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Mr. John Grantham
State of Washington
Department of Ecology
Nuclear & Mixed Waste Program
P. O. Box 47600
Olympia, WA 98504-7600

FLUOR DANIEL, INC.

Date: July 29, 1992

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

Transmittal No.: WDOE-177

Dear Mr. Grantham:

TRANSMITTAL

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

Response due to Fluor: N/A
Responds to: P190 PKG

NUMBER	Rev.	Date	TITLE
SEE TRANSMITTAL ATTACHMENT			P190 UNIT SUBSTATIONS PKG SPECIFICATIONS

9312975.0493

Distribution:

- REFERENCE: FRP-491, FUP-185
- R. L. Long, DOE-RL, w/0
- VPO/AME Corresp Cntrl Cntr, MSIN A5-10 (P190 PKG), w/0
- P. Felise, WHC-RL (MSIN G6-16), w/1 Spec
- Environmental Data Management Center (MSIN H4-44), w/1 Spec
- D. Duncan, US EPA, Region X, w/0

Very truly yours,

Rosalie Cadenas for
R. S. Poulter
Project Director

MHF
RSP:MHF:1t



TRANSMITTAL ATTACHMENT FOR PACKAGE SPECIFICATIONS

SPEC NUMBER	PKG REV	SECT REV	PACKAGE TITLE	SECT	SECTION TITLE
B-595-P-P190	3	3	UNIT SUBSTATIONS	01730	OPERATION AND MAINTENANCE DATA
		3		16320	13.8 KV METAL-ENCLOSED INTERRUPTER SWTGR
		3		16330	DRY-TYPE TRANSFORMER

9312975.0094

SPECIFICATIONS

**UNIT SUBSTATIONS
B-595-P-P190**

**HANFORD WASTE
VITRIFICATION PLANT**

**U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE**



**FLUOR DANIEL
ADVANCED TECHNOLOGY DIVISION
CONTRACT 8457**

**DOE CONTRACT NO.
DE-AC06-86RL10838**

9312975.0485

UNIT SUBSTATIONS
(B-595-P-P190)

"APPROVED FOR CONSTRUCTION"

REVISION NO. 3
Per CR-0739

SAFETY CLASS 4 (Ref)

ISSUE DATE 7-28-92

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Date

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Date

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UNIT SUBSTATIONS
(B-595-P-P190)

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16330	Dry-Type Transformer	3

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SECTION 01730
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 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 sufficient detail to clearly explain user O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/Subcontract.

1.1.1 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 1.3, "Schedule of Operations and Maintenance Data Packages."

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 Operating Instructions

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

1.2.1.1 Safety Precautions

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

1.2.1.2 Operator Prestart

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

1.2.1.3 Start-Up, Shutdown, and Post-Shutdown Procedures

Include a control sequence for each of these operations.

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1.2.1.4 Normal Operations

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

1.2.1.5 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.

1.2.1.6 Operator Service Requirements

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

1.2.1.7 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.

1.2.2 Preventive Maintenance

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

1.2.2.1 Lubrication Data

Include lubrication data, other than instructions for lubrication in accordance with Paragraph 1.2.1.6, Operator Service Requirements.

1.2.2.2 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.

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1.2.3 Corrective Maintenance

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

1.2.3.1 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.

1.2.3.2 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.

1.2.3.3 Maintenance and Repair Procedures

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

1.2.3.4 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.

1.2.3.5 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.

1.2.3.6 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.

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1.2.4 Appendices

Provide information specified in the preceding paragraphs pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.4.1 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

1.2.4.2 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.

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1.2.4.3 Personnel Training Requirements

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

1.2.4.4 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.

1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

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

1.3.1 Data Package

- A. Operating instructions
- B. Safety precautions
- C. Operation prestart
- D. Start-up, shutdown, and post shutdown
- E. Normal operations
- F. Emergency operations
- G. Operator Service Requirements
- H. Environmental conditions
- I. Preventative maintenance
- J. Lubrication data
- K. Preventive maintenance plan and schedule
- L. Corrective maintenance
- M. Troubleshooting guides and diagnostic techniques
- N. Wiring diagrams and control diagrams
- O. Maintenance and repair procedures and manhour requirements
- P. Removal and replacement instructions
- Q. Spare parts and supply list

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- R. Parts identification
- S. Warranty information
- T. Personnel training requirements
- U. Testing equipment and special tool information

