

START

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Hanford Waste Vitrification Plant
Westinghouse Hanford Company
P. O. Box 1970
Richland, Washington 99352

FLUOR DANIEL, INC.

Date: December 21, 1990

Reference: Hanford Waste Vitrification Plant
DOE Contract DE-AC06-86RL10838
Fluor Contract 8457

Attention: Mr. Mike Gordon
State of Washington
Department of Ecology (PV-11)
Olympia, WA 98504-8711

Transmittal No.: WDOE-030

Gentlemen:

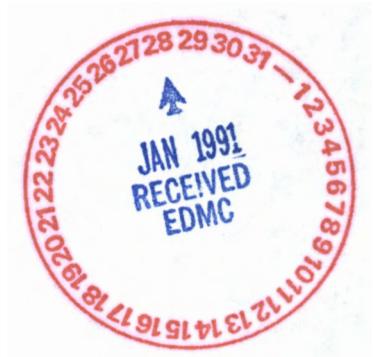
TRANSMITTAL

We enclose 5 copies of the items listed below. These are issued per US-DOE request.

Response due to Fluor: N/A

Responds to: Milestone No. P190.02(K826)

Number	Rev.	Date	Title
B-595-P-P190-163202	0	12/21/90	13.8 KV Metal-Enclosed Interrupter Switchgear
Related Document 1	0	12/21/90	Specification Section 01730, Operation and Maintenance Data
B-595-P-P190-16330	0	12/21/90	13,800/480V Pad-Mounted Transformer
Related Document 1	0	12/21/90	Specification Section 01730, Operation and Maintenance Data



Distribution:

Reference: FRP-172, FUP-012
VPO/AME Corresp Cntrl Cntr, MSIN A5-10 w/O
P. Felise, WHC-RL (MSIN G6-16) w/1
Environmental Data Management Center
(P190)w/1
D. Duncan, US EPA, Region X w/O

Very truly yours,

R. N. Gibbons
Project Director

RNG: js

91121374

SECTION 16330
13,800/480V PAD MOUNTED TRANSFORMER
(B-595-P-P190-16330)

REVISION NO. 0
SAFETY CLASS 3
ISSUE DATE 12/21/90

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SECTION 16330
 13,800/480V PAD MOUNTED TRANSFORMER

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ATTACHMENTS

<u>ATTACHMENT</u>	<u>TITLE</u>	<u>REV. NO</u>
ATTACHMENT A	DATA SHEET, EQUIP NO. XT-32T-001	0
ATTACHMENT B	DATA SHEET, EQUIP NO. XT-32T-002	0
ATTACHMENT C	DATA SHEET, EQUIP NO. XT-32T-003	0
ATTACHMENT D	DATA SHEET, EQUIP NO. XT-32T-004	0
ATTACHMENT E	DATA SHEET, EQUIP NO. XT-32T-005	0

SECTION 16330
13,800/480V PAD MOUNTED TRANSFORMER

PART 1 GENERAL

1.1 SUMMARY

The work includes the furnishing of outdoor three-phase oil-immersed, self cooled 13.8 Δ /.48 kV Wye pad mounted transformers.

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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C57.12.26 1987 Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34,500/19,920 Volts and Below; 2500 kVA and Smaller

ANSI C57.12.90 1987 Standard Test Code for Liquid Immersed Distribution, Power Load Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

ANSI Z35.1 1972 Accident Prevention Signs, Specs for

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1535 1989 Standard Test Method for Specifying Color by the Munsell System

1.3 RELATED REQUIREMENTS

Related Document 1 Specification Section 01730, Operation and Maintenance Data

1.4 DEFINITIONS

(Not Used)

91141117

1.5 **SYSTEM DESCRIPTION**

The 13.8/.48 kV pad mounted transformers shall provide construction power to Hanford Waste Vitrification Plant (HWVP) throughout the construction period.

1.6 **SUBMITTALS**

Submit the following in accordance with Part III, Section I, Exhibit 5, Vendor Drawing and Data Requirements (VDDR).

1.6.1 **Data Sheets**

Submit product data sheets for transformers, cable connectors, and bus connectors.

1.6.2 **Shop Drawings**

Submit detailed shop drawings including dimensioned plans, elevations, point-to-point wiring diagrams and descriptive literature for all component parts. Also provide position of overall center of gravity (vertical and horizontal), size and location of anchor bolts, hold down and/or base frame details, and the shipping and operating weights for the unit.

1.6.3 **Test Reports**

Submit factory Certified Test Reports on transformer after performing factory acceptance as tests as indicated in paragraph 2.2.1.

1.6.4 **Installation Instructions**

Submit manufacturer's installation instructions

1.6.5 **Operation and maintenance data in accordance with Related Document 1, Section 01730, "Operation and Maintenance Data."**

1.6.6 **Material Certification**

Submit manufacturer's material certification shall be provided for the transformer oil quality as described in Paragraph 2.1.4.3.

1.7 **CLASSIFICATION OF SYSTEM AND COMPONENTS**

The 13.8/.48kV pad mounted transformer is classified as an Occupational Safety (Safety Class 3) item and shall be controlled by conventional industry design standards and codes.

1.8 **PROJECT OR SITE ENVIRONMENTAL CONDITIONS**

- 1.8.1 Climatic and Geographic Site Conditions
- A. Site Elevation 714 feet above sea level
 - B. Barometric Pressure 14.3 psia
 - C. Outside Design Temperature
 - 1. Maximum Design Temperature 101°F
 - 2. Minimum Design Temperature 9°F
 - 3. Wet Bulb Design Temperature 68°F
- 1.8.2 Operating Environment
- A. Normal Temperature 9 - 101°F
 - B. Relative Humidity Not controlled

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 General

2.1.1.1 Compartmental pad-mounted transformers shall be in accordance with ANSI C57.12.26, of low silhouette design shall be provided with ratings as shown on the data sheet. Units shall be designed for outdoor application and be provided with a means to permanently anchor the unit to the foundation pad.

