will be available for use in performing the deceleration runs per the retardation method.

3.25.2.2 Temperature Test. The generator shall be tested to determine the maximum temperature rises of the various parts of the generator when operating continuously at 75,000 kVA, 0.9 power factor, 13.8 kV. The water supply to the surface air coolers shall be regulated so

that the temperature of the air leaving the coolers is approximately 40°C. Load will be provided by the Government. The testing shall be performed per IEEE 115. The preferred test method is conventional loading.

3.25.2.3 Open-Circuit and Short-Circuit Loading Temperature Test. The generator shall be tested to determine the maximum temperature rises of the various parts of the generator when operating continuously at 75,000 kVA, 0.9 power factor, 13.8 kV. The testing shall be performed per IEEE 115.

3.25.2.4 Ozone Measurement. The Contractor shall measure the ozone concentration in the generator barrel during the temperature test. The Government will routinely measure the ozone level in the generator housing. At the end of the warranty period, the ozone concentration shall be less than 0.1 part per million, as defined in part 1910.1000 of the Williams-Steiger Occupational Safety and Health Act of 1970 (54 FR 2920).

### **3.25.3 Determination Tests**

The Contractor shall perform the following testing to determine the machine parameters. This testing will be performed per IEEE 115.

3.25.3.1 Open-circuit saturation test.

3.25.3.2 Short-circuit saturation test.

3.25.3.3 Zero power factor saturation test.

3.25.3.4 Test for the determination of wave form deviation factor. Oscillograms shall be taken of the wave form of the voltage of each phase of the stator winding when the generator is operating at rated voltage and frequency at no load.

3.25.3.5 Test to determine saturated and unsaturated direct-axis transient reactance's.

3.25.3.6 Tests to determine saturated and unsaturated direct-axis subtransient reactance's.

3.25.3.7 Tests to determine unsaturated quadrature-axis subtransient reactance.

3.25.3.8 Test to determine unsaturated negative sequence reactance.

3.25.3.9 Test to determine zero sequence reactance.

3.25.3.10 Test to determine the telephone influence factors, balanced and residual component.

3.25.3.11 Test to determine direct-axis synchronous reactance.

3.25.3.12 Test to determine quadrature-axis synchronous reactance.

3.25.3.13 Test to determine direct-axis open-circuit transient time constant.

3.25.3.14 Test to determine direct-axis short-circuit transient time constant.

3.25.3.15 Test to determine direct-axis short-circuit subtransient time constant.

**END OF SECTION 16210**