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION

9312975.0503

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 | 1978 Standard Requirements for Instrument Transformers (R-1987) |
| ANSI C37.20.3 | 1987 Metal Enclosed Interrupter Switchgear |
| ANSI C37.47 | 1981 Distribution Fuse Disconnecting Switches, Fuse Supports, and Current Limiting Fuses, Specifications for (R-1988) |
| ANSI C37.55 | 1989 Switchgear-Metal Clad Switchgear Assemblies - Conformance Test Procedures |
| ANSI C37.90.1 | 1989 Standard Surge Withstand Capacity (SWC) Tests for Protective Relays and Relay Systems |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|-----------|---|
| NEMA 250 | 1985 Enclosures for Electrical Equipment (1000 Volts Maximum), Rev. 2, 1988 |
| NEMA LA 1 | 1986 Surge Arrestors |

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UNDERWRITERS LABORATORIES (UL)

UL 1449 1985 Transient Voltage Surge Suppressors

1.3 RELATED REQUIREMENTS

Specification Section 01730 Operation and Maintenance Data

1.4 DEFINITIONS

(Not Used)

1.5 SYSTEM DESCRIPTION

The 13.8 kV metal-enclosed interrupter switchgear shall provide construction power to Hanford Waste Vitrification Plant (HWVP) throughout the construction period.

1.6 SUBMITTALS

Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/Subcontract.

1.6.1 Data Sheets

Submit product data sheets for switchgear cable connectors and bus connections.

1.6.2 Shop Drawings

Submit detailed shop drawings indicating outline dimensions, enclosure construction, shipping splits, lifting and supporting points, schematic single line diagrams, elementary and detailed connection diagrams and equipment electrical rating. Also provide approximate position of overall vertical and horizontal center of gravity for unit, size and location of anchor bolts, hold down and/or base frame details and the shipping and operating weights.

1.6.3 Test Procedures

Test procedures for Buyer's approval, to include factory tests described under Factory Acceptance Test paragraph of this section.

1.6.4 Test Reports

Submit factory Certified Test Reports on 13.8 kV metal-enclosed interrupter switchgear after performing switchgear factory acceptance tests in accordance with ANSI C37.20.3 and ANSI C37.55 as indicated in paragraph 2.2.1.

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- 1.6.5 Installation Instructions
Submit manufacturer's installation instructions.
- 1.6.6 Operation and maintenance data in accordance with Specification Section 01730, "Operation and Maintenance Data."
- 1.7 CLASSIFICATIONS OF SYSTEMS AND COMPONENTS
(Not Used)
- 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 110°F
 - 2. Minimum Design Temperature -20°F
- 1.8.2 Operating Environment
- A. Normal Temperature -20°F to 110°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 (Attachment B).

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- 2.1.1.3 The switchgear shall have facilities for lifting and base construction for rolling the assembly.
- 2.1.1.4 Each switchgear assembly shall have the capability of adding 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.
- 2.1.1.5 Sheet steel barriers shall be provided between the vertical sections and between the control compartments and the power compartments.
- 2.1.1.6 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 opened 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 Plexiglas or equal wide-view window to permit checking the switch position.
- 2.1.2.7 Provision shall be made for padlocking the operating mechanism in the open position.
- 2.1.2.8 Furnish all 15kV cable lugs. Lugs shall be solderless type.

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- 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.
- 2.1.3.4 One set of spare fuses for each size of fuse shall be provided.
- 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. 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 continuous 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 crimp 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.

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- 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 Lightning Arresters
 - 2.1.7.1 Lightning 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. Lightning 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. Terminal blocks shall have at least 20 percent spare terminal positions.
 - 2.1.8.4 Short circuiting type terminal blocks shall be provided for current transformer circuits.
- 2.1.9 Cable-Termination Space
 - 2.1.9.1 Provisions shall be made for either front or rear 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 transformer thermal and mechanical capabilities shall be sufficient to withstand, without damage, the momentary and interrupting requirements same as 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 Metering accuracy shall meet or exceed ANSI/IEEE C57.13.

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2.1.11.2 Relays

2.1.11.2.1 Protective relays and all auxiliary relays associated with the protective relays shall be flush mounted inside the switchgear enclosure, and readily available for maintenance. Relays shall meet the requirements of ANSI C37.90.1.