2.1.1.2 Pad-mounted, compartmental-type transformers shall consist of the transformer tank, separate high voltage and low voltage feeder terminating compartments. The transformer tank and compartment shall be assembled as an integral unit for mounting on a pad. nuts, bolts, or other fastening devices which are externally removable. There shall be means for padlocking the compartment doors. There shall be a means of bolting the unit securely to concrete pad.

2.1.1.3 Full-height, air-filled incoming and outgoing terminal compartments with hinged doors shall be located side-by-side separated by a steel barrier, with the high voltage compartment on the left. The low-voltage compartment shall be accessible only after the door to the high-voltage compartment has been opened. To facilitate making connections and permit cable pulling, the door sill on the compartments shall be provided to permit rolling or skidding of unit into place over conduit stubs in the foundation.

- 2.1.1.4 The compartments shall have hinged doors equipped for latching in the open position. The low-voltage compartment door shall have a fastening device which is accessible only through the high-voltage compartment.
- 2.1.1.5 Both compartment doors shall be capable of being secured with a single padlock having a maximum 1/2-inch diameter shackle.
- 2.1.1.6 The hinge and padlocking assemblies shall be made of stainless steel. Stainless steel hinge pins of 3/8 inch minimum diameter shall be provided.
- 2.1.1.7 Lifting provisions shall be provided. Jacking and rolling provisions shall also be provided.
- 2.1.1.8 Transformer tank shall be sealed-tank construction with a welded main cover.
- 2.1.1.9 Ground pad connections with threaded fittings for tank grounding shall be supplied in both the high-voltage and low-voltage compartments.
- 2.1.2 Incoming Line Section
- 2.1.2.1 High voltage compartment shall contain the incoming line, load break connectors, tap changer, and parking stands. Arrange the Incoming line equipment shall be arranged for radial feed.
- 2.1.2.2 Load Break Switch: Switching shall consist of a two position on-off switch rated 15 kV, 95 kV BIL with a continuous rating of 200 amps, and a make and latch rating as shown on the data sheet. Locate switch handle in high voltage compartment.
- 2.1.3 Low Voltage Secondary Compartment Section
- 2.1.3.1 Low voltage compartment shall contain all the necessary pressure gauges, valves, thermometers, drains, cable lugs, low-voltage bushings, pressure relief valve, filling provisions, and stainless steel transformer nameplate.
- 2.1.4 Transformer Section
- 2.1.4.1 Transformer shall be three-phase, 60 Hz for pad mounted construction. Core and coil shall be immersed in self cooled insulating mineral oil. The transformer self cooled outside air (OA) rating shall be 65°C rise.
- 2.1.4.2 Transformer shall be rated as shown on the data sheet with four 2-1/2 percent full capacity taps, two 2-1/2% above and two 2-1/2% below rated primary voltage. Primary and secondary voltages shall be as shown on the data sheet. Impedance shall be not less than 5

percent. Tap changer, located inside the transformer compartment, shall be manual type for changing tap setting when the transformer is deenergized. Accessories shall include drain and sampler valve, filler connection, liquid level gauge, grounding pads, top filter press connection, lifting lugs, cover lifting eyes, provisions for jacking under base, dial type thermometer with maximum temperature indicator. The transformer base construction shall be of the fabricated type for using rollers or skidding in any direction. The transformer shall have an insulated low voltage neutral bushing with removable ground strap in both primary and secondary compartments with lugs for ground cable. Provide transformer top with an access handhole. Transformer shall have its kVA rating displayed on it's enclosure.

2.1.4.3 The transformer manufacturer shall submit certification that the fluid contained within is certified to contain less than 1 ppm of Polychlorinated Biphenyls (PCB) at time of manufacture (Non PCB Certification).

2.1.5 Transformer Identification

2.1.5.1 A stainless steel nameplate shall be mounted at eye level height inside the low voltage compartment, and shall present as a minimum the following information:

2.1.5.1.1 Graphic representation of the connections of the high voltage and low voltage windings.

2.1.5.1.2 The kVA ratings and temperature rises.

2.1.5.1.3 Transformer impedance, on the base (OA) kVA at 65°C rise.

2.1.5.1.4 Tap changer positions, voltages, and full load currents at each tap setting.

2.1.5.1.5 Low voltage rating and full load current at each tap.

2.1.5.1.6 Volume of liquid in tank(s) and radiators, and in any liquid-filled terminal chambers.

2.1.5.1.7 Total mass, and masses of core and coils, tank and fittings, liquid and untanking mass.

2.1.5.1.8 Design maximum operating pressures (positive and negative) for the transformer tank.

2.1.5.1.9 Conductor material of each winding.

2.1.5.1.10 Basic impulse level (BIL).

2.1.5.1.11 Liquid level-temperature data.

2.1.5.1.12 Full vacuum filling.

2.1.5.2 Each transformer shall be identified by a permanently attached on stainless steel nameplate showing the equipment number assigned on the data sheet. This nameplate shall be mounted next to the nameplate covered by Paragraph 2.1.5.1.

2.1.6 Warning Signs

2.1.6.1 The transformer shall be provided with appropriate precautionary warning signs in accordance with ANSI Z35.1 to call the users attention to potential hazards that are inherent to the equipment.

2.1.6.2 All external doors providing access to high voltage shall be provided with warning sign reading "DANGER-HIGH VOLTAGE-KEEP OUT-AUTHORIZED PERSONNEL ONLY."

2.2 **FABRICATION AND MANUFACTURE**

2.2.1 Factory Acceptance Test

2.2.1.1 The complete transformer shall be subjected to a factory acceptance test in accordance with ANSI C57.12.90. As a minimum an operational check of each component and a demonstration of overall performance as described below:

2.2.1.1.1 Resistance measurements, ratio, polarity and phase relation tests.

2.2.1.1.2 Core loss and exciting current.

2.2.1.1.3 Impedance and load loss.

2.2.1.1.4 Applied-potential test.

2.2.1.1.5 Induced potential test.

2.2.1.1.6 Pressure leak test.

2.2.1.1.7 Insulation power-factor.

2.2.1.2 The Buyer shall be informed ten (10) calendar days in advance of the date that all factory tests are to be conducted. The Buyer reserves the right to attend and witness all factory tests.

2.2.2 Finishes

2.2.2.1 The transformer shall be cleaned, primed and painted for maximum protection from the environment as shown on the data sheets.

2.2.2.2 The transformer exterior shall be finished with ANSI 61 grey in accordance with ASTM D1535.

PART 3 EXECUTION

3.1 PREPARATION

(Not Used)

3.2 INSTALLATION APPLICATION AND ERECTION

(Not Used)

3.3 FIELD QUALITY CONTROL

(Not Used)

3.4 ADJUSTMENT

(Not Used)

3.5 CLEANING

(Not Used)

3.6 PROTECTION

(Not Used)

3.7 DEMONSTRATION

(Not Used)

3.8 SCHEDULES

(Not Used)

END OF SECTION

DATA SHEET

PAD MOUNTED TRANSFORMER

Specification No.: B-595-P-P190-16330

EQUIPMENT NO.: XT-32T-001
SERVICE: Temporary Construction Power
CONTRACT NO.: 845734
PROJECT: HWVP
BY: R. A. HUR **DATE:** 12/20/90
REV.: 0 **DATE:** 12/20/90
CUSTOMER: DOE

I. Transformer

A. Ratings

1. KVA at Self-Cooled Ratings: 500kVA
2. Independence - % on Self-Cooled Rating: 5%
3. Temp Rise - °C at OA Ratings: 65°C
4. High Voltage: 13.8kV DELTA
5. Low Voltage: 480VWYE
6. BIL: 95kV

B. Type of Cooling

1. OA

C. Tap Changer

1. Taps (No Load)
 - a. Above normal, full capacity
(Number and % volts): 2, 2½%
 - b. Below normal, full capacity
(Number and % volts): 2, 2½%

II. Load Break Switch

A. Ratings

1. 15kV
2. BIL: 95kV
3. Make and Latch Rating: 20,000 AMP
4. Continuous Current: 200 AMP

DATA SHEET
PAD MOUNTED TRANSFORMER
Specification No.: B-595-P-P190-16330

EQUIPMENT NO.: XT-32T-002
SERVICE: Temporary Construction Power
CONTRACT NO.: 845734
PROJECT: HWVP
BY: R. A. HUR DATE: 12/20/90
REV.: 0 DATE: 12/20/90
CUSTOMER: DOE

I. Transformer

A. Ratings

1. KVA at Self-Cooled Ratings: 1,000kVA
2. Independence - % on Self-Cooled Rating: 5%
3. Temp Rise - °C at OA Ratings: 65°C
4. High Voltage: 13.8kV DELTA
5. Low Voltage: 480VWYE
6. BIL: 95kV

B. Type of Cooling

1. OA

C. Tap Changer

1. Taps (No Load)
 - a. Above normal, full capacity
(Number and % volts): 2, 2½%
 - b. Below normal, full capacity
(Number and % volts): 2, 2½%

II. Load Break Switch

A. Ratings

1. 15kV
2. BIL: 95kV
3. Make and Latch Rating: 20,000 AMP
4. Continuous Current: 200 AMP

DATA SHEET

PAD MOUNTED TRANSFORMER

Specification No.: B-595-P-P190-16330

EQUIPMENT NO.: XT-32T-003
SERVICE: Temporary Construction Power
CONTRACT NO.: 845734
PROJECT: HWVP
BY: R. A. HUR DATE: 12/20/90
REV.: 0 DATE: 12/20/90
CUSTOMER: DOE

I. Transformer

A. Ratings

1. KVA at Self-Cooled Ratings: 1,000kVA
2. Independence - % on Self-Cooled Rating: 5%
3. Temp Rise - °C at OA Ratings: 65°C
4. High Voltage: 13.8kV DELTA
5. Low Voltage: 480VWYE
6. BIL: 95kV

B. Type of Cooling

1. OA

C. Tap Changer

1. Taps (No Load)
 - a. Above normal, full capacity
(Number and % volts): 2, 2½%
 - b. Below normal, full capacity
(Number and % volts): 2, 2½%

II. Load Break Switch

A. Ratings

1. 15kV
2. BIL: 95kV
3. Make and Latch Rating: 20,000 AMP
4. Continuous Current: 200 AMP

DATA SHEET

PAD MOUNTED TRANSFORMER

Specification No.: B-595-P-P190-16330

EQUIPMENT NO.: XT-32T-004

SERVICE: Temporary Construction Power

CONTRACT NO.: 845734

PROJECT: HWVP

BY: R. A. HUR DATE: 12/20/90

REV.: 0 DATE: 12/20/90

CUSTOMER: DOE

I. Transformer

A. Ratings

1. KVA at Self-Cooled Ratings: 500kVA
2. Independence - % on Self-Cooled Rating: 5%
3. Temp Rise - °C at OA Ratings: 65°C
4. High Voltage: 13.8kV DELTA
5. Low Voltage: 480VWYE
6. BIL: 95kV

B. Type of Cooling

1. OA

C. Tap Changer

1. Taps (No Load)
 - a. Above normal, full capacity
(Number and % volts): 2, 2½%
 - b. Below normal, full capacity
(Number and % volts): 2, 2½%

II. Load Break Switch

A. Ratings

1. 15kV
2. BIL: 95kV
3. Make and Latch Rating: 20,000 AMP
4. Continuous Current: 200 AMP

DATA SHEET
PAD MOUNTED TRANSFORMER
Specification No.: B-595-P-P190-16330

EQUIPMENT NO.: XT-32T-005
SERVICE: Temporary Construction Power
CONTRACT NO.: 845734
PROJECT: HWVP
BY: R. A. HUR DATE: 12/20/90
REV.: 0 DATE: 12/20/90
CUSTOMER: DOE

I. Transformer

A. Ratings

1. KVA at Self-Cooled Ratings: 1,000kVA
2. Independence - % on Self-Cooled Rating: 5%
3. Temp Rise - °C at OA Ratings: 65°C
4. High Voltage: 13.8kV DELTA
5. Low Voltage: 480VWYE
6. BIL: 95kV