2.1.11.2.2 Relay type and quantity shall be as shown on the one line diagram (Attachment A).

2.1.11.3 Selector Switches

2.1.11.3.1 Selector switches shall be installed inside the outdoor switchgear enclosure.

2.1.11.3.2 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), Mva three-phase symmetrical rating 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 and refill units.

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 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.

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- 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."
- 2.1.14 Two vapor tight lighting fixtures with globes, guards and incandescent lamps, a switch and a duplex receptacle shall be provided for exterior lighting and power. The 120V power shall be supplied from the space heater control power transformer described in 2.1.4.1.
- 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 shall be made as described below:
- 2.2.1.1.1 Inspection checks of the switch mechanism and manual operation shall be made prior to electrical test of the switch.
- 2.2.1.1.2 Control circuits shall be checked functionally to determine that the devices will operate when proper voltages are applied.
- 2.2.1.1.3 Relaying and metering circuits shall be energized and devices shall be 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 environmental conditions 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. One pint of light gray No. 61 for touch up shall be provided during shipment.

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U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

Rev. 3

PART 3 EXECUTION

(Not Used)

END OF SECTION

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ATTACHMENT B
 DATA SHEET DS-1

EQUIPMENT NO. SG-32T-001
 SERVICE Temporary Construction Power
 CONTRACT NO. 845734 CUSTOMER DOE
 PROJECT HWVP
 BY R. Hur DATE 12/19/90
 REV. 2 DATE 7/2/92

DATA SHEET P190-DS-1
 METAL-ENCLOSED INTERRUPTER SWITCHGEAR

REFER TO SPECIFICATION NO. <u>B-595-P-P190-16320</u> FOR GENERAL REQUIREMENTS.	OUTGOING CABLES <input type="checkbox"/> TOP <input checked="" type="checkbox"/> COPPER <input checked="" type="checkbox"/> BOTTOM <input type="checkbox"/> ALUMINUM																		
REFER TO ONE-LINE DIAGRAM, DRAWING NOS. <u>Attachment A</u>	CONTROL CABLES <input type="checkbox"/> TOP <input checked="" type="checkbox"/> BOTTOM																		
SITE CONDITIONS ELEVATION: <u>714</u> FEET MIN/MAX TEMP <u>-20</u> °F/ <u>110</u> °F SEISMIC REQUIREMENTS: <u>N/A</u>	FUSE TYPE <input checked="" type="checkbox"/> POWER (EXPULSION) <input type="checkbox"/> CURRENT LIMITING																		
ENCLOSURE <input type="checkbox"/> INDOOR <input checked="" type="checkbox"/> OUTDOOR <input type="checkbox"/> OUTDOOR WITH MAINTENANCE AISLE	ACCESSORIES AND SPECIAL FEATURES <table border="1"> <thead> <tr> <th></th> <th>REC'D</th> </tr> </thead> <tbody> <tr> <td>SPACE HEATERS</td> <td>X</td> </tr> <tr> <td>SPECIAL MAINT. TOOLS</td> <td>X</td> </tr> <tr> <td>KEY INTERLOCKS</td> <td></td> </tr> <tr> <td>SURGE ARRESTORS</td> <td>X</td> </tr> <tr> <td>OTHER Interrupter switch rating: 15 KV, 600 Amp</td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table>		REC'D	SPACE HEATERS	X	SPECIAL MAINT. TOOLS	X	KEY INTERLOCKS		SURGE ARRESTORS	X	OTHER Interrupter switch rating: 15 KV, 600 Amp							
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SPACE HEATERS	X																		
SPECIAL MAINT. TOOLS	X																		
KEY INTERLOCKS																			
SURGE ARRESTORS	X																		
OTHER Interrupter switch rating: 15 KV, 600 Amp																			
RATINGS VOLTAGE CLASS <u>15</u> KV MVA CLASS _____ BIL <u>95</u> KV FREQUENCY <u>60</u> Hz CLOSE & LATCH _____ KA RMS SYM. FAULT CURRENT <u>20</u> KA																			
MAIN BUS <input checked="" type="checkbox"/> COPPER <input type="checkbox"/> ALUMINUM <input type="checkbox"/> 2000 AMP <input checked="" type="checkbox"/> 600 AMP <input type="checkbox"/> 1200 AMP																			
INCOMING SUPPLY <input type="checkbox"/> PORCELAIN ROOF BUSHINGS <input type="checkbox"/> CONDUIT HUBS NO. REQUIRED _____ SIZE _____ LOCATION _____ <input type="checkbox"/> REMOVABLE BOTTOM PLATE REQUIRED <input checked="" type="checkbox"/> COPPER CABLE <input type="checkbox"/> ALUMINUM CABLE	TESTS AND INSPECTION <table border="1"> <thead> <tr> <th></th> <th>REC'D</th> <th>WITNESSED</th> </tr> </thead> <tbody> <tr> <td>INSPECTION BY BUYER</td> <td>X</td> <td>X</td> </tr> <tr> <td>ROUTINE TESTS</td> <td>X</td> <td>X</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>		REC'D	WITNESSED	INSPECTION BY BUYER	X	X	ROUTINE TESTS	X	X	SPECIAL TESTS								
	REC'D	WITNESSED																	
INSPECTION BY BUYER	X	X																	
ROUTINE TESTS	X	X																	
SPECIAL TESTS																			