B. Type of Cooling

1. OA

C. Tap Changer

1. Taps (No Load)
 - a. Above normal, full capacity
(Number and % volts): 2, 2½%
 - b. Below normal, full capacity
(Number and % volts): 2, 2½%

II. Load Break Switch

A. Ratings

1. 15kV
2. BIL: 95kV
3. Make and Latch Rating: 20,000 AMP
4. Continuous Current: 200 AMP

13,800/480 VOLT PAD MOUNTED TRANSFORMER
(B-595-P-P190-16330)
RELATED DOCUMENT 1

SECTION 01730
OPERATION AND MAINTENANCE DATA

REVISION NO. 0
SAFETY CLASS 3
ISSUE DATE 12/21/90

ORIGINATOR(S):

CHECKER(S):

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J. R. Morey, Specification Writer J. M. Janzen, Project Engineer

(Name/Function) (Date) (Name/Function) (Date)

APPROVED BY:

K. A. Owrey 12-20-90
K. A. Owrey Lead Discipline Engineer Date
J. M. Janzen 12-21-90
J. M. Janzen Project Engineer Date
J. L. Smets 12-21-90
J. L. Smets Engineering/Plant Systems Manager Date
E. R. Phillips for ERP 12-21-90
E. R. Phillips Systems Manager Date
F. M. Badwan 12-21-90
F. M. Badwan Independent Safety Manager Date
O. P. Chawla 12-21-90
O. P. Chawla Q. A. Engineer Date
R. N. Gibbons 12-21-90
R. N. Gibbons Project Director Date

**SECTION 01730
OPERATION AND MAINTENANCE DATA**

PART 1 GENERAL

1.1 SUMMARY

(Not Used)

1.2 REFERENCES

(Not Used)

1.3 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit operation and maintenance (O&M) data which is specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Data containing extraneous information to be sorted through to find applicable instructions will not be accepted. Present information in detail to clearly explain user O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with Part III, Section I, Exhibit 5, Vendor Data and Drawing Review (VDDR).

1.3.1 Package Content

For each product, system, or piece of equipment requiring submission of O&M data, submit the package required in the individual technical section. Package content shall be as required in the Paragraph 1.5, "Schedule of Operations and Maintenance Data Packages."

1.4 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.4.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.4.1.1 Safety Precautions

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

1.4.1.2 Operator Prestart

Include requirements to set up and prepare each system for use.

1.4.1.3 Start-up, Shutdown, and Post-shutdown Procedures

Include a control sequence for each of these operations.

1.4.1.4 Normal Operations

Include control diagrams with data to explain operation and control of systems and specific equipment.

1.4.1.5 Emergency Operations

Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

1.4.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.

1.4.1.7 Environmental Conditions

Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

1.4.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.4.2.1 Lubrication Data

Include lubrication data, other than instructions for lubrication in accordance with paragraph entitled "Operator Service Requirements":

- A. A table showing recommended lubricants for specific temperature ranges and applications that will perform in the environment indicated in Section 1.8 of Specification Section 16330;

- B. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and
- C. A lubrication schedule showing service interval frequency.

1.4.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis.

1.4.3 Corrective Maintenance

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

1.4.3.1 Troubleshooting Guides and Diagnostic Techniques

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

1.4.3.2 Wiring Diagrams and Control Diagrams

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

1.4.3.3 Maintenance and Repair Procedures

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

1.4.3.4 Removal and Replacement Instructions

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

1.4.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays.

1.4.3.6 Corrective Maintenance Man-Hours

Include manufacturer's projection of corrective maintenance man-hours. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

1.4.4 Appendices

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

1.4.4.1 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

A. Manufacturer's Standard Commercial Practice: The parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

- B. Other Than Manufacturer's Standard Commercial Practice (MSCP): End item manufacturer may add a cross-reference to implement components' assemblies and parts requirements when implementation in manual form varies significantly from the style, format, and method of manufacturer's standard commercial practice. Use the format in the following example:

End Item Manufacturer's Alphanumeric Sequence	Actual Manufacturer's Name and MSCP	Actual Manufacturer Part No.
100001	John Doe & Co.	00000 2000002

1.4.4.2 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

1.4.4.3 Personnel Training Requirements

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

1.4.4.4 Testing Equipment and Special Tool Information

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

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information from Section 1.4 to be included in each O&M data package is as follows:

1.5.1 Data Package

- A. Safety precautions
- B. Operator prestart
- C. Start-up, shutdown, and post shutdown procedures
- D. Normal operations
- E. Emergency operations
- F. Operator service requirements

- G. Environmental conditions
- H. Lubrication data
- I. Preventive maintenance plan and schedule
- J. Troubleshooting guides and diagnostic techniques
- K. Wiring diagrams and control diagrams
- L. Maintenance and repair procedures
- M. Removal and replacement instructions
- N. Spare parts and supply list
- O. Corrective maintenance manhours
- P. Parts identification
- Q. Warranty information
- R. Personnel training requirements
- S. Testing equipment and special tool information

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION

SECTION 16320
13.8 KV METAL-ENCLOSED INTERRUPTER SWITCHGEAR
(B-595-P-P190-16320)

REVISION NO. 0
SAFETY CLASS 3
ISSUE DATE 12/21/90

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**SECTION 16320
 13.8 KV METAL-ENCLOSED INTERRUPTER SWITCHGEAR**

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SECTION 16320
13.8 KV METAL-ENCLOSED INTERRUPTER SWITCHGEAR

PART 1 GENERAL

1.1 SUMMARY

The work includes the furnishing of outdoor 13.8 kV metal-enclosed switchgear assembly employing fusible air interrupter switches. The specific requirements of the switchgear assembly are given on the One-Line Diagram (Attachment A).

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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/IEEE C57.13	1986 Requirements for Instrument Transformers
ANSI C37.20.3	1987 Metal Enclosed Interrupter Switchgear
ANSI C37.47	1981 Distribution Fuse Disconnecting Switches, Fuse Supports, and Current Limiting Fuses
ANSI C37.55	1989 Switchgear-Metal Clad Switchgear Assemblies
ANSI Z35.1	1972 Accident Prevention Signs, Specifications for

NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	1985 Enclosures for Electrical Equipment
NEMA LA1	1986 Surge Arrestors

1.6.4 Installation Instructions

Submit manufacturer's installation instructions.

1.6.5 Operation and maintenance data in accordance with Related Document 1, Section 01730, "Operation and Maintenance Data."

1.7 CLASSIFICATION OF SYSTEMS AND COMPONENTS

The 13.8 kV metal-enclosed interrupter switchgear is classified as an Occupational Safety (Safety Class 3) item and shall be controlled by conventional industry design standards and codes.

1.8 PROJECT OR SITE ENVIRONMENTAL CONDITIONS

1.8.1 Climatic and Geographic Site Conditions

A. Site Elevation 714 feet above sea level

B. Barometric Pressure 14.3 psia

C. Outside Design Temperature

1. Maximum Design Temperature 101°F

2. Minimum Design Temperature 9°F

3. Wet Bulb Design Temperature 68°F

1.8.2 Operating Environment

A. Normal Temperature 9 - 101°F

B. Relative Humidity Not controlled

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 General

2.1.1.1 The metal-enclosed switchgear assembly shall consist of outdoor self-supporting bays, containing interrupter switches and power fuses with the necessary accessory components, all completely factory-assembled and operationally checked in accordance with ANSI C37.20.3 and ANSI C37.55. The unit shall be designed for outdoor non walk-in application and be provided with a means to permanently anchor the unit to its foundation pad.

- 2.1.1.2 The switchgear shall be designed for use on a 13.8 kV, 3-phase, 3-wire, 60 hertz ungrounded power system, with rms symmetrical fault current as shown on the data sheet.
- 2.1.1.3 Switchgear assemblies shall be weatherproof and fully gasketed in accordance with NEMA Type 3R enclosure in accordance with NEMA 250, and adequately ventilated.
- 2.1.1.4 The switchgear shall have facilities for lifting and base construction suitable for rolling the assembly.
- 2.1.1.5 Each switchgear assembly shall be suitable for addition of units on each end, unless otherwise noted. Buses shall be drilled for future splice plates and a removable gasketed plate shall be furnished on the outside of the cubicle panel for bus extension.
- 2.1.1.6 Sheet steel barriers shall be provided between the vertical sections and between the control compartments and the power compartments.
- 2.1.1.7 Phase-to-phase and phase-to-ground clearance, equivalent to 95 kV BIL minimum, shall be maintained throughout the switchgear unit.
- 2.1.2 Air Interrupter Switches and Switch Operators
- 2.1.2.1 The interrupter switches shall be rated as shown on the data sheet and 3-pole group operated by the means of a switch operator for power operation in accordance with ANSI C37.20.3. The switch operator power shall be supplied from a control power transformer in the switchgear.
- 2.1.2.2 The interrupter switches shall be closed manually and open either manually or automatically.
- 2.1.2.3 Switch operators shall be of the stored energy type. They shall be equipped with an integral quick-make quick-break mechanism.
- 2.1.2.4 Switch operators shall be equipped with a tripping solenoid to release the stored energy to open the interrupter switch in the event of a single blown-out fuse.
- 2.1.2.5 The door of each switch section shall be mechanically interlocked with the switch to prevent opening of the door with the switch closed or closing the switch with the door open.
- 2.1.2.6 The door shall have a plexiglass wide-view window to permit checking the switch position.
- 2.1.2.7 Provision shall be made for padlocking the operating mechanism in both closed and open positions.

2.1.3 Power Fuses

2.1.3.1 Fuses shall be rated as shown on the One Line Diagram (Attachment A). They shall be solid-material type, self-contained and shall provide fast and complete interruption with a minimum of let-through current in accordance with ANSI C37.47.

2.1.3.2 Fuses shall be accessible for inspection, removal and changeout.

2.1.3.3 Fuses shall be equipped with a blown-fuse indicator that shall provide visible evidence of fuse operation while installed in the fuse mounting.

2.1.4 Space Heaters

2.1.4.1 Space heaters shall be provided in each vertical section to prevent condensation. The space heater power shall be supplied from a control power transformer in the switchgear.

2.1.4.2 Space heater control shall be provided with thermostat and single-pole, 120 volt ac circuit breaker.

2.1.5 Power Bus

2.1.5.1 Power bus shall be copper and shall be completely insulated with flame retardant, non-hygroscopic, non-tracking insulation. All bolted bus connections shall be silver or tin plated. Incoming and outgoing connections shall be suitable for conductor size as indicated on the One-Line Diagram (Attachment A). Bus supports shall be porcelain.

2.1.5.2 The bus supports, bus, and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the switchgear as shown on the data sheet.

2.1.6 Ground Bus

2.1.6.1 A copper ground bus shall be provided the entire length of the assembly and shall provide connections in each vertical section. It shall be equipped with solderless connectors for No. 2/0 AWG copper cable at each end for feeder ground wires in each section.

2.1.6.2 In each bay, the ground bus shall be bolted to a nickel-plated steel bracket, which shall be welded in place.

2.1.6.3 Nickel-plated steel brackets shall have a short-time current-carrying capability consistent with the short-circuit rating of the switchgear as shown on the data sheet.

2.1.7 Surge Arrestors

2.1.7.1 Surge arresters shall be provided in the switchgear incoming line compartment to provide an adequate capability and be voltage limiting to keep voltage surges below the insulating level of switchgear as shown on the data sheet. Surge arresters shall be in accordance with NEMA LA-1 and UL-1449.

2.1.8 Control Wiring and Terminal Blocks

2.1.8.1 Internal control wiring shall be flexible stranded copper conductor, minimum (No. 14 AWG) size, 600 volt, single conductor having moisture resistant and flame retardant insulation. All wiring shall be bundled and supported by straps.

2.1.8.2 All screw-type wire terminations shall make use of compression type connectors which grip the conductor and employ insulated compression sleeves to grip the wire insulation.

2.1.8.3 Terminal blocks shall be located so that control wiring is accessible without exposing personnel to bus voltage.

2.1.9 Cable-Termination Space

2.1.9.1 Provisions shall be made for full front access for positioning and removal of cable pulling sheaves to facilitate cable pulling and installation of cable terminators.