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

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SECTION 16330
DRY TYPE TRANSFORMER

PART 1 GENERAL

1.1 SUMMARY

The work includes the furnishing of outdoor three-phase dry type self cooled 13.8 Δ /.48 kV Wye 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 C37.20.3 1987 Metal Enclosed Interrupter Switchgear.

ANSI C57.12.51 1981 Ventilated Dry-Type power transformers, 501 kVA and Larger, 3-Phase, with High-Voltage 601 to 34,500 Volts, Low Voltage 208Y/120 to 4160 Volts, Requirements for (R-1989).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)

IEEE C57.12.01 1989 Standard General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and/or Resin-Encapsulated Windings

IEEE C57.12.91 1979 Standard Test Code for Dry-Type Distribution and Power Transformers

NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION (NEMA)

NEMA ST 20 1986 Dry Type Transformers for General Applications

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1.3 RELATED REQUIREMENTS

Specification Section 01730 Operation and Maintenance Data

1.4 DEFINITIONS

(Not Used)

1.5 SYSTEM DESCRIPTION

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

1.6 SUBMITTALS

Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/Subcontract.

1.6.1 Data Sheets

Submit product data sheets for disconnect switches, transformers, and low voltage bus ducts (bus throats).

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 each unit of a given size as shown on Attachment A.

1.6.3 Test Procedures

Test procedures for Buyer's approval, to include factory tests described under Factory Acceptance Test paragraph of this section.

1.6.4 Test Reports

Submit factory Certified Test Reports on transformers after performing factory acceptance test as indicated in Paragraph 2.2.1.

1.6.5 Installation Instructions

Submit manufacturer's installation instructions

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1.6.6 Operation and maintenance data in accordance with Specification Section 01730, "Operation and Maintenance Data."

1.7 CLASSIFICATION OF SYSTEMS AND COMPONENTS

(Not Used)

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 110°F

2) Minimum Design Temperature -20°F

1.8.2 Operating Environment

A. Normal Temperature -20° to 110°F

B. Relative Humidity Not Controlled

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 General

2.1.1.1 Transformers shall be dry-type, self-cooled, epoxy cast coil type, in accordance with ANSI C57.12.51, IEEE C57.12.01 and NEMA ST 20.

2.1.1.2 The transformers shall be metal enclosed, dead front, free standing, suitable for outdoor installation.

2.1.1.3 Transformers shall be three phase, 60 hertz with primary and secondary voltages as shown on Attachment A.

2.1.1.4 13.8/.48 kV transformers shall consist of the transformer, air interrupter switch and low voltage bus duct (bus throat). The transformer, the air interrupter switch and the bus duct (bus throat) shall be assembled as an integral unit for weld mounting on a concrete embedded steel channel.

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2.1.1.5 Each transformer shall be designed for continuous operation at the specified kVA rating and at the specified ambient temperature and site elevation conditions without exceeding the average winding temperature rise. Specified kVA rating and temperature rise shall be as shown on Attachment A.

2.1.1.6 Insulating level (BIL) shall be as specified on Attachment A and in accordance with IEEE C57.12.01.

2.1.1.7 The percent impedance shall be based on the self-cooled rating of the transformer as shown on Attachment A and in accordance with IEEE C57.12.01.

2.1.2 Transformer Enclosure

2.1.2.1 The enclosure shall be constructed of heavy gauge sheet steel in accordance with ANSI C57.12.51, IEEE C57.12.01 and NEMA ST 20 for outdoor enclosures. The base shall be constructed of structural steel members to permit skidding or rolling in any direction.