2.1.10 Instrument Transformers

2.1.10.1 Current Transformers

2.1.10.1.1 The current transformers shall have mechanical rating equal to the momentary rating of the switchgear as shown on the data sheet and shall be insulated for full voltage rating of the switchgear.

2.1.10.1.2 Normal current-carrying capacities and ratio shall be as indicated on the One Line Diagram (Attachment A).

2.1.10.1.3 The current transformers shall have an insulation level for the installed location as shown on the data sheet. Metering accuracy shall meet or exceed ANSI/IEEE C57.13.

2.1.10.2 Potential Transformers

2.1.10.2.1 The potential transformers shall be non-drawout type accessible from the front of the switchgear cubicle and shall be equipped with current limiting fuses. Fuses, sized to prevent overload to the potential transformers, shall be installed in both the high and low voltage circuits.

2.1.10.2.2 Primary fuses and high voltage parts shall not be accessible when connected to the power source. Potential transformers and current limiting fuses shall be completely disconnected and visibly grounded when in position for inspection.

2.1.10.2.3 The potential transformers shall have ratios as shown on the One Line Diagram (Attachment A).

2.1.10.2.4 The potential transformers shall have an insulation level to withstand the basic impulse level of the switchgear as shown on the data sheet and ANSI metering accuracy classification of 0.3 at 120V for ANSI standard burdens in accordance with ANSI/IEEE C57.13. Two spare fuses for each size fuse used shall be furnished with each potential transformer set.

2.1.11 Meters and Selector Switches

The meters and selector switches shall be mounted on the front of the switchgear panels and arranged in a symmetrical manner.

2.1.11.1 Meters

2.1.11.1.1 The watt-hour meter shall be semi-flush mounted switchboard type, 2-stator, 3 phase, 3 wire with a pulse initiator. The PT ratio of 14,400/120 and CT ratio of 800/5 are to be provided with auxiliary plate printed "kilowatt hour multiplied by 100".

2.1.11.1.2 Both voltmeter and ammeter shall be semi-flush mounted switchboard type, 4-1/2 inch square with scales spread 250 circular degrees and fitted with anti-glare glass. Moving elements shall be provided with zero adjustment. Accuracy shall be ± 1 percent of full scale deflection.

A. Ammeter scale: 0 ~ 800 amps

B. Voltmeter scale: 0 ~ 15,000 volts

2.1.11.2 Selector Switches

Both voltmeter and ammeter selector switches shall be heavy duty switch board type with "knurled knob" handles.

2.1.12 Switchgear Identification

2.1.12.1 The switchgear assembly shall be provided with an external nameplate indicating the manufacturer's drawing number, voltage ratings (kV, nominal; kV, maximum; kV, BIL), main bus continuous rating (amperes), short-circuit ratings (amperes, rms symmetrical and Mva three-phase symmetrical at rated nominal voltage, and the momentary and fault-closing ratings (amperes, rms asymmetrical).

- 2.1.12.2 Each individual bay shall bear a nameplate indicating the ratings of the interrupter switch (amperes continuous and interrupting) the maximum rating of the fuse in amperes and the catalog number of the fuse units, refill units, interrupting module, or control module.
- 2.1.12.3 Each shipping section of switchgear shall be identified by a permanently attached nameplate showing the equipment tag number.
- 2.1.13 Warning Signs
 - 2.1.13.1 The switchgear shall be provided with appropriate precautionary warning signs in accordance with ANSI Z35.1 to call the users attention to potential hazards.
 - 2.1.13.2 All external doors and hinged bolted panels providing access to high voltage shall be provided with "CAUTION - HIGH VOLTAGE - KEEP OUT" signs.
 - 2.1.13.3 All internal doors and protective screens providing access to high voltage shall be provided with "DANGER-HIGH VOLTAGE - KEEP OUT - AUTHORIZED PERSONNEL ONLY" signs.
 - 2.1.13.4 All internal doors and protective screens providing access to interrupter switches shall be provided with warning signs indicating that "Switch Blades May Be Energized in Any Position."
 - 2.1.13.5 All internal doors and protective screens providing access to power fuses shall be provided with warning signs indicating that "Fuses May Be Energized in Any Position."

2.2 FABRICATION AND MANUFACTURE

2.2.1 Factory Acceptance Test

- 2.2.1.1 The complete switchgear shall be subjected to factory tests in accordance with ANSI C37.20.3 and ANSI C37.55. As a minimum an operational check of each component and a demonstration of overall performance as described below:
 - 2.2.1.1.1 Inspection checks of the switch mechanism and manual operation are made prior to electrical test of the switch.
 - 2.2.1.1.2 No-load operational tests are made at maximum, standard and minimum control voltage ratings for electrically operated switches.
 - 2.2.1.1.3 Control circuits are checked functionally to determine that the devices will operate when proper voltages are applied. Interlock circuits are tested under operating conditions or are checked for continuity if not operated.

- 2.2.1.1.4 Relaying and metering circuits are energized and devices are checked to be certain polarities are correct, that elements are in operating condition, and that relay contacts will perform their assigned purposes.
- 2.2.1.2 The Buyer shall be informed ten (10) calendar days in advance of the date that all factory tests are to be conducted. The Buyer reserves the right to attend and witness all factory tests.
- 2.2.2 Finishes
 - 2.2.2.1 The switchgear shall be cleaned, primed, and painted for maximum protection from the environment as shown on the data sheet.
 - 2.2.2.2 The switchgear exterior shall be finished with light gray No. 61 in accordance with ASTM D1535.

PART 3 EXECUTION

3.1 PREPARATION

(Not Used)

3.2 INSTALLATION APPLICATION AND ERECTION

(Not Used)

3.3 FIELD QUALITY CONTROL

(Not Used)

3.4 ADJUSTMENTS

(Not Used)

3.5 CLEANING

(Not Used)

3.6 PROTECTION

(Not Used)

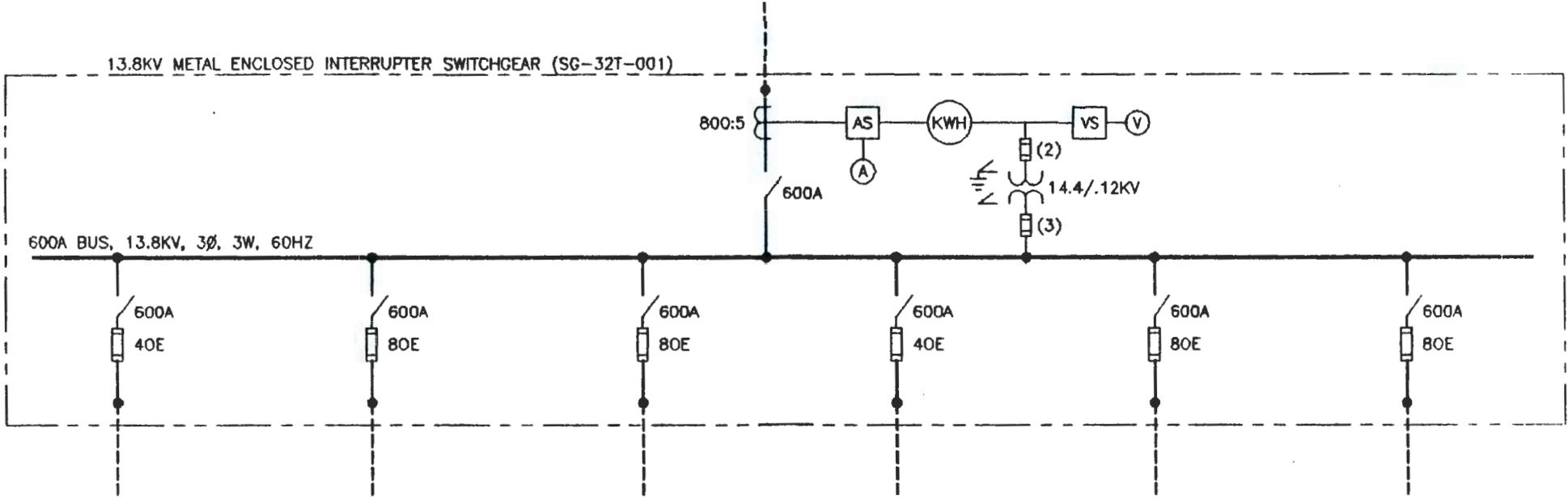
3.7 DEMONSTRATION

(Not Used)

3.8 SCHEDULES

(Not Used)

END OF SECTION



LEGEND:

- (*) FUSE, QUANTITY AS SHOWN (*)
- POWER FUSE, TYPE AS INDICATED
- SELECTOR SWITCH
VS:VOLTMETER, AS:AMMETER
- METER, V:VOLTMETER, A:AMMETER
KWH:KILOWATT-HOUR METER
- AIR INTERRUPTER SWITCH, 600A
- CURRENT TRANSFORMER,
800:5 RATIO
- POTENTIAL TRANSFORMER,
14400:120 RATIO
- FIELD WIRING

SECTION 16320
 13.8KV METAL-ENCLOSED
 INTERRUPTER SWITCHGEAR
 (B-595P-P190-16320)
 ATTACHMENT "A"
 ONE-LINE DIAGRAM
 SK-2-91313 REV. 0



DATA SHEET

METAL-ENCLOSED INTERRUPTER SWITCHGEAR

EQUIPMENT NO. SG-32T-001

SERVICE Temporary Construction Power

CONTRACT NO. 845734 CUSTOMER DOF

PROJECT HWVP

BY R. Hur DATE 12/19/90

REV. 0 DATE 12/21/90

<p>REFER TO SPECIFICATION NO. <u>B-595P-P190-16320</u> FOR GENERAL REQUIREMENTS.</p> <hr/> <p>REFER TO ONE-LINE DIAGRAM, DRAWING NOS. <u>Attachment A</u></p> <hr/> <p>SITE CONDITIONS</p> <p>ELEVATION: <u>714 FEET</u> MIN./MAX. TEMP.: <u>9</u> °F / <u>101</u> °F SEISMIC REQUIREMENTS: <u>N/A</u></p> <hr/> <p>ENCLOSURE</p> <p><input type="checkbox"/> INDOOR <input checked="" type="checkbox"/> OUTDOOR <input type="checkbox"/> OUTDOOR WITH MAINTENANCE AISLE</p> <hr/> <p>RATINGS</p> <p>VOLTAGE CLASS <u>15</u> KV MVA CLASS <u>250</u> BIL <u>95</u> KV FREQUENCY <u>60</u> Hz CLOSE & LATCH _____ KA RMS SYM Fault Current <u>14</u> KA</p> <hr/> <p>MAIN BUS</p> <p><input checked="" type="checkbox"/> COPPER <input type="checkbox"/> ALUMINUM <input type="checkbox"/> 8000 AMP <input checked="" type="checkbox"/> 600 AMP <input type="checkbox"/> 1200 AMP</p> <hr/> <p>INCOMING SUPPLY</p> <p><input type="checkbox"/> PORCELAIN ROOF BUSHINGS <input type="checkbox"/> CONDUIT HUBS NO. REQUIRED _____ SIZE _____ LOCATION _____</p> <p><input type="checkbox"/> REMOVABLE BOTTOM PLATE REQUIRED <input checked="" type="checkbox"/> COPPER CABLE <input type="checkbox"/> ALUMINUM CABLE</p>	<p>OUTGOING CABLES</p> <p><input type="checkbox"/> TOP <input checked="" type="checkbox"/> BOTTOM <input checked="" type="checkbox"/> COPPER <input type="checkbox"/> ALUMINUM</p> <hr/> <p>CONTROL CABLES</p> <p><input type="checkbox"/> TOP <input checked="" type="checkbox"/> BOTTOM</p> <hr/> <p>FUSE TYPE</p> <p><input type="checkbox"/> POWER (EXPULSION) <input checked="" type="checkbox"/> CURRENT LIMITING</p> <hr/> <p>ACCESSORIES AND SPECIAL FEATURES</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:80%;"></th> <th style="width:20%; text-align: center;">REQD</th> </tr> </thead> <tbody> <tr> <td>SPACE HEATERS _____</td> <td style="text-align: center;">X</td> </tr> <tr> <td>SPECIAL MAINT. TOOLS _____</td> <td></td> </tr> <tr> <td>KEY INTERLOCKS _____</td> <td style="text-align: center;">X</td> </tr> <tr> <td>BURGE ARRESTORS _____</td> <td style="text-align: center;">X</td> </tr> <tr> <td>OTHER <u>Interrupter Switch Rating; 15kV, 600 AMP</u></td> <td></td> </tr> <tr> <td>_____</td> <td></td> </tr> </tbody> </table> <hr/> <p>TESTS AND INSPECTION</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:70%;"></th> <th style="width:15%; text-align: center;">REQD</th> <th style="width:15%; text-align: center;">WITNESSED</th> </tr> </thead> <tbody> <tr> <td>INSPECTION BY BUYER _____</td> <td style="text-align: center;">X</td> <td></td> </tr> <tr> <td>ROUTINE TESTS _____</td> <td></td> <td></td> </tr> <tr> <td>SPECIAL TESTS _____</td> <td></td> <td></td> </tr> <tr> <td>_____</td> <td></td> <td></td> </tr> <tr> <td>_____</td> <td></td> <td></td> </tr> </tbody> </table>		REQD	SPACE HEATERS _____	X	SPECIAL MAINT. TOOLS _____		KEY INTERLOCKS _____	X	BURGE ARRESTORS _____	X	OTHER <u>Interrupter Switch Rating; 15kV, 600 AMP</u>		_____		_____		_____		_____		_____			REQD	WITNESSED	INSPECTION BY BUYER _____	X		ROUTINE TESTS _____			SPECIAL TESTS _____			_____			_____		
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INSPECTION BY BUYER _____	X																																								
ROUTINE TESTS _____																																									
SPECIAL TESTS _____																																									