2.1.3 Short Circuit Requirements

The transformer, including all items such as bushings, connections, switches, buses and taps, shall be designed and constructed to withstand the mechanical and thermal stresses produced by external short circuits having a duration of 2 seconds and a magnitude specified in accordance with IEEE C57.12.01.

2.1.4 Nameplates

2.1.4.1 A stainless steel nameplate shall be mounted approximately at eye level height on each transformer enclosure, and shall present as a minimum the following information:

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

2.1.4.1.2 The kVA rating and temperature rise.

2.1.4.1.3 Transformer impedance, on the base kVA rating.

2.1.4.1.4 Tap position, voltage, and full load current at each tap setting.

2.1.4.1.5 Low voltage rating and full load current.

2.1.4.1.6 Temperature rise in °C.

2.1.4.2.1 Total weight, and weight of core and coils.

2.1.4.2.2 Conductor material of each winding.

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2.1.4.3 Each transformer shall be identified by a permanently attached stainless steel nameplate showing the equipment number as shown on Attachment A. This nameplate shall be mounted next to the nameplate covered by Paragraph 2.1.4.1.

2.1.5 Taps

2.1.5.1 Four (4) 2.5 percent full capacity taps shall be supplied at the high voltage windings, two (2) above and two (2) below rated voltage.

2.1.6 Air Interrupter Switches

2.1.6.1 Air interrupter switches shall be provided on the primary side of the 13.8/.48 kV transformers with cable or bus connections to the transformers.

2.1.6.1.1 Structure

- A. The assembly shall be a full height, metal-enclosed, freestanding, dead-front steel structure for outdoor installation. It shall contain a ground bus, interrupter switch and termination hardware.
- B. The enclosure shall be rigidly constructed to allow mounting pad level variations of plus or minus 1/8 inch. Under these conditions, doors shall open and close smoothly and all mechanical interlocks shall function properly.
- C. A continuous copper ground bus shall be provided for the entire length of the assembly and shall afford connections in each vertical section. Each end shall be equipped with a solderless connector for 5/8 inch steel cable.

2.1.6.1.2 Equipment Enclosure

- A. Each assembly shall contain one compartment with a hinged door. Each door shall be equipped with a locking handle with two (2) keys.
- B. The doors shall be mechanically interlocked with the switch to prevent opening the doors with the switch closed or closing the switch with the doors open.
- C. The switch compartment door shall have a Plexiglas or equal covered window adequate for viewing the position of all switch contacts.

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2.1.6.1.3 Air Interrupter Switch

- A. The air interrupter switches shall be the "stored energy" type, using a direct acting spring charged mechanism for both the closing and opening strokes or an approved equivalent operating mechanism.
- B. Switches shall be 3 pole, 200A, 15 kV, load-break type and shall have an interrupting rating of 20 kA. Switches shall be in accordance with ANSI C37.20.3.

2.1.6.1.4 Cable Terminations

- A. All interconnecting conductors and their terminating hardware shall be provided by the Seller.
- B. Solderless crimp type cable lugs shall be provided for the termination of the incoming 13.8 kV conductors in the number and size specified on Attachment A.

2.1.7 Bus Duct

2.1.7.1 The transformers shall be furnished with a bus duct (throat) to connect the transformers to Buyer's outdoor switchboards. The bus ducts shall be metal enclosed, outdoor type, 18" long, 3-phase, 4-wire, plus ground. See attached sketch (Attachment B).

2.1.7.2 Bus duct flanges shall be furnished with a weather proof gasket and drilled for nut and bolt connection to the 480/277V switchboards. The gaskets, nuts and bolts shall be supplied by the transformer manufacturer.

2.1.8 Bushings

2.1.8.1 The insulation level of the line bushings shall be not less than that specified for the winding terminals to which they are connected.

2.1.8.2 Neutral connections shall be furnished for all three phase Wye-connected windings. Neutrals shall be connected to the ground bus.

2.1.9 Grounding

The transformer cores shall be grounded to the base and to the ground bus.

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2.1.10 Provisions for Handling and Field Erection

2.1.10.1 Lifting

2.1.10.1.1 Means for lifting the complete transformer shall be provided. Lifting means, such as lifting lugs or eyes, shall be free of sharp edges.

2.1.10.2 Moving Facilities

2.1.10.2.1 The base shall permit sliding or rolling (using pipe rollers) in the directions of both center lines of the transformer and provision shall be made for moving the transformer in these directions.

2.1.11 Warning Signs

2.1.11.1 The transformer shall be provided with appropriate precautionary warning signs to call attention to potential hazards of the equipment.

2.1.11.2 All external doors providing access to high voltage shall be provided with a 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 IEEE C57.12.91. The air interrupter switch shall be tested in accordance with ANSI C37.203. As a minimum, an operational check of each component and a demonstration of overall performance shall include the following:

2.2.1.1.1 Resistance measurements of all windings on the rated voltage tap of each transformer, and at the tap extremes of one transformer only of a given rating.

2.2.1.1.2 Ratio tests on the rated voltage connections and on all tap connections.

2.2.1.1.3 Polarity and phase relation tests on the rated voltage connections.

2.2.1.1.4 No-load losses and excitation current at rated voltage and frequency on the rated voltage connections.

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- 2.2.1.1.5 Impedance, voltage and load loss at rated current and rated frequency on the rated voltage tap of each transformer, and at the tap extremes of one transformer only of a given rating.
- 2.2.1.1.6 Applied potential and induced potential tests.
- 2.2.1.1.7 Regulation and efficiency calculations at rated load and rated voltage. Regulation shall be stated at both 0.8 and 1.0 power factor. Efficiency shall be stated at 1/4, 1/2, 3/4 and full load on the self-cooled rating.
- 2.2.1.1.8 Inspection checks of the switch mechanism and manual operation shall be made prior to electrical test of the switch.
- 2.2.1.1.9 Insulation resistance tests (high voltage to ground, low voltage to ground, high voltage to low voltage).
- 2.2.1.1.10 Temperature rise test shall be made on transformers of a given rating as shown on Attachment A.
- 2.2.2 Finishes
- 2.2.2.1 Transformers shall be cleaned, primed, and painted for maximum protection from the environmental conditions described in Paragraph 1.8. The transformer finish shall be light gray No. 61, in accordance with ASTM D1535.
- 2.2.2.2 Seller shall supply paint, matching color used, for field "touch-up" after installation of the equipment. Two one-pint aerosol spray cans of the color shall be supplied per transformer.

PART 3 EXECUTION

(Not Used)

END OF SECTION

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ATTACHMENT A
 DATA SHEET DS-1

TRANSFORMER TAG NUMBERS- XT-32T-001 thru 004

A. Ratings

1. Kva at Self-Cooled Rating	1500
2. Impedance-% on Self-Cooled Rating	5.75
3. Temp. Rise - °C at AA Ratings	80
4. High Voltage Winding	Volts Line-to-Line 13.8KV Connection Delta
5. Low Voltage	Volts Line-to-Line 480V Connection WYE
6. Vector Group	

B. Type of Cooling

1. AA	X
2. AA/FA	
3. AFA	
4. ANV	
5. ANV/FA	
6. GA	

C. Forced Cooling Control Method

1. Winding Temperature	
2. Top Gas Temperature Switch	
3. Single Stage Cooling	

D. Tap Changer

1. No-Load Tap Changer	Above
5 Position with	Rated Volts
Four 2-1/2% Taps	Below

E. Low Voltage Terminations

1. Side Bushings	
2. Flanged Throat for Bus Duct	
3. Terminal Chamber for Cable Connections	Air Oil
4. Incoming Conduits	Size & No. Size & No.
5. Cable Lugs (Phase) (Solderless)	No. Per Ø Cable Size

SPECIAL INSTRUCTIONS:

BIL: 95KV, Primary
 10KV, Secondary

BUSDUCT 2500A

F. High Voltage Terminations

1. Side Bushings	
2. Flanged Throat for Bus Duct	
3. Terminal Chamber	Air
4. Air-Filled Fused (CL) Disconnect Switch	
5. Load Break Disconnect Switch	Air X NO FUSES
6. Non-Load Break Disconnect Switch	Air
7. Incoming Conduits	Size & No. Size & No.
8. Type of Feed	Single X Double Loop
9. Potheads or Cable Terminators	1/C or 3/C No. per Ø Cable Size
10. Cable Lugs (Solderless)	No. per Ø 1 Cable Size #2
11. Ground cable size	#6

G. Additional Accessories

1. High Temperature Alarm Switch	X
2. Winding Temperature Alarm Switch	
3. Current Transformers	
H1-H2-H3	No. per Ø Multi-Ratio
	No. Ratio
X1-X2-X3	No. per Ø Ratio
X0	No. Multi-Ratio

H. Hazard Areas

1. Transformer & Accessories shall be suitable for operation in a nonhazardous area.

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ATTACHMENT A
 DATA SHEET DS-2

TRANSFORMER TAG NUMBERS- XT-32T-005

A. Ratings

1. Kva at Self-Cooled Rating	1000
2. Impedance-% on Self-Cooled Rating	5.75
3. Temp. Rise - °C at AA Ratings	80
4. High Voltage Winding	Volts Line-to-Line 13.8KV Connection DELTA
5. Low Voltage	Volts Line-to-Line 480V Connection WYE
6. Vector Group	

B. Type of Cooling

1. AA	X
2. AA/FA	
3. AFA	
4. ANV	
5. ANV/FA	
6. GA	

C. Forced Cooling Control Method

1. Winding Temperature	
2. Top Gas Temperature Switch	
3. Single Stage Cooling	

D. Tap Changer

1. No-Load Tap Changer	Above
5 Position with	Rated Volts
Four 2-1/2% Taps	Below

E. Low Voltage Terminations

1. Side Bushings	
2. Flanged Throat for Bus Duct	
3. Terminal Chamber for Cable Connections	Air Oil
4. Incoming Conduits	Size & No. Size & No.
5. Cable Lugs (Phase) (Solderless)	No. Per Ø Cable Size

SPECIAL INSTRUCTIONS:

BIL: 95KV, Primary
 10KV, Secondary

BUSDUCT 1600A

F. High Voltage Terminations

1. Side Bushings	
2. Flanged Throat for Bus Duct	
3. Terminal Chamber	Air
4. Air-Filled Fused (CL) Disconnect Switch	
5. Load Break Disconnect Switch	Air X NO FUSES
6. Non-Load Break Disconnect Switch	Air
7. Incoming Conduits	Size & No. Size & No.
8. Type of Feed	Single X Double Loop
9. Potheads or Cable Terminators	1/C or 3/C No. per Ø Cable Size
10. Cable Lugs (Solderless)	No. per Ø 2 Cable Size #2
11. Ground Cable Size	#6

G. Additional Accessories

1. High Temperature Alarm Switch	X
2. Winding Temperature Alarm Switch	
3. Current Transformers	
H1-H2-H3	No. per Ø Multi-Ratio
	No. Ratio
X1-X2-X3	No. per Ø Ratio
X0	No. Multi-Ratio

H. Hazard Areas

- Transformer & Accessories shall be suitable for operation in a nonhazardous area.

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ATTACHMENT A
 DATA SHEET DS-3

TRANSFORMER TAG NUMBERS- XT-32T-006

A. Ratings

1. Kva at Self-Cooled Rating	500
2. Impedance-% on Self-Cooled Rating	5.75
3. Temp. Rise = °C at AA Ratings	80
4. High Voltage Winding	Volts Line-to-Line 13.8KV Connection Delta
5. Low Voltage Winding	Volts Line-to-Line 480V Connection WYE
6. Vector Group	

B. Type of Cooling

1. AA	X
2. AA/FA	
3. AFA	
4. ANV	
5. ANV/FA	
6. GA	

C. Forced Cooling Control Method

1. Winding Temperature
2. Top Gas Temperature Switch
3. Single Stage Cooling

D. Tap Changer

1. No-Load Tap Changer	Above
5 Position with	Rated Volts
Four 2-1/2 Taps	Below

E. Low Voltage Terminations

1. Side Bushings	
2. Flanged Throat for Bus Duct	
3. Terminal Chamber for Cable Connections	Air Oil
4. Incoming Conduits	Size & No. Size & No.
5. Cable Lugs (Phase) (Solderless)	No. Per Ø Cable Size

SPECIAL INSTRUCTIONS:

BIL: 95KV, Primary
 10KV Secondary

BUSDUCT 800A

F. High Voltage Terminations

1. Side Bushings	
2. Flanged Throat for Bus Duct	
3. Terminal Chamber	Air
4. Air-Filled Fused (CL) Disconnect Switch	
5. Load Break Disconnect Switch	Air X 50 E FUSES
6. Non-Load Break Disconnect Switch	Air
7. Incoming Conduits	Size & No. Size & No.
8. Type of Feed	Single X Double Loop
9. Potheads or Cable Terminators	1/C or 3/C No. per Ø Cable Size
10. Cable Lugs (Solderless)	No. per Ø 1 Cable Size #2
11. Ground Cable Size	#6

G. Additional Accessories

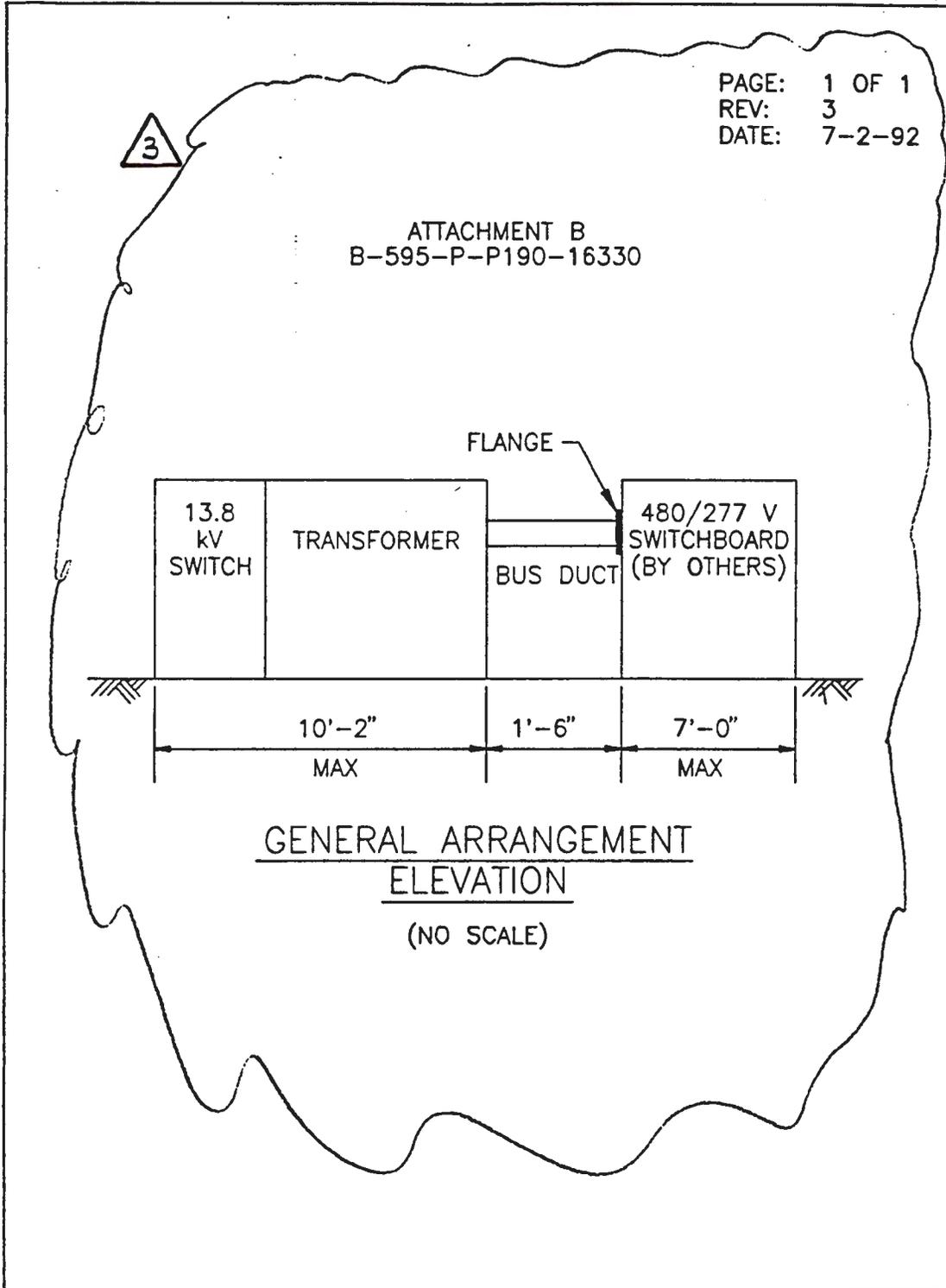
1. High Temperature Alarm Switch	X
2. Winding Temperature Alarm Switch	
3. Current Transformers	
H1-H2-H3	No. per Ø Multi-Ratio
	No. Ratio
X1-X2-X3	No. per Ø Ratio
X0	No. Multi-Ratio

H. Hazard Areas

1. Transformer & Accessories shall be suitable for operation in a nonhazardous area.

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ATTACHMENT B



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