OTHER REQUIREMENTS: Incoming cable entry to bottom of switchgear is required.

13.8 KV METAL-ENCLOSED INTERRUPTER SWITCHGEAR
(B-595-P-P190-16320)
RELATED DOCUMENT 1

SECTION 01730
OPERATION AND MAINTENANCE DATA

REVISION NO. 0
SAFETY CLASS 3
ISSUE DATE 12/21/90

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O. P. Chawla Q. A. Engineer 12-21-90
Date
R. N. Gibbons Project Director 12-21-90
Date

13.8 KV METAL-ENCLOSED INTERRUPTER SWITCHGEAR
(B-595-P-P190-16320)

SECTION 01730
OPERATION AND MAINTENANCE DATA

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**SECTION 01730
OPERATION AND MAINTENANCE DATA**

PART 1 GENERAL

1.1 SUMMARY

(Not Used)

1.2 REFERENCES

(Not Used)

1.3 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit operation and maintenance (O&M) data which is specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Data containing extraneous information to be sorted through to find applicable instructions will not be accepted. Present information in detail to clearly explain user O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with Part III, Section I, Exhibit 5, Vendor Data and Drawing Review (VDDR).

1.3.1 Package Content

For each product, system, or piece of equipment requiring submission of O&M data, submit the package required in the individual technical section. Package content shall be as required in the Paragraph 1.5, "Schedule of Operations and Maintenance Data Packages."

1.4 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.4.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.4.1.1 Safety Precautions

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

1.4.1.2 Operator Prestart

Include requirements to set up and prepare each system for use.

1.4.1.3 Start-up, Shutdown, and Post-shutdown Procedures

Include a control sequence for each of these operations.

1.4.1.4 Normal Operations

Include control diagrams with data to explain operation and control of systems and specific equipment.

1.4.1.5 Emergency Operations

Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

1.4.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.

1.4.1.7 Environmental Conditions

Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

1.4.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.4.2.1 Lubrication Data

Include lubrication data, other than instructions for lubrication in accordance with paragraph entitled "Operator Service Requirements":

- A. A table showing recommended lubricants for specific temperature ranges and applications that will perform in the environment indicated in Section 1.8 of Specification Section 16320;

- B. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and
- C. A lubrication schedule showing service interval frequency.

1.4.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis.

1.4.3 Corrective Maintenance

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

1.4.3.1 Troubleshooting Guides and Diagnostic Techniques

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

1.4.3.2 Wiring Diagrams and Control Diagrams

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

1.4.3.3 Maintenance and Repair Procedures

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

1.4.3.4 Removal and Replacement Instructions

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

1.4.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays.

1.4.3.6 Corrective Maintenance Man-Hours

Include manufacturer's projection of corrective maintenance man-hours. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

1.4.4 Appendices

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

1.4.4.1 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

- A. Manufacturer's Standard Commercial Practice: The parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

- B. Other Than Manufacturer's Standard Commercial Practice (MSCP): End item manufacturer may add a cross-reference to implement components' assemblies and parts requirements when implementation in manual form varies significantly from the style, format, and method of manufacturer's standard commercial practice. Use the format in the following example:

End Item Manufacturer's Alphanumeric Sequence	Actual Manufacturer's Name and MSCP	Actual Manufacturer Part No.
100001	John Doe & Co. 00000	2000002

1.4.4.2 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

1.4.4.3 Personnel Training Requirements

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

1.4.4.4 Testing Equipment and Special Tool Information

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

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information from Section 1.4 to be included in each O&M data package is as follows:

1.5.1 Data Package

- A. Safety precautions
- B. Operator prestart
- C. Start-up, shutdown, and post shutdown procedures
- D. Normal operations
- E. Emergency operations
- F. Operator service requirements

- G. Environmental conditions
- H. Lubrication data
- I. Preventive maintenance plan and schedule
- J. Troubleshooting guides and diagnostic techniques
- K. Wiring diagrams and control diagrams
- L. Maintenance and repair procedures
- M. Removal and replacement instructions
- N. Spare parts and supply list
- O. Corrective maintenance manhours
- P. Parts identification
- Q. Warranty information
- R. Personnel training requirements
- S. Testing equipment and special tool information

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION