

UNITED STATES
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA

SPECIFICATIONS
TO
REPLACE 750 KVA UNIT SUBSTATION

BUILDING 1208

LOCATED IN
WEST AREA

LANGLEY RESEARCH CENTER, HAMPTON, VIRGINIA

SPECIFICATION NO. 1-203-RFU.4038

DATE: 4-2-03

PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

- 01010 SUMMARY OF WORK
- 01011 GENERAL AND ADMINISTRATIVE REQUIREMENTS
- 01060 LANGLEY SAFETY AND ENVIRONMENTAL REQUIREMENTS
- 01330 SUBMITTALS
- 01420 SOURCES FOR REFERENCE PUBLICATIONS

DIVISION 16 - ELECTRICAL

- 16003 GENERAL ELECTRICAL PROVISIONS
- 16124 MEDIUM VOLTAGE CABLE
- 16145 STANDARD WIRING SYSTEMS
- 16286 METERING, CONTROL AND OVERCURRENT PROTECTIVE AND CONTROL DEVICES
- 16366 SECONDARY UNIT SUBSTATION

-- End of Project Table of Contents --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

1.2 DRAWINGS

1.2.1 Contract Drawings

1.3 LOCATION OF WORK

1.4 SCHEDULE

1.4.1 General Schedule Requirements

1.4.2 Special Work Scheduling Requirements

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

The work to be performed under these specifications consists of removal and replacement of 750 kVA outdoor substation equipment at Facility 1208 located in the West Area of the Langley Research Center.

The Contractor shall furnish all plant, equipment, tools, materials, labor and services necessary for or incidental to a complete and finished job as shown on the drawings listed below and as specified herein.

All references to the Contracting Officer contained in this specification, or any severable part thereof, shall be determined to mean the Contracting Officer or the Contracting Officer's Technical Representative. If any question arises concerning the "authorization" status of a Contracting Officer Technical Representative, the Contractor shall immediately refer the question, in writing, to the Contracting Officer. Any references to "approved by", "witnessed by", or "submitted to", shall be determined to mean the Contracting Officer.

Where "as indicated" and "as specified" are written it shall refer to "as indicated on the drawings," and "as specified in the specifications". The specifications will always take precedence over the drawings.

Where "day" or "days" are written it shall mean calendar day or days, unless otherwise stated in the specification.

Where "hour" or "hours" are written it shall mean clock hours, unless otherwise stated in the specification.

The work to be performed includes, but is not limited to the following:

1. Removal of the 750 KVA transformer;
 - a) Disconnect and remove fuses from existing primary switch, switch to remain for reuse.
 - b) Remove underground primary feeder cable, existing conduit shall be sealed and abandoned-in-place.
 - c) Disconnect and remove 750 KVA outdoor substation No. 2 transformer and associated air terminal box.
2. Removal of the 480 volt Switchgear

REPLACE 750 KVA UNIT SUBSTATION - B1208

- a) Disconnect and remove 480 volt outdoor switchgear and associated equipment.

3. Replacement Transformer and Switchgear

- a) Provide new primary fuses, sized to protect new transformer.
- b) Provide new feeder cable and conduit to serve new transformer.
- c) Provide 1000 KVA transformer with primary air terminal and complete accessories.
- d) Provide 480 volt switchgear and complete accessories as indicated on contract drawings and specifications.

The equipment shall be designed to fit the existing area shown on the contract drawings, and shall be connected to new primary feeder, existing secondary feeders and existing low voltage controls.

1.2 DRAWINGS

After contract award, a maximum of ten sets of full size contract drawings will be furnished to the Contractor without charge.

1.2.1 Contract Drawings

The work shall conform to these specifications and the drawings listed below:

<u>DRAWING NO.</u>	<u>REV.</u>	<u>SHEET NO.</u>	<u>TITLE</u>	<u>LATEST DATE</u>
1239925	-	E1	Existing One-Line Diagram Vicinity Plan and Drawing Index	9-19-02
1239926	-	E2	New One-Line Diagram	9-19-02
1239927	-	E3	Unit Substation No. 2 Demolition Plan and Existing Elevation	9-19-02
1239928	-	E4	Unit Substation No. 2 New Work Plan and Elevation	9-19-02

1.3 LOCATION OF WORK

The work to be done under these specifications is located in the the West area of Langley Research Center, as indicated on the West Area Key Plan, Section 01010, Attachment 1.

1.4 SCHEDULE

1.4.1 General Schedule Requirements

The Contractor shall commence work within ten (10) calendar days after date of receipt of Notice to Proceed. All work as required by these specifications shall be completed within 360 consecutive calendar days after date of receipt of Notice to Proceed.

1.4.2 Special Work Scheduling Requirements

The Contractor shall ensure all equipment and materials required for a complete installation are on-site prior to beginning any work requiring a facility shutdown period.

Facility 1208 will be in use throughout the period of contract performance; therefore, all work requiring a power outage shall be performed on weekends, during scheduled weekend outages. See Section 01011 of this specification for additional requirements regarding outages.

All equipment and materials required for a complete installation during any scheduled weekend power outage shall be on-site and tested 7 calendar days prior to beginning work. Processing of power outage requests shall not be started until 7 calendar days prior to start of weekend work.

The Contractor shall coordinate all work with the Contracting Officer to ensure minimum interference with Government activities during construction.

During the scheduled weekend outage, sufficient work must be accomplished to allow unit substation or secondary switchgear to be re-energized at the end of the weekend period. Feeders shall be energized and de-energized in accordance with Section 01060, paragraph entitled, "Switching".

The Contractor shall read and record the kilowatt hour readings for the unit substation just prior to demolition work. The data shall be witnessed by the Government inspector and turned over to the Government just prior to removal of the substation.

The existing facility and the contents shall be kept secure at all times. The Contractor shall provide all temporary closures as required to maintain security as directed by the Contracting Officer.

The Contractor shall remove all debris at the end of each day or more frequently if required to keep the space useable. Duct covers or protective enclosures shall be provided to protect Government property during the construction period.

The Contractor shall provide generator power and temporary lighting for construction purposes, as required, during the weekend outage.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01011

GENERAL AND ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 SUBMITTALS
- 1.3 PRECONSTRUCTION CONFERENCE
- 1.4 SECURITY REQUIREMENTS AND REGULATION OBSERVANCE
 - 1.4.1 References
 - 1.4.2 Identification Badges
- 1.5 SCHEDULING OF WORK
- 1.6 ADDRESSING CORRESPONDENCE, SUBMITTALS AND INVOICES
- 1.7 SCHEDULE OF CONSTRUCTION, MONTHLY PROGRESS SCHEDULES AND MONTHLY TECHNICAL PROGRESS NARRATIVES
 - 1.7.1 Schedule of Construction
 - 1.7.2 Monthly Progress Schedules and Monthly Technical Progress Narratives
 - 1.7.2.1 Monthly Progress Schedules
 - 1.7.2.2 Monthly Technical Progress Narratives
- 1.8 AS-BUILT DRAWINGS
- 1.9 FINAL DRAWINGS
- 1.10 OPERATION AND MAINTENANCE (O&M) MANUAL
- 1.11 PRICE BREAKDOWN FOR DETERMINING PROGRESS PAYMENTS
- 1.12 PRICE BREAKDOWN FOR MODIFICATION PROPOSALS
- 1.13 MINIMUM EMPLOYEE COMPENSATION
- 1.14 CONTRACTOR RELEASE FORM
- 1.15 BULLETIN BOARD
- 1.16 ORDER STATUS REPORTS
- 1.17 SALVAGE MATERIAL AND EQUIPMENT
 - 1.17.1 Removed Materials Turned Over to the Government
 - 1.17.2 Removed Materials Disposed of by the Contractor
- 1.18 MATERIALS AND EQUIPMENT
- 1.19 MATERIAL AND EQUIPMENT INSTALLATION
- 1.20 HANDLING/PROTECTION OF CONTRACTOR MATERIAL AND EQUIPMENT
- 1.21 ON-SITE CLEAN-UP AND DISPOSAL OF MATERIALS
- 1.22 UTILITY OUTAGES AND POWER CONNECTIONS
 - 1.22.1 Utility Outages
 - 1.22.2 Application for Connecting to Government Electrical Utilities
- 1.23 USE OF GOVERNMENT PREMISES
 - 1.23.1 Boundaries and Site Requirements
 - 1.23.2 Adjacent Premises and Existing Services
 - 1.23.3 Vehicle Weight Limits
 - 1.23.4 Heavy Equipment Movement

REPLACE 750 KVA UNIT SUBSTATION - B1208

- 1.24 BARRICADES AND TRAFFIC CONTROL
 - 1.25 ON-SITE UTILITIES
 - 1.25.1 Water
 - 1.25.2 Electrical Power
 - 1.25.3 Telephone Service
 - 1.26 DUST CONTROL
 - 1.27 ON-SITE WATER CONTAMINATION
 - 1.28 ON-SITE GOVERNMENT/CONTRACTOR/SUBCONTRACTOR COORDINATION
 - 1.29 SANITARY CONVENIENCES
 - 1.30 ELECTRICAL WORKERS' QUALIFICATIONS
 - 1.31 INSPECTION RECORDS
- PART 2 PRODUCTS (Not Applicable)
- PART 3 EXECUTION (Not Applicable)
- End of Section Table of Contents --

SECTION 01011

GENERAL AND ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

This section covers Langley Research Center's unique general and administrative requirements.

1.2 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals:

SD-04 Drawings

As-Built Drawings

SD-08 Statements

Materials and Equipment Substitutions

Application for Making Connection to Utilities

Utility Outage Requests

Electrical Worker's Qualifications

SD-18 Records

Invoices

Contractor Release Form

Price Breakdown for Modification Proposals

Price Breakdown for Progress Payments

Order Status Reports

Schedule of Construction

Monthly Progress Schedules

Monthly Technical Progress Narrative

Certified Payrolls

Government-Furnished Property (GFP) Non Conformance Report

SD-19 Operation and Maintenance Manuals

1.3 PRECONSTRUCTION CONFERENCE

The Contractor shall attend a preconstruction conference scheduled by the Contracting Officer. Work on-site shall not commence prior to the conference. Subcontractor representatives may attend.

Discussion will address project orientation, key points of contact, safety issues, permits, the on-site location of the Contractor's office, if any, and other pertinent issues. The Contractor shall be prepared to review and discuss the specifications and drawings with the Contracting Officer to resolve any post award questions prior to construction start.

1.4 SECURITY REQUIREMENTS AND REGULATION OBSERVANCE

1.4.1 References

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

LAPD 1600.3	(March 2000) Langley Research Center Security Policy
LAPD 1600.4	(August 1999) Firearms and Dangerous Weapons Policy
LAPD 1600.5	(August 1999) Workplace Violence and Threatening Behavior
LAPD 1700.7	(March 2001) Traffic Management
LAPD 1700.8	(June 1999) Parking Regulations
NPG 1371.2	(April 1999) Procedures and Guidelines for Processing Request for Access to NASA by Foreign Nationals or Representatives

1.4.2 Identification Badges

At all times while on LaRC property, the Contractor shall require its employees, subcontractors and agents to wear badges which will be issued by the NASA Contract Badge and Pass Office, located at 1 Langley Boulevard (Building No. 1228). Badges shall be issued only between the hours of 6:30 a.m. and 3:30 p.m., Monday through Friday. Temporary ID badges will be issued upon submission of a completed Langley Form 227, "Construction/Contractor Badge and/or Vehicle Permit Request". The Contractor will be held accountable for these badges and may be required to validate outstanding badges with the NASA LaRC Security Office. Immediately after employee termination or contract completion, badges shall be returned to the NASA Contract Badge and Pass Office.

1.5 SCHEDULING OF WORK

The established hours of work at Langley Research Center are 7:00 a.m. to 4:30 p.m. Monday through Friday, excluding U.S. Government holidays and closings declared by Administrative or Executive order.

In order that the necessary and proper inspection of the Contractor's work may be effectively accomplished, and to assure the availability of required Government facilities, the Contractor shall schedule work performance to be compatible with the established work week, hours of work and legal holidays observed by the Government organization having cognizance over the work performed at the particular work site. No work shall be performed during other hours without prior authorization of the Contracting Officer.

All requests for overtime work shall be submitted to the NASA Inspector 2 calendar days prior to the proposed overtime.

The Contractor shall give at least three calendar notice to the Contracting Officer and the Safety and Facility Assurance Office of the date when the contract work will begin at the site.

If the Contractor suspends work at any time, it shall notify the Construction Inspection Service (CIS) and shall not again resume work without notifying the CIS in advance.

1.6 ADDRESSING CORRESPONDENCE, SUBMITTALS AND INVOICES

All correspondence, submittals and invoices shall be clearly marked with the assigned Government contract number. Unless otherwise specified herein, the Contractor shall submit an original and five copies of all correspondence and submittals.

The Contractor shall submit all shop drawings, test reports, equipment data sheets, and any other technical data under an original cover letter and with copies as required by these specifications. Samples shall be accompanied by a cover letter and appropriate copies.

Correspondence and submittals shall be addressed to the designated Government addressee(s) and mail stop(s) shown in the Submittal Summary of Section 01330 to the following address:

All correspondence to the Contracting Officer or Contract Administrator shall be addressed as follows:

Contracting Officer/Contract Administrator, Mail Stop 126
Contract NAS1- _____
NASA, Langley Research Center
Hampton, Virginia 23681-0001

All correspondence to the Contracting Officer Technical Representative (COTR) shall be addressed as follows:

COTR, Mail Stop 465
Contract NAS1- _____

REPLACE 750 KVA UNIT SUBSTATION - B1208

NASA, Langley Research Center
Hampton, Virginia 23681-0001

Progress payment, final payment invoices, and Contractor's release form (NASA Form 778) shall be addressed as follows:

Accounts Payable and Employee Services Branch, Mail Stop 175
Contract NAS1- _____
NASA, Langley Research Center
Hampton, Virginia 23681-0001

Certified payrolls shall be addressed as follows:

Construction Services Unit, Mail Stop 428
Contract NAS1- _____
NASA, Langley Research Center
Hampton, Virginia 23681-0001

Submittals to the Safety and Facility Assurance Office shall be addressed as follows:

Safety and Facility Assurance Office, Mail Stop 429
Contract NAS1- _____
NASA, Langley Research Center
Hampton, Virginia 23681-0001

Submittals to the Environmental Management Office shall be addressed as follows:

Environmental Management Office, Mail Stop 418
Contract NAS1- _____
NASA, Langley Research Center
Hampton, Virginia 23681-0001

1.7 SCHEDULE OF CONSTRUCTION, MONTHLY PROGRESS SCHEDULES AND MONTHLY TECHNICAL PROGRESS NARRATIVES

1.7.1 Schedule of Construction

Within 30 calendar days after date of receipt of Notice to Proceed, the Contractor shall submit to the Contracting Officer for approval, 6 copies of a practical and feasible schedule of construction on Form LF-107, Contract Progress Schedule Report (Attachment 1). This schedule shall indicate the sequence of work the Contractor plans to complete the contract within the specified completion period and shall include, as a minimum, the following categories of work:

Mobilization
Equipment submittals
Equipment delivery and testing and weekend work for Building 1208
Outdoor Substation "2"
As-builts
Punch list
Closeout with completion of all submittals and removals

Demobilization

Upon Contracting Officer approval of the schedule of construction, the Contractor shall utilize this approved schedule for its contract progress schedule reporting. The Contractor shall adhere to the approved schedule of construction. The schedule of construction shall not be altered without the written approval of the Contracting Officer. In the event of changes in the schedule of construction, under applicable provisions of the contract, the Contractor shall resubmit to the Contracting Officer the schedule of construction reflecting such changes.

Questions, concerns, and information pertaining to the project shall be submitted to the Contracting Officer on Form LF-253, Request for Information, Attachment 2 to this section.

1.7.2 Monthly Progress Schedules and Monthly Technical Progress Narratives

The Contractor shall submit to the Contracting Officer the following reports covering work accomplished each month of contract performance. The technical progress narrative and the monthly progress schedule, on Form LF-107, (Attachment 1), shall be prepared covering a period from the tenth of one month through the ninth of the following month and shall be submitted so as to be received no later than the 15th of the month in which the reporting period ends. The Contractor shall certify the accuracy of monthly reports being submitted by signing the technical progress narrative and block 4 of Form LF-107.

1.7.2.1 Monthly Progress Schedules

The Contractor shall prepare monthly progress schedules, on Form LF-107, in accordance with the instructions on the reverse side of the form and shall show both the NASA approved schedule and the Contractor's current working schedule.

1.7.2.2 Monthly Technical Progress Narratives

Monthly technical progress narratives shall be brief, factual, and informal and shall be prepared in accordance with the following format:

A cover page containing:

Contract number and title.

Period of performance being reported.

Contractor's name and signature.

Date of publication.

Summary outlook - A short statement summarizing the current time status in relation to plan as well as the outlook for achieving major goals.

Status versus plans.

Significant progress - A description of overall progress plus a separate description for each reporting category on the Form LF-107, Contract Progress Schedule Report, on which effort was expended during the reporting period.

Problem areas - A description of current problems and their schedule and resource implication which may impede performance.

Corrective actions - A description of corrective action which has been taken or which is planned to correct any existing problem.

Plans - A description of work to be performed during the next reporting period.

Recommendations - Recommendations for action on the part of Langley Research Center.

1.8 AS-BUILT DRAWINGS

The Contractor's construction drawings shall be used to create a full-size set of "As-Built Contract Drawings to be maintained during the project's site construction phase. The As-Built Drawings shall accurately reflect the current configuration of the design and construction, and shall be red-lined concurrently with any changes being made. The Contractor shall implement an established drawing control process to ensure that design changes are communicated to construction personnel and to the Government for approval in a timely manner. The As-Built Drawings shall be maintained at the construction site, and shall be available for inspection anytime by the Contracting Officer. The Contractor shall submit one (1) copy of these marked up drawings to the Contracting Officer at the end of the contract period for Government review and approval prior to final payment and acceptance of the contract.

1.9 FINAL DRAWINGS

At the completion of the construction, all drawings shall be revised and updated to incorporate the as-built red-lines. These drawings shall be stamped "AS-BUILT CONDITIONS" on each sheet or page, dated, and signed by the Contractor. The final drawings shall be submitted to the Contracting Officer in both hard copy and electronic format for government review and approval prior to final payment and acceptance of the contract.

1.10 OPERATION AND MAINTENANCE (O&M) MANUAL

The Contractor shall submit to the Contracting Officer for approval the Operation and Maintenance (O&M) Manuals for the equipment specified under the various headings of these specifications. These submittals shall be complete and detailed.

1.11 PRICE BREAKDOWN FOR DETERMINING PROGRESS PAYMENTS

The Contractor shall submit a price breakdown if it intends to request progress payments. Where several items are involved, each shall be shown separately. This breakdown shall be prepared using the items, major parts,

and components which were approved by the Contracting Officer for the schedule of construction, as required above, to provide a schedule/price correlation for use in the assessment of progress payments, and shall separate equipment and material prices from labor prices for each portion of the work. No progress payments will be made until the price breakdown as submitted has been approved by the Contracting Officer.

1.12 PRICE BREAKDOWN FOR MODIFICATION PROPOSALS

The Contractor shall furnish an itemized price breakdown within 14 calendar days of receipt of a Government change order or request for proposal. Unless otherwise directed, the breakdown shall be in sufficient detail to permit an analysis of all material, labor, equipment, subcontract and overhead costs as well as profit, and shall cover all work involved to accomplish the modification whether deleted, added, or changed. Subcontractor costs shall also be supported by similarly detailed price breakdown. If the proposal includes a requested time extension, a detailed justification shall also be furnished. The Attachment 3, Estimate for Contract Modification Change Item forms shall be used to furnish this price breakdown.

1.13 MINIMUM EMPLOYEE COMPENSATION

The U.S. Department of Labor Wage Determination, Enclosure 4 of the Solicitation, establishes the minimum compensation levels for laborers and mechanics employed on site at the Langley Research Center.

Certified payrolls for on-site work of the prime Contractor and all subcontractors shall be submitted weekly as required by the Submittal Summary Section 01330.

1.14 CONTRACTOR RELEASE FORM

The Contractor shall execute and submit a Contractor's Release, NASA Form 778, at contract completion.

1.15 BULLETIN BOARD

Immediately upon beginning site work, the Contractor shall provide at the job site a weatherproof bulletin board for displaying the fair employment poster, wage rates, and safety bulletins and posters. The bulletin board shall be located in a conspicuous place, easily accessible to all employees. Legible copies of the aforementioned data shall be displayed until on-site work is complete.

1.16 ORDER STATUS REPORTS

Upon request of the Contracting Officer, the Contractor shall promptly submit reports showing the status of any orders or subcontracts which may delay or are delaying the overall contract schedule. Order status reports shall include:

Contract or order number, date submitted to the supplier, date accepted by the supplier, supplier's name and address.

Delivery date needed to meet contract schedule.

Delivery date agreed to by the supplier, and any subsequent changes in that date.

Reasons for changes in delivery dates.

Effect which the latest promised delivery date will have on the contract schedule.

A summary of the Contractor's efforts to bring the promised delivery date in line with the requirements of the contract schedule, including efforts made to place the order or subcontract with other suppliers.

1.17 SALVAGE MATERIAL AND EQUIPMENT

Any items of material designated by the Contracting Officer as salvage shall remain the property of the Government.

The Contractor shall segregate, itemize, deliver, and off-load such items at the Contracting Officer designated storage area located on the Langley Research Center.

The Contractor shall maintain property control records for material or equipment designated as salvage. The Contractor's system of property control may be used if approved by the Contracting Officer. The Contractor shall be responsible for storage and protection of salvaged materials and equipment until disposition by the Contracting Officer. Any salvage materials which are of a hazardous nature shall be handled as required by Section 01060, Langley Safety and Environmental Requirements, and applicable Federal and/or State and local regulations.

The Contractor shall submit to the Contracting Officer a written short/damaged property non-conformance report within two calendar days of removal of salvage material or equipment if such equipment is not in the condition or quantity contractually specified.

The Contractor shall replace or repair, at no cost to the Government, all salvaged materials and equipment which are broken, damaged, or lost due to the Contractor's negligence while such items are in the Contractor's possession.

1.17.1 Removed Materials Turned Over to the Government

Primary switch fuses shall be turned over to the Contracting Officer.

The following items are hereby designated as "salvage" and shall be removed and turned over to the Government at Building 1240; and filing of Langley Form 40, Property Disposition/Storage Request:

Outdoor Unit, 480 Volt Switchgear

1.17.2 Removed Materials Disposed of by the Contractor

REPLACE 750 KVA UNIT SUBSTATION - B1208

The following materials shall be disposed of by the Contractor including the following:

1. 750 kVA substation "2" transformer
2. All other scrap and materials not reused or designated to be turned over to the Government.

The oil to be removed from the transformer is classified as non-PCB contaminated at less than 50 ppm. Cooling oil from the equipment shall be pumped into Contractor furnished oil drums by the Contractor. The Contractor shall remove the oil from Langley Research Center and shall comply with the applicable Federal, State, and Municipal laws and regulations in the manner of its disposal. The oil shall be removed in drums before removing the equipment.

1.18 MATERIALS AND EQUIPMENT

Materials and equipment provided by the Contractor shall be standard catalog products of manufacturers regularly engaged in the manufacture of the products unless otherwise specified in the specifications.

Materials and equipment shall meet the requirements of the contract and shall be suitable for the specified installation. Where two or more units of the same equipment class are furnished, the equipment shall be from the same manufacturer and shall be interchangeable. Materials and equipment shall be new and free from defects.

Where equipment specified by designations of the manufacturer requires modification to fully meet contract requirements, such modification shall be made by the Contractor without additional cost to the Government.

Where two or more types of equipment or materials are specified without indication of preference, it shall be optional with the Contractor which one is used; but the same type shall be used throughout.

Where equipment or materials are specified by the designations of the manufacturer, "or equal", the Contractor, if it elects to furnish other than the brand name product, is responsible for any necessary redesign, relocation and rework of associated construction, at any time during the course of the contract. The proposed materials or equipment substitution with any required redesign, relocation, or rework data shall be submitted for approval of the Contracting Officer.

All equipment and material data, including location, function, and characteristics shall be furnished to the Contracting Officer for approval as specified in the following sections. Machinery, equipment, materials, and articles furnished without such approval shall be at the risk of subsequent rejection, and will not be considered in computing progress payments.

1.19 MATERIAL AND EQUIPMENT INSTALLATION

The Contractor shall install material and equipment in accordance with the requirements of the contract drawings and Government approved recommendations of the manufacturers. Degradation of the designated fire ratings of walls, partitions, ceilings, and floors by the installation shall not be permitted.

1.20 HANDLING/PROTECTION OF CONTRACTOR MATERIAL AND EQUIPMENT

All shipments shall be addressed to the Contractor and the Contractor shall be responsible for their receipt, unloading, handling, and storage at the site. The Government will not accept deliveries on behalf of the Contractor or its subcontractors, nor assume any responsibility for security of materials, equipment or supplies delivered to the site.

The Contractor shall at all times protect and preserve all contractually required materials, supplies and equipment of every description (including property which may be Government-furnished or owned) and all work performed. If, as determined by the Contracting Officer, material, equipment, supplies and work performed are not adequately protected by the Contractor, such property may be protected by the Government and the cost thereof will be charged to the Contractor.

When Government-owned equipment is to be utilized by the Contractor at the construction site, the Contractor shall jointly inventory such equipment with the assigned Inspector, mutually agreeing as to condition and quantities. Upon completion of the inventory, the Contractor shall accept the equipment and give the Government a signed receipt. The Contractor shall be responsible for the equipment, its protection from damage, and availability for installation. Even in the absence of such a joint inventory, the Contractor assumes full responsibility for such Government-owned equipment when it comes into its possession. The Contractor shall submit a record of existing conditions prior to use of Government-owned equipment.

1.21 ON-SITE CLEAN-UP AND DISPOSAL OF MATERIALS

If the operations of the Contractor result in deposition of dirt or other debris on any area, it shall clean such facilities at such intervals and in such manner to prevent the formation of undesirable quantities of mud or dust, and avoid making any other nuisance.

The Contractor shall not dispose of materials of hazardous or environmentally damaging nature into the storm or sanitary sewer systems. The Contractor shall be responsible for proper handling and disposal of hazardous wastes generated by its activities in accordance with applicable federal, state and local regulations. See Section 01060, Langley Safety and Environmental Requirements, for additional hazardous waste disposal requirements.

Scrap materials removed and not specified for reuse or for return to the Government shall become the property of the Contractor and shall be removed from the Government premises and properly dispositioned.

All excess soil excavated from the project site shall become the property

of the Contractor. The Contractor shall remove and dispose of all excess soil from the confines of Langley Research Center at a permitted landfill. The Contractor shall notify the Contracting Officer, in writing a minimum of ten calendar days prior to scheduling the removal and disposal of excavated soils. The Contractor's notification shall include the name, address, and permit number of the intended disposal site, a written description of the soil type, and an estimated quantity of soil to be disposed. The Contracting Officer will provide testing of the soil materials and notify the Contractor, in writing, of test results with approval of disposal or specific direction on special disposal requirements. The Contractor shall be required to stockpile excavated materials until testing results are received. At no time shall the contractor remove soil materials without prior approval by the Contracting Officer. The Contractor is responsible for ensuring that removal and disposal of excavated soils complies with all applicable Federal, State, and local environmental laws and regulations.

When construction work is performed in Government facilities and the Government continues to use these areas, the Contractor shall keep floors and platforms swept clean or vacuumed daily of any debris created by its work. Debris shall be stored in closed metal containers and shall be removed from these areas at least weekly.

In other construction areas, the Contractor shall collect and store all waste material, scrap lumber and rubbish in piles or containers. This material shall be removed weekly from the site or more often if the material constitutes a fire hazard.

The Contractor shall clean application equipment promptly and thoroughly with a suitable solvent after each use and store the solvent in a clean, covered, well-ventilated container.

At the end of each working day, the Contractor shall collect and remove paint materials, rubbish, rags and other similar materials shall be collected and removed from the project area.

At the completion of the work, the Contractor shall remove all paint spots from finished surfaces and leave the project in a clean condition.

1.22 UTILITY OUTAGES AND POWER CONNECTIONS

1.22.1 Utility Outages

Work shall be scheduled to hold outages to a minimum.

Utility outages required during the prosecution of work that affect existing systems shall be scheduled at the convenience of the Government. Any interruption of utilities or services that would interfere with the operation of a facility will be permitted only on week-ends between the hours of 12:00 midnight Friday and 10:00 p.m. on the following Sunday. The Contracting Officer may permit interruptions at other times. Any utilities or service connections made at other than normal working hours shall be at no additional cost to the Government. Permission to make such an interruption shall be requested in writing to the Contracting Officer at

least seven calendar days prior to the day of interruption.

The Contractor shall schedule all work necessitating power shutdowns or outages shall be scheduled with the Contracting Officer by submitting a written request for utility outage stating the date and time the desired interruption will commence, the anticipated period of interruption, and feeders and circuits to be interrupted. No interruption shall be made without authorization from the Contracting Officer. If a scheduled power interruption is to extend into the regular working hours, the Contractor shall notify the Contracting Officer 24 hours in advance.

1.22.2 Application for Connecting to Government Electrical Utilities

Prior to making connection to any part of the Government's electrical power distribution system, the Contractor shall make application to the Contracting Officer stating the date, time, location, and the service required. The Contractor shall also state when such connection is desired.

Before granting the Contractor permission for such connection, the Government will make the necessary checks of the Contractor's system to assure its adequacy and safety and that the Government's supply is adequate at that point for such connection.

The Contractor shall perform the initial energizing of all new electrical equipment in the presence of an authorized representative of the Contracting Officer.

Prior to connecting into any existing Government electrical utility, the Contractor shall conform to the requirements of Section 01060.

1.23 USE OF GOVERNMENT PREMISES

The Contractor shall submit to the Contracting Officer a record of existing conditions detailing damaged Government property as agreed upon with the Government Representative.

1.23.1 Boundaries and Site Requirements

Boundary lines on drawings are for delineation of the general working area. Such lines do not relieve the Contractor of its responsibility for completing construction features, utility runs or tie-ins which cross or extend beyond such limit lines as provided by specifications or drawings requirements. The site will be made available "as is", and unless otherwise specified, the Contractor shall be responsible for clearing the site area, roads, utilities, and other off-site areas of all obstructions, both natural and manmade, which would interfere with the performance of the work.

1.23.2 Adjacent Premises and Existing Services

Government premises adjacent to the construction will be made available for use by the Contractor, without cost, whenever such use will not interfere with other Government uses or purposes. The Contractor shall promptly vacate such premises if ordered to do so by the Contracting Officer. When

the contract work is to be connected to existing buildings or other construction, the Contractor shall do such repairs and cleanup as may be necessary to leave the completed work in a neat and orderly condition.

Existing services shall be maintained without interruptions, or, if interrupted by the operations of the Contractor, shall be promptly restored. The Contractor shall establish and maintain adequate drainage, from the beginning of construction, in the prescribed work areas, and shall avoid making drainage problems in adjacent or other work areas. The Contractor may block existing roads and sidewalks only by permission of the Contracting Officer obtained two calendar days in advance. The Contractor shall provide a temporary by-pass during such operations, unless otherwise directed.

1.23.3 Vehicle Weight Limits

Roads at the Langley Research Center are limited to axle loads of less than 32,000 pounds. The Contractor shall not exceed these limits. When it is necessary to cross curbing or sidewalks, the Contractor shall construct secure bridges across them, and at the completion of all work, such bridges shall be removed.

1.23.4 Heavy Equipment Movement

Heavy equipment such as cranes, pile drivers, or bulldozers shall not be moved on the paved roadways of the Langley Research Center without prior approval of the Contracting Officer or its designee. Tracked equipment shall be transported on trailers unless the Contracting Officer issues a prior approval to the contrary. Movement of heavy equipment over the paved roadways of the Langley Research Center shall be only at times acceptable to the Contracting Officer and shall not obstruct vehicular traffic. In no event shall such equipment traverse temporary roadway bridging without the Contracting Officer's prior approval.

1.24 BARRICADES AND TRAFFIC CONTROL

The Contractor shall conduct all work shall be conducted to minimize obstruction of traffic, and traffic shall be maintained on at least one half of the roadway width at all times. Approval of the Contracting Officer shall be obtained before starting any activity that will obstruct traffic. Barricades and traffic control devices shall comply with Section 01060, Signs, Signals and Barricades.

1.25 ON-SITE UTILITIES

1.25.1 Water

Potable water will be furnished by the Government without charge. The Contractor shall make all necessary connections to the existing outdoor water faucet, shall furnish all equipment and shall run the water lines required, connecting at points and following routes approved by the Contracting Officer. Lines shall be installed and maintained in a sanitary and watertight manner, and shall be removed at the completion of the contract. Water will be made available within 150 feet of the job site.

1.25.2 Electrical Power

The Contractor shall provide generator power and temporary lighting for construction purposes as required, during the construction period.

1.25.3 Telephone Service

The Government charges a fee for providing an on-site circuit to the Contractor. This fee at the Contractor's option may be charged directly to the Contractor or may be a deduction from the contract value. The Contractor is responsible for making arrangements with the local phone company for phone service. The Contractor shall contact the Contracting Officer's Technical Representative for guidance in having an on-site circuit installed.

1.26 DUST CONTROL

The Contractor shall maintain the project site boundaries free from dust which would cause a hazard or nuisance to others.

1.27 ON-SITE WATER CONTAMINATION

The Contractor shall not pollute streams, lakes, beaches, waterways, or reservoirs. Refuse, fuels, oils, bitumens, calcium chloride, acids, and toxic materials shall be disposed of in a manner to prevent their entry into the water. The Contractor shall comply with applicable federal, state, and municipal laws concerning pollution of rivers and streams. Work under this contract shall be performed in such a manner that objectionable conditions will not be created on or adjacent to project site areas.

1.28 ON-SITE GOVERNMENT/CONTRACTOR/SUBCONTRACTOR COORDINATION

The existing facility will be occupied by the Government during construction. The Contractor shall coordinate its work with the Contracting Officer to ensure minimum interference with Government activities during construction.

Other Contractors will not be working at the site of the work during the performance of this contract.

The Contractor shall be responsible for familiarizing each of its subcontractors with all requirements (this includes administrative as well as technical) of the contract affecting each subcontractor, respectively. The Contractor shall be responsible for coordinating the work of its subcontractors or suppliers to prevent any interference or omission whatsoever. The divisions or sections of the specifications shall not be interpreted as limiting or defining the work for purposes of dividing the work among subcontractors, or to limit the work performed by any trade.

The Contractor shall be responsible to the Government for acts and omissions of its own employees and of subcontractors and their employees. The Contracting Officer will not undertake to settle any differences between the Contractor and its subcontractors, or between subcontractors.

All business pertaining to the contract shall be conducted through the Contractor. If the Contractor specifically authorizes in writing a subcontractor to act as its agent, it shall state the specific authority conferred. The Contractor shall also be bound by any agreement made between the agent acting within the scope of its authority and the Government.

The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work. The Contractor shall conduct its work so as not to impede or interfere with the work of such other Contractors or persons engaged in or about the site. Whenever any work performed by the Contractor adjoins or affects any work by any other Contractor, the Contracting Officer will decide any disputes between the Contractor and such other Contractor. The Contracting Officer's decision, in writing, shall be final and conclusive upon both parties.

If the Contractor causes damage to the work or property of any other Contractor on the project, the Contractor shall, upon due notice, repair such damage or pay for such repair as directed by the Contracting Officer. If such other Contractor sues the Government on account of any damage alleged to have been so sustained, the Government will notify this Contractor who shall defend such proceeding, and if any judgment or award against the Government arises therefrom, this Contractor shall indemnify it and shall reimburse the Government for all attorneys' fees and court costs which the Government has incurred.

The Contractor shall not endanger any work of any other Contractors by cutting, excavating or otherwise altering any work of any other Contractor, except with the written consent of the Contracting Officer.

If a dispute arises between the various on-site Contractors as to their responsibility for cleaning up as required, the Government may clean up and charge the cost thereof to the several Contractors as the Contracting Officer shall determine to be just.

1.29 SANITARY CONVENIENCES

The Contractor shall provide and maintain all necessary sanitary conveniences for use of its employees, as directed by the Contracting Officer. The criteria for determining the adequacy of such facilities provided shall be as stated in the Department of Labor, Safety and Health Regulations, as amended. These facilities shall be kept clean and their use shall be strictly enforced.

1.30 ELECTRICAL WORKERS' QUALIFICATIONS

All electrical work shall be performed by electrical tradesmen who have in their possession a current Apprentice, Journeyman, or Master's Electrical License Card, as issued by the Commonwealth of Virginia. When electrical tradesmen do not have such a Virginia license, the Contractor shall submit to the Contracting Officer for approval, evidence that such tradesmen have equivalent permits issued by other Governmental jurisdictions. Such equivalency submittals shall include documentation defining the criteria

required for licensing by the involved jurisdiction, so that the Contracting Officer can determine that valid equivalency exists.

1.31 INSPECTION RECORDS

In accordance with FAR Clause 52.246-12, "Inspection of Construction", (August 1996), the Contractor shall maintain daily inspection records and make them available to the Contracting Officer. Attachment 4, Daily Construction Report, shall be used to maintain the required inspection records.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

INSTRUCTIONS FOR COMPLETING OF THE CONTRACT PROGRESS SCHEDULE REPORT
(Previously NASA C-63)

Obtain forms from the NASA-Langley Research Center Contracting Officer.

Refer to the submittal instructions in the contract Statement of Work (SOW) _____ for space and flight projects, and sections 01011 and 01330 for facilities projects.

Block Entries

1. The ending date of the accounting month being reported.
2. The contract title as shown on the cover page of the contract.
3. The full name and address of the contractor (if a division of the contractor is performing the work, use the division name and address).
4. Contractor's Project Manager's signature and date approved.
5. The complete NASA contract number and latest modification number.
6. The date the NASA Project Manager for space and flight projects/Contracting Officer's Technical Representative (COTR), for facilities projects approved the original baseline schedule. If the original baseline schedule is revised, ONLY USE the date the NASA Project Manager/COTR approves the revision.
7. The WBS reporting categories agreed to in the current negotiated contract. (See SOW _____ or section 01011.)
8. The attached chart shall be used to show the schedules and status of the Work Breakdown Structure (WBS) reporting categories.

Top line: The calendar years.

Second line: The first letter of each month starting with the month of the contract award.

Time-now indicator: Make a vertical broken line to indicate the end of the reporting month.

Shaded blocks: Use open triangles to indicate the start and completion milestones. This line shall show the current NASA-approved schedule for each WBS reporting category.

Unshaded blocks: Use an open schedule bar to indicate the time span of the Contractor's current operating schedule. Place an open triangle at the end of the open bar to represent the completion milestones. The contractor's current operating schedule may be the same as, or different from the current NASA-approved baseline schedule.

To show schedule status to time-now, determine the length of time allocated in the baseline schedule for the technical achievement to date. Then blacken the schedule bar to the time point in the baseline schedule that represents this technical achievement to date. Blacken the completion triangle at the point in time each milestone is actually achieved. Consider any modifications made in the current working schedule. NOTE: The percent-ratio of the blackened portion of the schedule bar to its total schedule is not necessarily the same as the percent completion of the technical objective. The percent of manhours or dollars used to date is not a measure of schedule progress for end-item WBS categories.

Use arrows (< >) to indicate a break in scheduled activity.

Place a number (1,2,3, etc.) within a triangle to indicate number of times officially rescheduled. The baseline triangles are a permanent part of the schedules. After displaying the prior milestone triangle for 1 month, it should be deleted (leaving only the current re-scheduled triangle).

9. Evaluate the progress toward meeting the technical objective of each reporting category. Enter an estimated percentage that indicates the progress toward the technical objective actually achieved as of the Report for Month Ending date.

Consider all aspects of progress: technical specifications met, quality, production of hardware, software achievement, etc. Subjective factors, such as complexity of tasks, state-of-the-art, and level of confidence that the objective can be achieved, should be considered. Use actual costs or manhours to date as a guide to determine technical achievement ONLY if there is a direct correlation.

Request for Information (R.F.I.)

Distribution:

TO:

FROM:

Contract No.:

Project/Delivery
Order (DO) Number:

Project Title:

TO BE COMPLETED BY REQUESTOR

RFI No.:

Date Submitted:

Title:

REPLY BELOW

REVIEWER:

M/S:

DATE TO REVIEWER:

DATE FROM REVIEWER:

REVIEWER: *(printed name)*

SIGNATURE:

Date:

COTR: *(printed name)*

SIGNATURE:

Date to Requester

PROJECT TITLE:

MODIFICATION DESCRIPTION:

PRIME CONTRACTOR'S WORK

Revisions/Comments

1. Direct Materials				
2. Sales Tax on Materials	4.50 % of line 1	4.50 %		
3. Direct Labor (including fringe benefits)				
*4. Insurance & Taxes	_____ % of line 3	%		
5. Rental Equipment				
6. Sales Tax on Rental Equipment	4.50 % of line 5	4.50 %		
7. Equipment Ownership and Operating Expenses				
8. SUBTOTAL (Add lines 1-7)				
9. Overhead (Field + Home Office)	_____ % of line 8	%		
10. SUBTOTAL (Add lines 8 and 9)				
11. Prime Profit	_____ % of line 10	%		
12. SUBTOTAL (Add lines 10 and 11)				

Prime Remarks:

SUBCONTRACTOR'S WORK

Revisions/Comments

13. Direct Materials				
14. Sales Tax on Materials	4.50 % of line 13	4.50 %		
15. Direct Labor (including fringe benefits)				
*16. Insurance & Taxes	_____ % of line 15	%		
17. Rental Equipment				
18. Sales Tax on Rental Equipment	4.50 % of line 17	4.50 %		
19. Equipment Ownership and Operating Expenses				
20. SUBTOTAL (Add lines 13-19)				
21. Overhead (Field + Home Office)	_____ % of line 20	%		
22. SUBTOTAL (Add lines 20 and 21)				
23. Profit	_____ % of line 22	%		
24. SUBTOTAL (Add lines 22 and 23)				

Sub's Remarks:

SUMMARY

Revisions/Comments

25. Prime Contractor's Work (from line 12)				
26. Subcontractor's Work (from line 24)				
27. Prime's Commission on Subcontractor Work	_____ % of line 20	%		
28. SUBTOTAL (add lines 25, 26, and 27)				
29. Prime Contractor's Bond	_____ % of line 28	%		
30. TOTAL COST (Add lines 28 and 29)				

Estimated time extension and justification

Prime Contractor Name:

Subcontractor Name:

Signature of Preparer

Title of Preparer

*THIS ITEM MAY ONLY INCLUDE LABOR BURDEN FOR FICA, FUTA, SUTA, AND WORKER'S COMP.

BREAKDOWN OF DIRECT COSTS

DATE _____

Work Items Prime Contractor	QTY	UNIT	MATERIAL COST		LABOR COST		O = Owned R = Rental	EQUIPMENT			
			Per Unit	Total	Per Unit	Total		Qty	Rate	Owned	Rental
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											
13.											
14.											
15.											
16.											
17.											
18.											
19.											
20.											
DIRECT Prime Contractor's TOTAL											
				Mat/Cost Total		Labor/Cost Total				Owned Total	Rental Total

Work Items Subcontractor	QTY	UNIT	MATERIAL COST		LABOR COST		O = Owned R = Rental	EQUIPMENT			
			Per Unit	Total	Per Unit	Total		Qty	Rate	Owned	Rental
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											
13.											
14.											
15.											
16.											
17.											
18.											
19.											
20.											
DIRECT Subcontractor's TOTAL											
				Mat/Cost Total		Labor/Cost Total				Owned Total	Rental Total

Daily Construction Report	Date
----------------------------------	------

Contract No.	Title and Location
--------------	--------------------

Contractor	Superintendent or Foreman
------------	---------------------------

Weather	Temperature °F
---------	----------------

Weather Affects Delay Critical Path Activity Yes No

Prime Contractor/Subcontractor Workforce <i>(if space provided below is inadequate, use additional sheets)</i>	Location and Description Of Work Performed
---	---

No.	Trade	Hours	Employer	

Total Work Hours on Job Site This Date	Were there any lost time accidents this date? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, a copy of the completed NASA Form 95 is required.
---	---

Material Received and Equipment On-Site (*w/value > \$10,000*)

Test Performed (*give brief description of test performed*)

Remarks (*Include directions received from CO/COTR, Safety; compliance notices received; pertinent information.*)

Check if continued on other side

_____ Contractor/Superintendent _____ Date

Inspector's Remarks and/or exceptions to this report

Check if continued on other side

_____ Inspector _____ Date

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01060

LANGLEY SAFETY AND ENVIRONMENTAL REQUIREMENTS

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 GENERAL SAFETY REQUIREMENTS
 - 1.4.1 Safety Plan
 - 1.4.2 Recordkeeping
 - 1.4.3 Safety Briefing
 - 1.4.4 Inspections
 - 1.4.5 Housekeeping
 - 1.4.6 Illumination
 - 1.4.7 Ladders
 - 1.4.8 Motor Vehicles and Mechanized Equipment
 - 1.4.9 Hazardous Materials
- 1.5 SAFETY CLEARANCE PROCEDURES/LOCKOUT/TAGOUT
- 1.6 ELECTRICAL SAFETY
 - 1.6.1 General Electrical Safety Requirements
 - 1.6.2 Special Electrical Safety Requirements
 - 1.6.2.1 Electrical Safety Workers' Qualifications and Duties
 - 1.6.3 Equipment Safety Tests and Checks
 - 1.6.4 Protective System Checks
 - 1.6.5 High Voltage Insulation Testing of Electrical Equipment
 - 1.6.6 Rules Governing Contractor Connection Into Government
 - Electrical Utilities
 - 1.6.7 Switching
 - 1.6.8 Removal of Electrical Equipment and/or Wiring
 - 1.6.9 PCB Operations
 - 1.6.10 Energized Substations (2300 Volts and Above)
 - 1.6.11 Protective Grounding
 - 1.6.11.1 Definition and Requirements
 - 1.6.11.2 Responsibility
 - 1.6.11.3 Method of Application and Removal
 - 1.6.11.4 Transformers
 - 1.6.11.5 Current and Potential Transformers
 - 1.6.12 Underground Electrical
 - 1.6.12.1 Cutting and Splicing Power Cables
- 1.7 OIL TRANSFER OPERATIONS
- 1.8 DEMOLITION OPERATIONS
- 1.9 PAINTING AND COATING OPERATIONS
- 1.10 FIRE PREVENTION AND PROTECTION

REPLACE 750 KVA UNIT SUBSTATION - B1208

- 1.10.1 General Requirements
 - 1.10.2 Welding, Flame Cutting and Melting
 - 1.10.3 Prohibitions
 - 1.10.4 Safeguards
 - 1.10.5 Firewatch
 - 1.10.6 Means of Egress
 - 1.10.7 Portable Fire Extinguishers
 - 1.10.8 Temporary Heaters
 - 1.10.9 Removal of Combustible Waste Material
 - 1.10.10 Disposal of Rubbish
 - 1.10.11 Flammable and Combustible Liquids
 - 1.10.12 Smoking
 - 1.10.13 Non-Emergency Use of Fire Hydrants
 - 1.10.14 Fire Department Access
 - 1.11 USE OF EXPLOSIVES
 - 1.12 FALL PROTECTION (OSHA 29 CFR PART 1926.500 THROUGH 1926.503)
 - 1.13 LIFTING OPERATIONS
 - 1.13.1 General
 - 1.13.2 Lifting Devices
 - 1.13.3 Guidelines for Proper Use of A-Frame Type Lifting Devices
 - 1.14 ACCIDENTS AND SAFETY RELATED INCIDENTS
 - 1.14.1 Emergency Response and First Aid Facilities
 - 1.14.2 Accident Reporting
 - 1.15 DISPOSAL OF HAZARDOUS WASTE MATERIAL
 - 1.16 PERSONAL PROTECTIVE EQUIPMENT
 - 1.17 SIGNS, SIGNALS AND BARRICADES
 - 1.17.1 Accident Prevention Signs
 - 1.17.2 Signaling
 - 1.17.3 Barricades
 - 1.18 HAND AND POWER TOOLS
 - 1.19 SCAFFOLDING
 - 1.19.1 Aerial Lifts
 - 1.20 STEEL ERECTION
- PART 2 PRODUCTS (Not Applicable)
- PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01060

LANGLEY SAFETY AND ENVIRONMENTAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO D-MUTCD-3 (2001) Manual for Uniform Control of
Traffic Devices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ANSI/ASTM F 496 (2002) Standard Specification for the
In-Service Care of Insulating Gloves and
Sleeves

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.1 (2000) Safety Requirements for Ladders -
Portable Wood

ANSI A14.2 (2000) Safety Requirements for Portable
Metal Ladders

ANSI A14.5 (2000) Safety Requirements for Fiberglass
Ladders

ANSI/SIA A92.2 (2002) For Vehicle Mounted Elevating and
Rotating Aerial Devices

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B15.1 (2000) Safety Standard for Mechanical
Power Transmission

CODE OF FEDERAL REGULATIONS (CFR)

REPLACE 750 KVA UNIT SUBSTATION - B1208

29 CFR Part 1910	Occupational Safety and Health Standards
29 CFR Part 1926	Safety and Health Regulations for Construction
40 CFR Part 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

LANGLEY RESEARCH CENTER (LaRC)

LAPD 1700.7	(March 2001) Traffic Management
LAPG 1710.6	(July 1999) Electrical Safety Handbook
LAPG 1710.10	(August 2002) Safety Clearance Procedures (Lockout/Tagout)
LAPG 8800.1	(September 2002) Environmental Program Manual

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA-STD-8719.11	(2000) NASA Safety Standard for Fire Protection
------------------	---

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(1998) Standard for Portable Fire Extinguishers
NFPA 30	(2000) Flammable Liquids Code
NFPA 31	(2001) Standard for the Installation of Oil-Burning Equipment
NFPA 51	(1997) Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding and Allied Processes
NFPA 51B	(1999) Standard for Fire Prevention in Use of Cutting and Welding Processes
NFPA 54	(1999) National Fuel Gas Code
NFPA 58	(2001) Standard for the Storage and Handling of Liquefied Petroleum Gases
NFPA 70	(2002) National Electrical Code
NFPA 101	(2000) Life Safety Code
NFPA 211	(2000) Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances

VIRGINIA ADMINISTRATIVE CODE (VAC)

9 VAC-20-60 State Regulations (VAC)

13 VAC-5-51 Virginia Statewide Fire Prevention Code

1.3 SUBMITTALS

The following shall be submitted in accordance with the requirements of Section 01330, "Submittals":

SD-08 Statements

Safety Plan

Application for Working on Energized Electrical Circuits Below 600 Volts

Electrical Safety Workers Qualifications

Application for Making Connection to Government Electrical Utilities

Energized Substations Work Plan

Power Outage Request

List of Riggers

PCB Operations

Hazardous Waste Disposal Plan

1.4 GENERAL SAFETY REQUIREMENTS

1.4.1 Safety Plan

On-site work shall not commence prior to the Contracting Officer's approval of the Safety Plan.

The Contractor safety plan is a written plan prepared by the Contractor summarizing the overall safety program that will cover the employees and equipment used to fulfill the contract. The safety plan shall address all aspects of the contract to include manufacturing, construction, transportation, and testing. It is not intended that the Contractor's normal industrial home-plant safety rules and directives be subject to NASA approval. However, it is intended to ensure that the Contractor has an adequate safety program for on-site work. Attachment 1 to this section provides a list of items required to be addressed in the safety plan; however, special safety procedures may be required, depending on the scope of work, environmental conditions or area of operation.

The safety plan shall contain a brief summary and scope of the work to be

performed.

The Contractor's safety representative, responsible for ensuring compliance with all applicable rules and regulations, shall be identified in the safety plan.

1.4.2 Recordkeeping

The Contractor shall have a log and summary of all recordable occupational injuries and illnesses for their company, on an OSHA 300, Log of Work-Related Injuries and Illnesses, and OSHA 300A, Summary of Work-Related Injuries and Illnesses, or their equivalent at a central place. The on-site Contractor shall have the address and telephone number of the central place where the OSHA 300 and 300A logs are maintained and shall have personnel available at the central place during normal business hours to provide information from the records maintained there, by telephone or mail. (OSHA 29 CFR 1904)

1.4.3 Safety Briefing

The Contractor's on-site Superintendent, as well as a subcontractor representative from each on-site subcontractor supporting the effort and the Facility Safety Head, as required, shall attend a Safety Briefing at the Safety and Facility Assurance Office, Building 1162, Room 122, Langley Research Center (LaRC), prior to any on-site activity. Briefing time is 7:30 a.m., Monday, Wednesday and Friday. This effort will be coordinated with the required badging activity. The prime contractor shall provide a list of all prime and subcontracted personnel to the LaRC Badge and Pass Office to acquire badges.

1.4.4 Inspections

In accordance with Section 107 of the Contract Work Hours and Safety Standards Act, a representative of the NASA Langley Research Center shall have the right of entry to any on-site area of contract performance to ensure compliance with all applicable rules and regulations. (OSHA 29 CFR Part 1926.3)

Any condition that threatens the safety or security of (1) personnel (2) Government property or equipment, or (3) information, or any conditions that affect LaRC's environmental compliance may be subject to immediate work stoppage by the Contracting Officer (CO), the Contracting Officer's Technical Representative (COTR), or the CO's designated inspection representative, and shall not resume until directed by the Contracting Officer.

1.4.5 Housekeeping

During the course of construction, alteration, or repairs, form and scrap lumber with protruding nails, and all other debris, shall be kept cleared from work areas, passageways, and stairs, in and around buildings or other structures.

1.4.6 Illumination

The Contractor shall light construction areas, aisles, stairs, ramps, runways, corridors, offices, shops, and storage areas where work is in progress shall be lighted with either natural or artificial illumination. (OSHA 29 CFR Part 1926.26)

1.4.7 Ladders

All ladders shall comply with ANSI A14: wood ladders (ANSI A14.1), metal ladders (ANSI A14.2), and fiberglass ladders (ANSI A14.5).

1.4.8 Motor Vehicles and Mechanized Equipment

All contractor-owned vehicles shall abide by LaRC traffic regulations in accordance with LAPD 1700.7, "Traffic Management," and OSHA regulations in accordance with OSHA 29 CFR Part 1926.600 through 1926.606.

1.4.9 Hazardous Materials

In accordance with OSHA 29 CFR Part 1910.1200, the Contractor shall have a hazardous communications program, when applicable, available for each chemical, oil, lubricant, or solvent used on the job-site. A Material Safety Data Sheet (MSDS) shall be available for each chemical used on the job-site.

1.5 SAFETY CLEARANCE PROCEDURES/LOCKOUT/TAGOUT

All contractors performing work at Langley Research Center (LaRC) shall comply with the safety clearance procedures described in LAPG 1710, "Safety Clearance Procedures (Lockout/Tagout)". Failure to comply with LAPG 1710.10 will result in the issuance of a Notice of Violation and may result in the exclusion of the individual responsible for violating LAPG 1710.10 from LaRC. The LaRC Lockout/Tagout procedures involve the use of red tags, red locks, associated locking hardware, LaRC issued personal locks, and LaRC issued lock boxes.

Lockout/Tagout Overview

(Terminology: "Protected Person" refers to any person who after placing a personal lock on the lockout/tagout where required becomes protected by a lockout/tagout; "Responsible Person" refers to a person who has lockout/tagout responsibility for a group of protected persons; and "Requester" refers to the individual who requests the lockout/tagout. The requestor may be an individual who only has lockout/tagout responsibility for him/herself or may be the responsible person who has lockout/tagout responsibility for a group of workers.)

When lockout/tagout is required, the requestor contacts the Facility Coordinator who is responsible for the system/item requiring lockout/tagout. The Facility Coordinator then contacts a qualified Safety Operator who performs the required lockout/tagout. **At LaRC, the only persons authorized to perform lockout/tagout are Safety Operators who have in their possession a current NASA Langley Form 453, "NASA Langley Safety Operator Permit."** Once the lockout/tagout has been completed, the Safety

Operator contacts the requestor, communicates the limits of the lockout/tagout, demonstrates the effectiveness of the lockout/tagout, and delivers red tag stub(s), lock box when required, and personal lock(s) to the requestor. When the requestor no longer requires the protection of the lockout/tagout, he/she signs the red tag stub(s) and delivers the signed red tag stub(s), the lock box if used, and personal lock(s) to the Facility Coordinator. The Facility Coordinator contacts the Safety Operator who clears the lockout/tagout.

1.6 ELECTRICAL SAFETY

1.6.1 General Electrical Safety Requirements

Before commencing work on any mechanical equipment or systems, which have electrical connections or contain combustible, or other dangerous gases or fluids, such equipment shall be properly grounded, and/or made safe in accordance with LaRC safety regulations concerning these materials. No work (other than performing routine electrical tasks such as taking electrical measurements, replacing plug-in components, or changing fuses) shall be performed on energized power circuits without prior approval of the Contracting Officer. All references to a "qualified electrical," "properly instructed," or "less-qualified" contained in this section shall be as defined in Section 01011.

Only qualified electrical people shall perform the work. If work is planned to be performed on energized circuits, the Contractor shall submit to the Contracting Officer a written application defining the procedure(s) to be used, for approval. Work shall not proceed until approval is received.

The buddy system, a second qualified electrical person directly observing the operation, is mandatory whenever electrical work (including measurements) is to be performed on energized circuits of 601 volts (phase-to-phase) or higher except as follows:

- o A properly instructed person may accompany electrical personnel in lieu of a qualified electrical person when work such as switching or locking/tagging is being performed.
- o A qualified electrical person may be authorized by their line supervisor to take meter readings without the presence of a second person.

A properly instructed electrical person shall be present when non-electrical work such as grounds-keeping is being performed in an energized substation.

All personnel shall wear safety glasses or goggles shall be worn when making electrical measurements, inspecting internal wiring of panels, or working with tools in proximity to any energized power circuits. Safety glasses or goggles shall be worn when performing other types of electrical work including control modification and/or checkout.

Identification markings on building light and power distribution panels,

circuits, and components for establishing safe work conditions shall not be relied upon.

Ground wires or connections to frames or cases shall not be removed from any energized equipment.

Earth return is not to be used in the wiring of any power circuit.

Temporary electrical wiring shall be supported by suitable wood or other insulating materials.

Temporary electrical wiring and portable electrical cords shall be kept out of water at all times unless the cable is approved by the latest revision of the National Electrical Code for that purpose.

When fishing a conductive tape or wire through a conduit, personnel shall be stationed to prevent the free ends of the tape or wire from contacting energized equipment.

All portable electrical tools (except battery operated) shall have ground-fault protection.

The cases of all portable electrical motor-driven hand tools shall be grounded by use of standard three-prong plugs and receptacles and all other electrical equipment supplied with 50 volts or above shall have their cases or frames connected to ground, except:

- o Devices operated solely from self-contained batteries.
- o Devices that have cases and all exposed parts protected by insulating material.
- o "Double insulated" tools.
- o Devices supplied with less than 150 volts to ground for which exceptions have been granted by the Safety and Facility Assurance Office.

Tools, equipment, and other potential sources of ignition used in hazardous locations shall comply with Article 500 of NFPA 70, "National Electric Code."

Welding or burning shall not be permitted in the immediate vicinity of electrical equipment unless specifically authorized by the Contracting Officer.

Only devices designed for voltage testing and rated for the nominal voltage of the circuit under test shall be used to make voltage checks. The Contractor shall verify test voltage indicators immediately before and after use by application to an energized circuit or by using an appropriate test unit.

Only fiberglass or wood ladders shall be used near electrical hazards. Metal ladders shall be marked with signs or decals reading CAUTION--DO NOT

REPLACE 750 KVA UNIT SUBSTATION - B1208

USE NEAR ELECTRICAL EQUIPMENT. Ladders shall be clean and in good condition.

Portable electrical hand tools shall be unplugged when not in use.

Before maintaining or repairing any electrical equipment, the equipment shall be disconnected from the power source.

Equipment that has frayed cords or three-wire cord ends that have had the grounding prong removed shall not be used. Qualified electrical personnel shall repair faulty equipment and tools.

Lamp replacement or other work or tests shall not be done on the series street lighting system unless the fuse disconnects on the 2,300-volt supply line are properly opened and red tagged.

High-voltage equipment that has been energized and then de-energized shall be grounded prior to performing work, to insure no residual voltage remains as a potential shock hazard.

High voltage areas in buildings shall be screened off or barricaded, to allow only authorized personnel to enter. Electrical and mechanical safety interlocks shall be used where practicable.

Exposed energized circuits shall not be approached closer than the following distances, for any reason, unless such parts are adequately guarded:

Alternating Current Voltage Range - Phase-to-Phase	Minimum Distances
600 - 10,000 volts	2 feet

Lineman's type rubber gloves shall be tested at least every 180 calendar days for the circuit voltages involved in accordance with ANSI/ASTM F 496 -022, "Standard Specification for the In-Service Care of Insulating Gloves and Sleeves". In addition, a standard air test (ASTM F496-022, "Standard Specification for In-Service Care of Insulating Gloves and Sleeves (2002)") shall be performed immediately before use. Leather protectors shall always be worn over lineman's rubber gloves.

Rubber gloves shall not be relied upon for protection from energized circuits of more than 3500 volts to ground.

Fuses shall not be removed on energized circuits above 600 volts. Fuses shall not be removed from loaded energized circuits. Procedures to be used when removing or replacing fuses on unloaded energized circuits shall conform to the following for circuits:

- o Rated 50 to 600 volts, insulated fuse tongs or extractors, shall be used.

1.6.2 Special Electrical Safety Requirements

1.6.2.1 Electrical Safety Workers' Qualifications and Duties

All appointed safety workers shall be electrical tradesmen.

- o The Contractor shall appoint a Safety Supervisor knowledgeable of contract safety requirements specified herein. The Safety Supervisor shall be available at the worksite during all work and shall be responsible for the safety of each of the Contractor's work teams.
- o The Contractor shall appoint an Assistant Safety Supervisor who shall take over the responsibilities and perform all duties of the Safety Supervisor if the Safety Supervisor is not present.
- o The Contractor shall furnish to the Contracting Officer, in writing, the names and qualifications of the Safety Supervisor and Assistant Safety Supervisor prior to commencement of work. This submittal is in addition to the Safety Plan required above.
- o When working in energized substations, manholes, and cable tunnels, the Contractor shall:
 - o Assign an employee knowledgeable of the safety required, and without other duties, to assist the Safety Supervisor to assure the safety of the work area whenever the work involves the handling of lengths of conduit, bus, steel or large equipment.
 - o Assign additional employees, knowledgeable of the safety required and without other duties, for the protection of the workers when the work is so divided and extensive that one safety employee cannot effectively maintain the safety surveillance over the workers and their operations.
 - o Ensure no work is performed without a minimum of two (2) employees present in any one-work team, one of which shall be a safety team leader.

1.6.3 Equipment Safety Tests and Checks

The following tests shall be performed prior to energizing electrical equipment for the first time:

- o Initial energizing of all electrical equipment shall be performed in the presence of the Contracting Officer.
- o All power feeder circuit breakers shall be checked for proper adjustment and operation in accordance with the manufacturer's instructions. Molded case circuit breakers without solid state trip devices are excluded from this requirement.
- o All wiring shall be field verified for conformity to the design, fabrication, and functional requirements.

1.6.4 Protective System Checks

Protected relay settings shall be coordinated to provide selective tripping. The Contractor shall coordinate this effort through the Contracting Officer.

All circuit interruption devices shall be rated to interrupt the maximum short circuit current of the power system at the point of application of the device.

Circuit breakers shall be immediately inspected and checked to assure suitability for reuse after any operation in which the circuit breaker opens under short circuit or fault conditions. When a trip occurs on breakers above 600 volts, the troubleshooting process shall verify the settings of all breakers between the fault and the breaker when tripped.

1.6.5 High Voltage Insulation Testing of Electrical Equipment

High voltage dielectric testing, the Contractor shall perform the following actions:

- o Verify lockout/tagout procedure for the applicable circuits.
- o Secure the area.
- o Perform a low voltage dielectric test (Megger test).
- o Perform grounding procedures.

These tests shall be in accordance with Section 5, Paragraph 6.9 of IEEE Std. 95-2002.

1.6.6 Rules Governing Contractor Connection Into Government Electrical Utilities

Prior to connecting into any part of the Government electrical power distribution system, the Contractor shall:

- o Make written application to the Contracting Officer stating the date time, location, and the service desired.
- o Jointly with the Contracting Officer, make the necessary checks of the Contractor's system and the Government's supply to assure their compatibility and safety.

1.6.7 Switching

All electrical switching that is required for clearance to work on equipment operating from electrical circuits shall only be performed by Government personnel who have been authorized as LaRC Safety Operators for the specific equipment.

When work is to be performed on secondary circuits or equipment, which are only disconnected from sources of power by oil switches, the following procedures shall be performed:

- o Obtain concurrence from the Contracting Officer.
- o Verify status of de-energized oil switch.
- o Perform tests to verify that there is no voltage on the load side of the transformer from phase-to-phase and from each phase-to-ground.
- o Apply locks/tags. Indicate on the lock/tag that no work shall be performed on the high voltage (primary) side of the equipment.
- o Apply protective grounding as close as physically possible to the load side of the transformer or power source.

1.6.8 Removal of Electrical Equipment and/or Wiring

When equipment is designated to be permanently removed, the electrical wiring, conduit, enclosure, and control boxes shall be removed back to the source of feed, unless noted in the drawings or specifications. Where practicable, the power source shall be deenergized and disconnected prior to disconnecting the load or cutting the cables.

1.6.9 PCB Operations

Electrical equipment, such as transformer, which is classified as non-PCB contaminated is filled with insulating fluid that contains Parts Per Million of Polychlorinated Biphenyls (PCB). PCB fluids have been sold under various trade names, such as "Askeral," "Inerteen," "Chlorexol," "Noflama" and "Pyranol." Any spills or leaks of fluid containing any Parts Per Million (PPM) of PCB's shall be reported immediately to the Inspector and LaRC Environmental Management Office (EMO) Spill Coordinator at 864-3320.

A. REQUIREMENTS FOR POLYCHLORINATED BIPHENYL (PCB) REMOVAL

All PCB operations shall be conducted in accordance with applicable provisions of 40 CFR Part 761, Polychlorinated Biphenyls (PCB's) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions, Subparts A through K, other Federal and Local application regulations applicable to PCB removal, and Section 6 of LAPG 8800.1, "LaRC Environmental Program Manual," and Section 6 of LAPG 8800.1, "PCB Management." All fluids and equipment containing any percentage of PCB's shall be carefully controlled and monitored. The Contractor shall notify LaRC, Environmental Management Office (EMO) prior to work involving the removal or disposal of any PPM concentration of PCB's or PCB items. All storage and disposal practices shall be reviewed by the LaRC EMO.

B. OPERATIONAL PROCEDURE FOR PCB REMOVAL

The Contractor shall submit an operational procedure to the Contracting Officer for approval. The procedure shall specify the means by which the Contractor will assure compliance with all applicable regulations. The procedure shall include attention to the following elements, as appropriate to the specific job:

REPLACE 750 KVA UNIT SUBSTATION - B1208

- o Emergency Plan (approved by the EMO Spill Coordinator)
- o A work schedule to include start and anticipated finish dates
- o Work area control procedures
- o Personal protective equipment and clothing to be worn
- o Work practices to be observed
- o Personnel hygiene procedures
- o Labeling and proper packaging of PCB items and related waste
- o PCB handling procedures, including a description of the waste and estimated volume to be generated
- o Disposal practices
- o Proof of training qualifications of PCB workers

C. TEMPORARY STORAGE FOR DISPOSAL

The Contractor may temporarily store, on LaRC, PCB items (transformers, capacitors, etc.), for a period of time, not to exceed 30 calendar days, from the date of removal from service. Storage shall be in accordance with EPA regulations 40 CFR Part 761.65 and coordinated with EMO to assure proper storage practices. A notation shall be attached to the PCB item or PCB container housing which indicates the date of removal from service, its weight, and PCB PPM content (Office of Security and Environmental Management (OSEM) provides or if unknown, Contractor provides analysis). The Contractor shall package all PCB items for transportation in accordance with Department of Transportation (DOT) regulations.

The Contractor may request the use of LaRC Storage Facility, Building 1167, as a temporary storage site. In this case, the Contractor shall notify EMO, seven calendar days prior to storage, of the amount of PCB waste to be stored.

D. RESPONSIBILITIES FOR STORAGE

The Contractor shall adhere to the following requirements for items placed in storage:

- o Follow EPA Regulations 40 CFR Part 761.65, (a) through (c) (9).
- o Request/Coordinate storage of PCB with LaRC EMO.
- o Package PCB items for disposal in accordance with DOT regulations.
- o Survey the storage location every week for evidence of PCB contamination and leaks.
- o Make a written report stating the results of the survey and cleanup

REPLACE 750 KVA UNIT SUBSTATION - B1208

actions required or taken. Forward a copy of the original survey to EMO within seven calendar days of survey.

E. PCB DISPOSAL

Disposal of any concentration of PCB's and PCB items shall comply with applicable regulations of 40 CFR Part 761, Subparts A through K, other Federal and Local regulations and Section 6 of LAPG 8800.1, Chapter 6, "LaRC Environmental Program Manual," " PCB Management." All transformers and PCB electrical equipment too large to be contained in drums and that contain any PPM PCB fluids, shall be drained before removing the transformers or other electrical equipment off the Center for disposal. Small transformers or capacitors that can be contained without modification in a drum or other leakproof container are not required to be drained. Items and fluids that contain less than 50 PPM PCB are considered non-PCB and are excluded from federal regulation with the exception of disposal practices provided in 40 CFR Part 279 and Part 761.20 (d) and (e). Also, oil containing any quantifiable level of PCB's (greater than 2 PPM) shall be marketed to incinerators or burners defined in 40 CFR Part 761.20 (e)(1) or an EPA approved chemical treatment facility. The disposal of drained transformer carcasses and other electrical equipment is regulated in accordance with 40 CFR Part 761.60 (b) through (c). The Contractor shall notify LaRC EMO, prior to draining any equipment and ensure that proper accumulation containers are used. All PCB items shall be packaged in accordance with DOT regulations. A shipping document or state manifest shall accompany the oil in transportation for disposal.

F. RESPONSIBILITIES FOR DISPOSAL ARE AS FOLLOWS:

Thirty calendar days after date of Receipt of Notice to Proceed:

- o Submit to the Contracting Officer for approval the name and location of the ultimate disposal facility. Only NASA LaRC audited/approved facilities may be used for the disposal of PCB items.
- o Submit to the Contracting Officer for approval a one-time written and signed notice certifying that the burner (Disposal Company) has complied with requirements applicable to incinerators or burners defined in 40 CFR Part 761.20 (e)(1) and identify the class of burner he qualifies [40 CFR Part 761.20 (e)(3)].
- o Submit to the Contracting Officer certification that electrical equipment drained of oil containing any PPM of PCB's complies with 40 CFR Part 761.60 (b) and (c).
- o Submit to the Contracting Officer a list of all PCB items for disposal, to EMO for review.
- o Submit to the Contracting Officer an Emergency Spill Plan that defines the procedures and materials that will be provided by the Contractor in the event of a spill or leak of any amount of PCBs.

Five calendar days prior to removal from LaRC the Contractor shall:

Submit to the Contracting Officer a completed shipping document or, if required, a state manifest that fulfills all requirements of 40 CFR Part 761.207 and Part 761.208. The EMO will review the manifest prior to approval and signature.

G. SPILL CLEANUP

The Contractor is responsible for spill cleanup as required under 40 CFR Part 761, Subpart G. In the event of a spill, the Contractor shall take immediate action to contain the spill and notify the Inspector. During non-working hours, the Contractor shall notify the Duty Office at 864-4927.

H. RESPONSIBILITIES

All Contractor and subcontractor PCB removal personnel, including supervisors involved with prevention and cleanup, shall be trained in accordance with applicable EPA, Federal, State, and Local regulations. Proof of training shall be submitted 30 calendar days prior to PCB operation removal.

No PCB site operations shall be performed if spill materials and qualified personnel defined under the Emergency Spill Plan are not at the site prior to starting any PCB operations.

1.6.10 Energized Substations (2300 Volts and Above)

The Contractor shall:

- o Conform to all applicable OSHA and LaRC safety rules and regulations.
- o Submit a work plan to the Contracting Officer at least seven calendar days prior to initiating work in a substation. Outline the work to be done and identify the circuits required to be deenergized to safely conduct operations. The plan shall include a detailed step-by-step work procedure for each phase of the work. All changes to this work plan shall be reviewed with the responsible LaRC personnel prior to initiation.
- o Appoint an individual responsible for the electrical safety of each work team. The electrical Safety Supervisor(s) shall attend the Construction Safety Briefing. Before starting the work, the responsible individual shall provide a document to the Contracting Officer establishing that the appointed Safety Supervisor(s) is (are) qualified and knowledgeable in OSHA and LaRC safety regulations and requirements. (Refer to paragraph entitled, "Electrical Safety Workers' Qualifications and Duties" of this section.
- o Request an electric power outage at least seven calendar days in advance of the need.
- o After receipt of the lockout/tagout stubs, check to assure that the designated circuits have been deenergized and properly grounded and verify that the immediate work area and a zone beyond the work area

have been made safe, before permitting employees to work in the substations. As a minimum, the Contractor shall perform the following:

- o Install all barriers and rope guards that are deemed necessary to clearly define the work area.
- o Barriers and rope guards shall be sufficient to restrain the workers from inadvertently moving out of the work area.
- o Establish a safe zone area between the work area and the energized parts of the substation so that all live circuits and parts clear the designated work area by at least 10 feet.
- o Use physical barriers whenever practicable. When adequate barriers cannot be installed around all energized parts adjacent to the work area, the Contractor shall take whatever action is needed to provide the continuous safeguarding of each worker.
- o Assign a full-time employee, knowledgeable of the safety required and without other duties, to assist the Safety Supervisor in assuring the safety of the work area when the work involves handling of lengths of conduit, bus, steel, or large equipment.
- o Assign additional safety supervisors as needed for the protection of the workers when the work is so divided and extensive that one safety supervisor cannot effectively maintain the safety surveillance over the workers and their operations.
- o Refrain from using any crane in or near an energized substation where movement of the crane might cause objects to fall into or strike energized parts of the substation.
- o Contact the Government representative at the beginning of work each day for admittance to the substation. Maintain surveillance of the substation gates to only permit authorized personnel to enter. No entrance shall be made while work is being conducted unless the Contractor Safety Supervisor has been first contacted to verify conditions are safe.

1.6.11 Protective Grounding

1.6.11.1 Definition and Requirements

Equipment normally energized above 600 volts should always be considered energized unless protective grounds are confirmed to be in place. (See LAPG 1710.10, "Safety Clearance Procedures (Lockout/Tagout).") Protective grounds are temporary grounding and short circuiting conductors, which are placed on deenergized electrical equipment for personnel protection. These grounds are a temporary protective measure and should not be confused with the fixed ground system required by NEC. Protective grounds are normally used to prevent accidental energizing of equipment and systems and shall be applied to any equipment when, in the opinion of the worker, the worker's supervisor or the Safety Supervisor, the application is required. If

protective grounds are determined to be necessary, they shall be applied before beginning work on systems or equipment which may bring personnel into contact with parts which are normally energized at or above 600 volts.

1.6.11.2 Responsibility

The electrical safety worker shall determine that adequate grounds are placed for the protection of personnel performing work, even though the lockout/tagout may be placed in the name of another person (see paragraph entitled, "Safety Clearance Procedures (Lockout/Tagout)"). Protective grounds shall be placed on all sides of the work where there is a possible source of power (including wire crossings and parallel lines) and as close as possible to the point of work. Additional grounds shall be placed where necessary to reduce static charges or induced voltages from adjacent lines.

1.6.11.3 Method of Application and Removal

Before attaching protective grounds, the equipment or circuit to be protected must be deenergized, tested to verify that the voltage is zero, and locked/tagged out. (See LAPG 1710.10, "Safety Clearance Procedures (Lockout/Tagout)".) All conductors, static wires, circuit neutrals, and cable sheaths shall be connected in a manner which will ground all conductive portions of the circuit to a common point. The protective grounds shall not be removed until all workers are clear of the circuit or equipment. The ground end of the protective grounding cable shall always be connected first and disconnected last. Protective grounding cables shall not be less than 2/0 AWG copper or equivalent.

1.6.11.4 Transformers

Before working on transformers, the following shall be performed:

- o Open the transformer primary disconnects switch.
- o Remove the secondary fuses or open the secondary breaker.
- o Check the system to verify that the voltage is zero.
- o Install protective grounds.
- o Install insulated barriers or boards to isolate energized studs.

Where connected transformers are in the zone between protective grounds, either removing the line taps or opening the fuse cutouts shall disconnect the primary side of the transformer. Where primary line work is to be performed on the transformer pole, the secondary wires shall also be disconnected or protective grounds applied. The secondary neutral, if established as grounded, may be considered as an adequate ground. On distribution transformers, the secondary neutral shall be considered an adequate ground for protective grounding, if the permanent ground is interconnected with the secondary neutral, the transformer case and a ground electrode.

Whenever work is to be performed on connected transformers, protective

ground shall be applied in accordance with LAPG 1710.6, "Electrical Safety."

When transformers are installed and before they are energized, the ground connection shall be made to the case, and where applicable, to the neutral.

All transformers shall be considered energized at full voltage unless they are disconnected from the primary and secondary wires, or unless they are disconnected from the primary wires and the secondary wires have had protective grounds applied. The opening of a fused primary cutout or switch shall not be considered as a primary disconnection unless the de-energized side of the cutout or switch is grounded.

When transformers are installed or replaced, the secondaries shall be checked for correct voltage and phase rotation.

Because it is possible to have up to full phase-to-ground voltage on the transformer neutral, transformer neutrals shall always be treated as phase conductors, unless established as a ground.

When removing transformers, the case and neutral grounds shall be disconnected last.

Transformer covers or handholes plates shall not be removed from energized transformers.

1.6.11.5 Current and Potential Transformers

Current transformer cases and secondaries shall be grounded.

Where more than one set of current transformer secondaries is connected electrically, a ground point shall be selected that provides grounding for the network.

When the primary circuit is energized, secondaries are electrically connected; a ground point shall be selected that provides grounding for the network.

The case and one wire on the low-voltage side of potential transformers shall always be grounded before energizing the transformer.

1.6.12 Underground Electrical

1.6.12.1 Cutting and Splicing Power Cables

Splicing or tapping of energized power cables is not permitted.

1.7 OIL TRANSFER OPERATIONS

All personnel involved in oil transfer operations shall be trained in safe fill and shutdown procedures. Tanker trucks shall have the truck wheels blocked while parked to prevent movement during transfer operations. Oil absorbent and containment material shall be stored in the truck for containment and cleanup of any spills. Before the transfer operation begins, the operator shall measure the tank using a sounding stick or level

stick to ensure the volume available in the tank is greater than the volume to be transferred. The lower-most drain valve and all outlets of the equipment shall be closely examined for leakage and tightened, adjusted, or replaced, if necessary, to prevent leakage. During oil transfer operations, the operator shall monitor the hose connection at all times to ensure the tanks are not over filled.

After transfer operations and before the truck departs, the outlets of the truck and equipment shall be examined to ensure the transfer line is completely drained and disconnected and the outlets are tightened. Signs shall be posted in the oil transfer operation vicinity to warn truck drivers against departing before the transfer lines are completely disconnected. A bucket or drum shall be used for collecting small quantities of oil left in the hose. The residual oil shall be poured into a used oil accumulation drum for recycling.

1.8 DEMOLITION OPERATIONS

Demolition operations shall be conducted to ensure the safe passage of persons to and from facilities occupied and used by the Government and to prevent damage to adjacent buildings, structures, and other facilities. Demolition operations shall be in accordance with OSHA 29 CFR Part 1926.850 through 1926.859.

1.9 PAINTING AND COATING OPERATIONS

The Contractor shall protect all adjacent materials and equipment against damage from spillage, dripping and spatter of coating materials. All building materials and equipment shall be left clean, with all damaged surfaces corrected. Provide "WET PAINT" signs to indicate newly painted surfaces.

The Contractor shall provide adequate ventilation for all interior spaces during application and drying of coatings, to prevent the build-up of toxic or explosive concentrations of solvent vapors.

1.10 FIRE PREVENTION AND PROTECTION

1.10.1 General Requirements

Fire prevention and protection shall be in accordance with NASA-STD-8719.11, "NASA Safety Standard for Fire Protection"

All hot work, (activities which require the use of flame-, heat-, smoke-, or spark-producing tools), as defined in NASA-STD 9719.11, shall have a "Hot Work Permit" issued by the Fire Department. Hot Work will not be permitted until a Hot Work Permit has been issued and posted. Deviations or waivers from this and the following requirements must be presented to the LaRC Fire Chief, in writing, for review and consideration. Only the LaRC Fire Chief can grant deviation or waiver approval.

1.10.2 Welding, Flame Cutting and Melting

All welding and cutting operations including, but not limited to, the use

of acetylene and propane torches, heat guns, grinders, electric arc welders, and activities such as brazing, shall be done in accordance with the publications of the American Welding Society, and the National Fire Protection Association NFPA 51 and NFPA 51B, Chapter 22 of the "Virginia Statewide Fire Prevention Code" (13 VAC-5-51).

1.10.3 Prohibitions

Hot work activities shall not be performed on the following:

- o Combustible walls or ceilings or those containing combustible insulation.
- o Tanks or pipes that have held flammable liquids, (unless they have been thoroughly purged and tested for residual vapors).
- o Pipes or other metal in contact with combustible materials if ignition of material is possible due to conduction.
- o Metal partitions, walls, ceilings, or roofs having a combustible covering.
- o Walls or partitions of combustible sandwich-type panel construction.
- o Automatic sprinkler systems after initial installation of systems have been completed.

1.10.4 Safeguards

- o Contractor shall remove flammable liquids, oily deposits, and combustible materials within 35-feet of the hot work area.
- o Contractor shall cover or shield combustible materials that cannot be removed with flameproof covers, fire resistant guards, or fire resistant curtains.
- o Contractor shall cover cracks in walls, floors, ducts, or other concealed spaces within 35-feet of the hot work area to prevent the passage of sparks or slag to adjacent areas.
- o Prior to beginning hot work, Contractor shall remove combustible materials from the opposite side of walls, partitions, ceilings or roofs.
- o Nearby personnel shall be protected from heat, sparks, and/or slag, through the use of fire resistive screens or shields.

Special precautions, as recommended by the LaRC Fire Chief and approved by the Contracting Officer, shall be taken to avoid unwanted activation of automatic detection or suppression systems due to the use of hot work equipment.

1.10.5 Firewatch

The Contractor shall assign a firewatch for every job involving hot work.

The firewatch personnel shall not have any other collateral duties to distract or occupy them.

The firewatch personnel shall know the location of fire alarm pull stations in the work area and shall have two fully charged, 10-pound, ABC multi-purpose, dry chemical fire extinguishers available at all times. Facility fire extinguishers shall not be used to satisfy this requirement. The firewatch personnel shall be qualified in the proper use of fire extinguishers for controlling or extinguishing incipient fires.

The firewatch personnel shall continuously monitor the work area for any smoldering fires or hot spots during the period the hot work is being conducted, and for a period of 30 minutes following the termination of the hot work operation. The firewatch personnel shall immediately notify other workers if any dangerous conditions develop, and call the LaRC Fire Department, at 911 on Center telephones or 864-2222 on cellular telephones.

1.10.6 Means of Egress

An unobstructed means of egress in accordance with NFPA 101, "Life Safety Code," shall be maintained at all times, for use by construction workers and LaRC employees.

1.10.7 Portable Fire Extinguishers

The suitability, distribution, and maintenance of portable fire extinguishers shall be in accordance with NFPA 10, "Standard for Portable Fire Extinguishers." The Contractor shall provide and maintain at least one 10-pound, multipurpose dry chemical fire extinguisher in a visible location on each floor of the construction area and at each usable stairway, at all times. The Contractor shall provide and maintain two 4-A, 60-B:C rated fire extinguishers within 25 feet of each asphalt (tar) kettle, during the period such kettle is being utilized, and one additional 4-A, 60-B:C fire extinguisher on the roof being covered. Contractor employees shall be instructed in the proper use of extinguishers.

1.10.8 Temporary Heaters

When open-flame heating devices or other temporary heating equipment are used, the Contractor shall obtain a written permit from the Fire Chief for each use.

- o A list of temporary heating equipment, to be used on-site, shall be provided to the LaRC Fire Chief.
- o The temporary heating equipment shall be installed, used, and maintained in accordance with the manufacturer's instructions, including clearance to combustible material, equipment and/or construction areas.
- o Chimney or vent connectors, where required by direct-fired heaters, shall be maintained at least 18-inches from combustibles and shall be installed in accordance with NFPA 211, "Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances."

- o Oil-fired heaters shall be designed and installed with features in accordance with NFPA 31, "Standard for the Installation of Oil-Burning Equipment."
- o Fuel supplies for liquefied petroleum gas-fired heaters shall be in accordance with NFPA 54, "National Fuel Gas Code," and NFPA 58, "Standard for the Storage and Handling of Liquefied Petroleum Gases."
- o Refueling operations shall be conducted in accordance with NFPA 58.
- o Temporary heating equipment, where utilized, shall be monitored for safe operation and maintained by properly trained personnel.
- o All heating equipment approved by the Contracting Officer, shall be provided with safeguards, such that when tilted or tipped over, their power source will be automatically shut off.
- o Temporary burner-type heaters that are in use during other than normal working hours shall have an hourly firewatch provided.
- o Burner-type heaters are not permitted in areas where painting or similar operations may create an explosive atmosphere.

1.10.9 Removal of Combustible Waste Material

The Contractor shall remove accumulations of combustible waste material including, paper/plastic packing and wrappings, scrap lumber, dust, and other construction rubbish from the structure and its immediate vicinity at the end of each work shift or more frequently as necessary for safe operations.

The Contractor shall promptly dispose of materials subject to spontaneous ignition, such as oily waste and rags used with paint, linseed oil or other flammable or combustible liquids. Such materials shall only be placed in noncombustible receptacles with tight-fitting lids that are physically located away from any building or structure.

1.10.10 Disposal of Rubbish

The burning or incineration of rubbish, such as construction debris, brush, or trees is prohibited on LaRC. The Contracting Officer will provide direction as to the appropriate method of disposal.

1.10.11 Flammable and Combustible Liquids

Flammable and combustible liquids shall be stored and handled in accordance with NFPA 30, "Flammable and Combustible Liquids Code."

Open flames and smoking shall not be permitted in flammable and combustible liquid storage areas. Such areas shall be appropriately posted as "NO SMOKING" areas.

Class I and Class II liquids shall be kept in approved safety containers as

defined in CFR 1926.

Class I liquids shall be dispensed only where there are no open flames or other sources of ignition within the possible path of vapor travel.

Bulk storage of flammable liquids is prohibited unless the LaRC Fire Chief or designee has granted prior approval.

1.10.12 Smoking

Smoking shall only be permitted in areas designated by the LaRC Fire Chief or designee. The Contractor shall provide receptacles of non-combustible construction designed for collection of waste smoking material.

1.10.13 Non-Emergency Use of Fire Hydrants

Requests for the non-emergency use of fire hydrants shall be made to the LaRC Fire Chief or designee prior to use. Requests may be approved with the following restrictions:

- o The hydrant user shall install one valve on the 4-1/2-inch port on each hydrant to be used. (This 4-1/2-inch port with the valve installed is reserved for LaRC Fire Department use only.)
- o One or both of the 2-1/2-inch fire hydrant ports shall be reserved for non-emergency use. The hydrant user shall provide an approved 2-1/2-inch gate valve on one or both of the 2-1/2-inch fire hydrant ports, reduced down to 1-1/2-inches.

1.10.14 Fire Department Access

Main access roadways shall not be obstructed in any manner.

The Contractor shall provide unobstructed access from the street to fire hydrants and to outside connections for standpipes, sprinklers, or other fire extinguishing equipment, whether permanent or temporary, shall be provided and maintained at all times.

Unobstructed access to the main fire alarm control panel, permanent, temporary, or portable first-aid fire equipment shall be provided and maintained at all times.

1.11 USE OF EXPLOSIVES

The use of explosives is not permitted.

1.12 FALL PROTECTION (OSHA 29 CFR PART 1926.500 THROUGH 1926.503)

Fall protection devices and systems shall be in accordance with OSHA 29 CFR Part 1926.500.

The Contractor shall provide fall protection devices and systems for employees in accordance with OSHA 29 CFR Part 1926.501, when working at a height greater than 6 feet.

Body belts are not acceptable as part of a personal fall arrest system. Personnel shall use a full body harness with shock absorbing lanyard.

1.13 LIFTING OPERATIONS

1.13.1 General

Only capable and experienced riggers and equipment operators shall be engaged in on-site lifting operations. In establishing the qualification of such riggers and equipment operators, it is essential that such personnel be knowledgeable about and capable of: determining center of gravity (C.G.) of items to be lifted; determining load weights; calculating lifting line strengths and the margins of safety; calculating sling tension loads; using common slings and hitches; selecting proper sizes and the use of chocks; using hydra-sets; using proof loading specifications; use of hand signals; using and determining strength of knots; using and determining strength of shackles/hooks; and the factors causing distortion of loads (blocking). Personnel involved in these operations shall have at least four years experience in such efforts.

Certification Letter for Operators of Non-Government Owned Lifting Equipment

The Contractor shall provide a certification letter to the Contracting Officer listing all qualified riggers and equipment operators who will be working on-site stating; (1) their years of experience, (2) specialized training, and (3) medical qualifications, (i.e., any visual, hearing, or other physical limitations). This letter shall be submitted to the Contracting Officer prior to on-site lifting operations.

If lifting operations are being conducted in an unskillful manner, the Contracting Officer may, in accordance with FAR Clause 52.236-5, Material and Workmanship, require the Contractor to remove any employee failing to follow appropriate procedures.

1.13.2 Lifting Devices

All Contractor-furnished lifting devices used on-site shall meet the minimum requirements of the applicable ANSI specifications incorporated in OSHA 29 CFR Part 1910, Occupational Safety and Health Standards, Subpart N, Materials Handling and Storage, and OSHA 29 CFR 1926, Safety and Health Regulations for Construction, Subpart N, Cranes, Derricks, Hoists, Elevators, and Conveyors.

All mobile/truck-mounted cranes must have a current annual inspection and "Certification of Load Test". The Certification must be kept on the crane and be made available for inspection by the NASA Inspector or the Safety and Facility Assurance Office Representative upon request. The Safety and Facility Assurance Office shall be notified prior to any mobile/truck mounted crane being brought onto LaRC, at 864-5594 or 864-7233.

The Contracting Officer may inspect at any time, any or all of the Contractor-furnished lifting devices used on-site. If any of the devices do not meet the above requirements, they will be barred from further use until all necessary repairs have been made and they have been reinspected.

Where cranes and derricks are used in or around high-voltage substations, overhead lines, or exposed energized parts, the operations and equipment shall be in accordance with OSHA Subpart N, Paragraph 1926.550, "Cranes and Derricks."

All lifting equipment shall be effectively grounded when being moved or operated in proximity to energized lines or equipment. Consideration shall also be given to grounding the load, particularly if insulated lifting straps are in use.

Lifting equipment shall be operated with a dedicated observer to warn the equipment operator of potentially hazardous situations and/or movements.

1.13.3 Guidelines for Proper Use of A-Frame Type Lifting Devices

A-frames with spreader beams shall be positioned directly over the object to be lifted with the lifting line vertical, the hoist-to-object attachment vertical, or the sling vertical.

Lifts shall be performed through the center of gravity of the object to be lifted or lateral movement restraints shall be imposed to maintain the lifting line vertical.

If the lifted object is to be transported by the A-frame, the center of gravity of the object shall be as low as practical and lateral restraints imposed to maintain the lifting line vertical during transport.

At no time during the use of A-frames shall the lifting line be allowed to get outside of the A-frame base dimensions.

- o A-frames shall be marked with their load capacity rating.
- o A-frames shall be constrained to a 2.5 to 1 height-to-base ratio, to allow the lifting line to be approximately 11 degrees from vertical before an unsafe condition could occur.
- o A-frame base support devices shall be provided for A-frames with wheels, to preclude overturn due to the loss of a wheel when lifting its rated load.

1.14 ACCIDENTS AND SAFETY RELATED INCIDENTS

1.14.1 Emergency Response and First Aid Facilities

Contractor employees working onsite may use the Occupational Medical Center for emergency first aid. This facility is located in Building 1149 at 10 West Taylor Street and is open 7:00 a.m. to 3:30 p.m., Monday through Friday. The telephone number is 864-3196.

To facilitate the rapid notification of emergency responders in the event of a fire, injury or other hazardous conditions, it is recommended the Contractor have a telephone available at the job site.

Emergency response may be obtained by dialing 911 from any Center telephone or by dialing 864-2222 from cellular telephones.

The Contractor shall assure that its personnel are aware of these emergency first aid and emergency response services and shall post the above information conspicuously at the job site.

Accidents shall be reported to the Safety and Facility Assurance Office at 864-7233 as soon as possible. A written report of the accident shall be filed with the Safety and Facility Assurance Office within 3 working days after the accident.

1.14.2 Accident Reporting

All near miss/close call accidents occurring on the Center involving NASA property or equipment, shall immediately be reported to the Safety and Facility Assurance Office at 864-7233.

A near miss/close call accident is defined as a work-related accident that could have caused an injury or property/equipment damage.

1.15 DISPOSAL OF HAZARDOUS WASTE MATERIAL

Disposal of hazardous waste shall be conducted in accordance with RCRA and Federal regulations, State regulations (9 VAC-20-60), and LAPG 8800.1, Chapter 5 (Environmental Program Manual). The Government will be responsible for disposal of all hazardous/regulated waste. Any waste generated by the Contractor at the construction site shall be reported to the Contracting Officer to determine if the waste is regulated or hazardous. The Contractor shall not generate hazardous/regulated waste until it has received written approval and been informed of all applicable regulations concerning the waste generated, by the Environmental Management Office (EMO). The Contractor will be audited by the Environmental Management Office to assure that all RCRA regulations and proper hazardous waste practices are being followed. Contractor shall take appropriate actions to assure compliance with all Hazardous Waste regulations. The Contracting Officer shall be advised of all waste disposal practices at the construction site and will be the liaison between EMO and the Contractor.

Disposal of hazardous waste into the storm or sanitary sewer is prohibited at all times. Disposal of non-hazardous wastes into sewer systems is authorized only after approval by the Contracting Officer. A permit issued by EMO is required before these waste practices can be permitted. The permit form is Attachment 2 to this section.

1.16 PERSONAL PROTECTIVE EQUIPMENT

Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in accordance with OSHA 29 CFR Part 1926, Safety and Health Regulations for Construction, Subpart E, Personal Protective and Life Saving Equipment, wherever it is necessary by reason of hazards, processes, environment, chemical hazards, radiological hazards, or mechanical irritants encountered

in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

1.17 SIGNS, SIGNALS AND BARRICADES

1.17.1 Accident Prevention Signs

Contractor shall place signs at locations where hazards exist, as described below. These signs shall be visible at all times when work is being performed and shall be removed or covered promptly when the hazard(s) no longer exists. (OSHA 29 CFR Part 1926.200)

Danger signs shall be used where an immediate hazard exists. Caution signs shall be used to warn against potential hazards or to caution against unsafe practices.

Safety instruction signs shall be used to identify safety requirements relating to the work (e.g., Hard Hats Area, Eye and Hearing Protection Required). Contractor shall post construction areas with legible traffic signs at points of hazard. All traffic control signs or devices used for protection of construction workmen shall conform to AASHTO D-MUTCD-3, Manual for Uniform Traffic Control Devices.

1.17.2 Signaling

When operations are such that signs, signals, and barricades do not provide the necessary protection on or adjacent to a roadway, flagmen or another appropriate traffic control shall be provided. Signaling directions by flagmen shall conform to AASHTO D-MUTCD-3, Manual for Uniform Traffic Control Devices.

1.17.3 Barricades

Barricades shall be used to deter the passage of persons or vehicles from a hazard, such as openings in walls, floors and roof edges. Barricades shall conform to the portions of AASHTO D-MUTCD-3, Manual for Uniform Traffic Control Devices, relating to barricades. (OSHA 29 CFR Part 1926.202)

1.18 HAND AND POWER TOOLS

All hand and power tools and similar equipment shall be maintained in a safe condition. When power operated tools are designed to accommodate guards, they shall be equipped with such guards when in use. (OSHA 29 CFR Part 1926.300)

Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded if such parts are exposed to contact by employees or otherwise create a hazard. Guarding shall meet the requirements as set forth in ASME B15.1, Safety Standard for Mechanical Power Transmission.

1.19 SCAFFOLDING

All scaffolding activities shall be in accordance with OSHA

29 CFR Part 1926.451.

1.19.1 Aerial Lifts

Aerial lifts acquired for use on or after January 22, 1973 shall be designed and constructed in accordance with the applicable requirements of the American National Standards, ANSI/SIA A92.2-2002, for "Vehicle Mounted Elevating and Rotating Work Platforms." Aerial lifts acquired before January 22, 1973 which do not meet the requirements of ANSI/SIA A92.2-2002, may not be used, unless they have been modified to conform to the applicable design and construction requirements of ANSI/SIA A92.2-2002. A fall arrest system shall be used in accordance with OSHA 29 CFR Part 1910.66(j).

All aerial lifts shall be in accordance with OSHA 29 CFR Part 1926.453.

1.20 STEEL ERECTION

All steel erection activities shall be in accordance with OSHA 29 CFR Part 1926.750 through 1926.752.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

REPLACE 750 KVA UNIT SUBSTATION - B1208

Safety Program Guide
Items That Must Be Addressed
(Unless Totally Inapplicable) On All Safety Plans

Contract Identification - Job title and contract number and a brief summary and scope of the work. The safety representative shall be identified.

Policy - Provide Company's safety policy statement with the plan. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Goals and Objectives - Describe specific goals and objects to be met. Describe the contractor's approach (including milestone schedule) to achieve and maintain level 5 of the NASA Performance Evaluation Profile in all areas. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Management Leadership - Describe management's procedures for implementing its commitment to safety and health through visible management activities and initiatives including a commitment to the exercise of management control to ensure work place safety and health. Describe processes and procedures for making this visible in all contract and subcontract activities and products. Include a statement from the project manager or designated safety official indicating that the plan will be implemented as approved and that the project manager will take personal responsibility for its implementation. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Employee Involvement - Describe procedures to promote and implement employee (e.g., non-supervisory) involvement in safety and health program development, implementation, and decision-making. Describe the scope and breadth of employee participation to be achieved so that approximate safety and health risk areas of the contract are equitably represented. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Assignment of Responsibility - Describe line and staff responsibilities for safety and health program implementation. Identify any other personnel or organization that provides safety services or exercises any form of control or assurance in these areas. State the means of communication and interface concerning related issues used by line, staff, and others (such as documentation, concurrence requirements, committee structure, sharing of the work site with NASA and other contractors, or other special responsibilities and support). As a minimum, the contractor will identify the following, as required per Appendix H of NPG 8715.3, "NASA Safety Manual":

- a. Safety Representative - Identify by title the individual who will be responsible for the contractor's adherence to Center-wide safety, health, environmental and fire protection concerns and goals, and who will participate in meetings and other activities related to the Center's safety and Health program.
- b. Company Physician - The contractor shall identify their company physician, including name, address and telephone number.

Notice of Violations - The prime contractor shall respond to any Notice of Violation (NOV) issued to them or their subcontractors within 3 working days

REPLACE 750 KVA UNIT SUBSTATION - B1208

from issuance. This response shall be provided to the issuer of the NOV.

SECTION 01060 - ATTACHMENT 1, PAGE 1

REPLACE 750 KVA UNIT SUBSTATION - B1208

Accountability - Describe procedures for ensuring that management and employees will be held accountable for implementing their tasks in a safe and healthful manner. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Voluntary Protection Program (VPP) - The contractor shall explain their approach to comply with the elements of the VPP while working on LaRC, which is a designated VPP Star site. This approach shall include, but is not limited to logs, records, minutes, procedures, checklists, statistics, reports, analyses, notes, or other written or electronic documentation that contains in whole or in part any subject matter pertinent to safety, health, environmental protection, or emergency preparedness. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Workplace Analysis - Describe the method by which hazards, within the contractor's workplace, shall be systematically identified. The identified method shall explain the information collection process through a combination of survey analyses, inspections of the workplace, investigations of mishaps and close calls, and the collection and trend analysis of safety and health data such as: records of occupational injuries and illnesses; reports of spills and inadvertent releases to the environment, facility related incidents, employee reports of hazards, etc. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Hazard Identification - Describe the procedures and techniques to be used to compile an inventory of hazards associated with the work to be performed on the contract. This inventory of hazards shall address the work specified in the contract, as well as, operations and work environments, which are performed in the vicinity or in close proximity to contract operations.

(Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Employee Reports of Hazards - Identification of methods to encourage employee reports of hazardous conditions (e.g., close calls) and analyze/abate hazards. The contractor shall describe steps it will take to create reprisal-free employee reporting with emphasis on management support for employees and describe methods to be used to incorporate employee insights into hazard abatement and motivation/awareness activities. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Inspections - The contract shall include requirements for assignments, procedures and frequency for regular inspections and evaluation of work areas for hazards and accountability for implementation of corrective measures. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Accident Reporting - All serious accidents shall be reported (as soon as possible) to the Safety and Facility Assurance Office at 864-7233. A written report of the accident shall be filed with the Safety and Facility Assurance Office within 3 working days after the accident. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Recordkeeping - The Contractor shall maintain the appropriate records concerning accidents and injuries, in accordance with OSHA 29 CFR 1904.

REPLACE 750 KVA UNIT SUBSTATION - B1208

(Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

SECTION 01060 - ATTACHMENT 1, PAGE 2

REPLACE 750 KVA UNIT SUBSTATION - B1208

Mishap Investigation - Identification of methods to assure the reporting and investigation of mishaps including corrective actions implemented to prevent recurrence. The contractor shall describe the methods to be used to report and investigate mishaps on NASA property and on contractor or third party property. The contractor shall discuss its procedures for immediate notification requirements for fires, hazardous materials spills and releases and other emergencies. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Hazard Prevention and Control - Describe approach to identify, control and/or eliminate hazards in the work place. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Hazardous Operations - Identify hazardous operations to be performed and written procedures developed to ensure the safety and health of employees while performing them. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Flammable Liquid Storage Containers - Flammable liquids shall only be stored in "approved" flammable liquid safety cans that have self-closing spouts.

NASA LaRC Lockout/Tagout System - All contractors/subcontractors shall comply with the NASA LaRC Lockout/Tagout system when performing work on-site, as described in LAPG 1910.10, "Safety Clearance Procedures (Lockout/Tagout). Under no circumstances shall a NASA LaRC Lockout/Tagout device be violated.

Safety Regulations - In addition to OSHA and Federal Regulations, the Contractor shall adhere to all applicable State, Local and Langley Research Center Safety Regulations. (Required per Appendix H of NPG 8715.3, "NASA Safety Manual.")

Confined Space Entry - Confined spaces shall not be entered until a Confined Space Entry Permit has been obtained. The Contractor shall have personnel trained in confined space entry, shall provide the permit and conduct initial and hourly readings as required by OSHA 29 CFR 1910.146.

Crane Certification - All mobile/truck-mounted cranes shall have a current "Annual Certification of Load Test". The Certification shall be kept on the crane and be made available for inspection by the NASA Inspector or the Safety and Facility Assurance Office Representative upon request. The Safety and Facility Assurance Office shall be notified immediately when any mobile/truck mounted crane is brought onto the Center, at 864-5594 or 864-7233.

Scaffolding - When scaffolding is required, it shall be designed, constructed and assembled in accordance with OSHA 29 CFR 1926.450 through 454.

Excavations and Trenching - Surface penetrations of 6 inches or more require a "Digging Permit" and shall follow all applicable standards under OSHA 1926.650-652.

Material Safety Data Sheets (MSDS) - A MSDS shall be available for each chemical, oil, lubricant, solvent, etc., used on the job-site. (Required per

REPLACE 750 KVA UNIT SUBSTATION - B1208

Appendix H of NPG 8715.3, "NASA Safety Manual.")

SECTION 01060 - ATTACHMENT 1, PAGE 3

REPLACE 750 KVA UNIT SUBSTATION - B1208

Fall Protection - When fall protection is required, the Contractor shall comply with OSHA 29 CFR 1926.500 through 1926.503, which defines the types of fall protection devices and systems. Personnel shall use a full body harness with shock absorbing lanyard.

Extension Cords and Ground Fault Protection - All extension cords shall be the three wire grounded type and be in good working order (No broken or missing pins). Extension cords or other temporary wiring shall be protected by a Ground Fault Interrupt (GFI) device.

Subcontractor Compliance - All subcontractors shall comply with the Prime Contractor's Safety Plan.

Safety Meetings - The Contractor shall hold weekly safety meetings.

Hazardous Communications Program - The Contractor shall furnish a copy of his hazardous communications program as defined in CFR 29 Part 1910.1200.

Floors, Openings, Etc. - Unprotected openings in walls, floors or roof edges shall be guarded using standard handrails, barricades, or equivalent protection.

Steel Erection - When steel erection is required, it shall be performed in accordance with OSHA 29 CFR 1926.750 through 1926.752.

Personal Protective Equipment - When required, the appropriate PPE shall be used in accordance with OSHA 29 CFR 1926 Subpart E.

Hot Work Permit - Hot Work will not be permitted until a Hot Work Permit has been issued by the Fire Department, approved and posted. Deviations or waivers from this and must be presented to the LaRC Fire Chief, in writing, for review and consideration. Only the LaRC Fire Chief can grant deviation or waiver approval.

Appendix H, NPG 8715.3, "NASA Safety Manual" may be viewed at:
http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_8715_0003_&page_name=AppendixH

REPLACE 750 KVA UNIT SUBSTATION - B1208

SECTION 01060 - ATTACHMENT 1, PAGE 4

REPLACE 750 KVA UNIT SUBSTATION - B1208

SEWER DISPOSAL PERMIT

PART ONE (TO BE COMPLETED BY REQUESTOR)

- 1. Name of material_____
- 2. Quantity_____
- 3. Date(s) of proposed disposal_____
- 4. Analytical Data: MSDS___ Laboratory Analysis___ Attached___ (Check at least one)
- 5. Sanitary Sewer_____ Storm Sewer_____
- 6. Signature of Requestor_____
- 7. Organization_____
- 8. Date_____

PART TWO (TO BE COMPLETED BY THE ENVIRONMENTAL MANAGEMENT OFFICE)

Authorization for disposal of the material described above is granted. Any deviation invalidates this permit.

Environmental Management Office

Date

REPLACE 750 KVA UNIT SUBSTATION - B1208

SECTION 01060, ATTACHMENT 2

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

1.2 SUBMITTAL PREPARATION AND CONTENT

1.2.1 Technical Submittals

1.2.2 General

1.2.3 Calculations, Drawings, Data, and Other Contractor Submittals

1.2.3.1 Calculations and Drawings

1.2.4 Submittal Descriptions (SD)

1.3 MARKING

1.4 SAMPLES

1.5 SUBMITTAL REQUIREMENTS

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

This section defines and explains the general submittal requirements applicable to all submittals under this contract. Specific submittals required are set forth by the various administrative or technical sections of this specification, the contract drawings, or other portions of this contract. Accordingly, the Contractor shall make timely and complete submittals as required by all applicable contract provisions.

The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 SUBMITTAL PREPARATION AND CONTENT

1.2.1 Technical Submittals

All technical submittals, for action of the Contracting Officer, shall be submitted on the Langley Technical Submittal Form (see Attachment 1). The actual transmittal form for this project will be transmitted to the Contractor at the time of Notice to Proceed.

The technical submittal form shall serve as the Contractor's cover sheet and also the Government's approval/review sheet back to the Contractor.

The Contractor shall submit one technical submittal form cover sheet for each package of submittals.

Technical submittals shall be grouped by specification section, limited to eight (8) submittals per cover sheet from one specific specification section.

The Contractor shall complete the item number, specification section and paragraph number, SD number and description for each item submitted.

The Contractor shall note any specification deviation included in the submittal package.

1.2.2 General

All submittals shall be in the English language.

Submittals become the property of the Government. The Government reserves the right to duplicate, use, and disclose, in any manner and for any purpose, shop drawings delivered under this contract. Wording such as

"Confidential", "Do not reproduce", and similar statements shall not be included on the submittals. Submittals that prohibit duplication will be returned to the Contractor for correction and resubmitting. Refer to FAR 52.236-21, Performance of Work by the Contractor, for additional information.

The Contractor shall specifically point out variations of submittal items from contract requirements in transmittal letters. Failure to point out deviations may result in the Contracting Officer requiring rejection and removal of such work at no additional cost to the Government.

The Contractor shall allow 30 calendar days for review of submittals. If the Contractor deems a submittal critical or urgent (e.g., to order long lead-time items; enter into firm subcontracts or supplier purchase orders), it shall so state on the letter or form transmitting such submittal and shall indicate its priority for the items submitted.

The Contracting Officer will, after receipt of submittals, return one copy to the Contractor marked "Reviewed", "Approved," "Approved with corrections as noted," "Reviewed with corrections as noted," or "Returned for corrections," which shall be interpreted as follows:

Submittals marked "Reviewed" authorize the Contractor to proceed with the work covered by such submittals.

Submittals marked "Approved" authorize the Contractor to proceed with the work covered by such submittals.

Submittals marked "Approved with corrections as noted" or "Reviewed with corrections as noted," authorize the Contractor to proceed with the work covered by such submittals in accordance with the corrections indicated thereon. The Contractor shall make the corrections to the submittals and resubmit them to the Contracting Officer within fifteen calendar days after receipt of the marked submittals.

Submittals marked "Returned for correction" require the Contractor to make the necessary corrections and revisions to the submittals and to resubmit them for approval by the Contracting Officer.

Where the submittal is for Information, the Government may indicate recommended corrections, or take no action, at its discretion. The Contractor may proceed with the work without response from the Government.

Government review or approval does not relieve the Contractor of responsibility for the accuracy and correctness of submittal data furnished or for compliance of the submittal's subject items with all applicable contract requirements.

Where review of the submittals is indicated, the Contracting Officer will notify the Contractor of any recommended corrections within 30 calendar days after receipt. If the Government takes no action within 30 calendar days, the Contractor may assume Government acceptance and proceed with the work.

Where approval of submittals concerning materials, drawings, or other submittals is required prior to work execution, the Contractor shall not proceed with the affected work until such approval is received from the Contracting Officer. Government action will be taken within 30 calendar days.

Partial Submittals will not be accepted for expediency of the contract's completion.

1.2.3 Calculations, Drawings, Data, and Other Contractor Submittals

The Contractor shall collect required data submittals for each specific material, product, unit of work, or system shall be collected into a single submittal and marked for choices, options, and portions applicable to the submittal. Marking of each copy of product data submitted shall be identical.

1.2.3.1 Calculations and Drawings

As required by these specifications, the Contractor shall prepare all calculations and/or drawings to fabricate, assemble and install all parts of the work, in such detail that will enable the Contracting Officer to understand and check conformity with the contract specifications.

The Contractor shall collect copies of the calculations and computations shall be submitted in booklet form, arranged to show electrical, mechanical, and structural/architectural divisions.

When action on submittals is taken by the Contracting Officer, each copy of drawings/calculations will be identified as having received such action by being so stamped and dated. The Contractor shall make any corrections required by the Contracting Officer. If the Contractor considers any correction indicated to constitute a change to the contractual requirements, it shall promptly notify the Contracting Officer and shall not proceed with the work covered thereby until directed to do so. The approval of the drawings by the Contracting Officer shall not be construed as a complete check, but will indicate only that the general method of construction and detailing is satisfactory. The Contractor shall be responsible for the dimensions and design of adequate connections, and details, and satisfactory construction of all work.

The drawings shall be made by such methods and be of such quality of workmanship to permit the making of legible reproductions and revisions without impairing their usefulness. Drafting standards employed shall permit reducing the drawing to a 35mm negative from which a full size enlarged print can be reproduced without loss of resolution of the information contained thereon. The drawing shall be made on white bond paper, not less than 8-1/2 by 11 inches in size, not larger than 22 by 34 inches in size, except for full size patterns or templates. Shop drawings shall be prepared in accurate size, with scale indicated, except where other form is required. A responsible representative of the Contractor shall sign all drawings.

Drawing reproducibles shall be suitable for microfilming and reproduction

and shall be of a quality to produce clear, distinct lines and letters. Drawings shall have dark lines on a white background.

Copies of each drawing shall have the following information clearly marked thereon:

- a. The job name, which shall be the general title of the contract drawings.
- b. The date of the drawings and revisions.
- c. Name of Contractor.
- d. Name of Subcontractor and/or manufacturer.
- e. The name of the item, material, or equipment detailed thereon.
- f. The number of the submittal (e.g., first submittal) in a uniform location adjacent to the title block.

The Contractor shall submit drawings in a sequence that will permit the work to proceed in an orderly manner consistent with the sequence of events as scheduled on the Contractor's scheduling technique required by this contract.

1.2.4 Submittal Descriptions (SD)

Submittal Description (SD): These are drawings, diagrams, layouts, schematics, catalog cuts, descriptive literature, illustrations, schedules, performance and test data, and similar materials to be furnished by the Contractor explaining in detail specific portions of the contractually required work.

The following items are descriptions of data to be submitted for the project. The requirements to actually furnish the applicable items will be called out in each specification section.

SD-01 Data

General:

Submittals which provide calculations, descriptions, or other documentation regarding the work.

Manufacturer's Catalog Data:

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

Manufacturer's Standard Color Charts:

Printed illustrations displaying choices of color and finish for a material or product.

Design Data:

Design calculations, mix design analyses, or other data pertaining to a part of the work.

Recertification Status Sheets:

Tabular summary of component data including: end connections, manufacturer, description, material, installation date, allowable working pressure, and code compliance.

SD-04 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, detail of fabrications, layout of particular elements, connections, and other relational aspects of the work. Drawings may include the types of graphically depicted information discussed below.

Original shop drawings including Connection Diagrams, Elementary Diagrams, Interconnection Diagrams and Schematics shall be created using the current or immediately previous release of AutoCAD. Drawings shall be on 22-inch x 34-inch white bond paper with standard Langley Research Center title blocks. The diagrams shall be coordinated with the wiring diagrams of the equipment furnished under sections of Division 16. Prior to final payment on this contract, the "as-built" original tracings of the control diagrams, including electronic files in AutoCAD format, shall be forwarded to Langley Research Center for retention.

Connection Diagrams

Connection diagrams shall indicate the relations and connections of devices and apparatus. They shall show the general physical layout of all controls, the interconnection of one system, or portion of system, with another, and all internal tubing, wiring, and other devices.

Control Diagrams

Control diagrams shall show the physical and functional relationship of equipment. Electrical diagrams shall show size, type, and capacity of the systems. Pneumatic diagrams shall be furnished where air or gas systems are used.

Elementary Diagrams

Elementary diagrams shall indicate, in straight-line form, without regard for physical relationship, all supporting systems and elements of equipment and associated apparatus.

Interconnection Diagrams

Interconnection diagrams shall indicate, to scale, interface between associated units of equipment and between equipment and systems.

Schematics

Schematic drawings shall depict the functional flow of systems and their interfaces with facilities and other systems. Functional and physical interfaces shall be indicated. Schematics need not be to scale. Schematics may be structural, mechanical, electrical, or a combination of these.

Fabrication/Erection/Installation Drawings

Fabrication, erection, installation, and checkout drawings and specifications shall indicate equipment arrangement, with elevations, sections, and enlarged details. Details shall indicate proper methods of fabrication, construction, and installation.

As-Built Drawings

As-built drawings shall provide current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible.

Pressure Systems Drawings:

Pressure systems drawings shall be an isometric depiction of the pressure piping system as installed. The drawing shall include all system components, each uniquely numbered, including supports and all other specific elements which represent the as-built configuration. Component numbering shall be continuous throughout the system.

SD-06 Instructions

Preprinted material describing installation of a product, system, or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-08 Statements

A document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other subcontractor, to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications, or other verification of quality. This shall include plans or other documentation to ensure compliance with local, state, and federal safety laws and regulations.

SD-09 Reports

General:

Reports of inspections and/or laboratory tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

Test Reports:

A report signed by an authorized official of a testing laboratory that a material, product, or system identical to the material, product, or system to be provided has been tested in accordance with requirements specified by naming the test method and material. The test report must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. Testing must have been within 3 years of the date of award of this contract.

Factory Test Report:

A written report which includes the findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for this project before it is shipped to the job site. The report must be signed by an authorized official of the manufacturer or an independent testing laboratory and must state the test results. The report shall also indicate whether the material, product, or system has passed or failed the test. These reports shall be subject to approval of the Contracting Officer, unless otherwise specified herein, before delivery of the materials or equipment. This approval shall not relieve the Contractor of the obligation to meet all the requirements of the contract.

Field Test Report:

A written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report shall be signed by an authorized official of a testing laboratory or agency, must state the test results, and indicate whether the material, product, or system has passed or failed the test.

SD-13 Certificates

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system or material meets specified requirements. The statements must be dated after award of contract, name the project, and list the specific requirements.

SD-18 Records

Documentation required for contract administration.

SD-19 Operation and Maintenance Manuals

The technical specifications identify requirements for operation, maintenance instructions, and parts, and describe specific testing requirements for certain items of equipment and/or systems. Where such requirements exist, the Contractor shall furnish commercially available standard operation and maintenance data, including operating instructions, maintenance instructions and parts listings. Testing procedures shall be

REPLACE 750 KVA UNIT SUBSTATION - B1208

furnished as required to demonstrate full compliance with the technical provisions. Detailed requirements for these items follow.

Information required for the preparation of Operation and Maintenance Manuals (O & M) may be furnished in the form of manufacturers' standard brochures, schematics, and other printed instructions. Data shall include as a minimum the following items:

Recommended procedures and frequencies for preventive maintenance, inspection, adjustment, lubrication, and cleaning.

Special tools and equipment required for testing and maintenance.

Parts lists reflecting the true manufacturer's name, part number, and nomenclature.

Recommended spares by part number and nomenclature and spare stocking levels.

Integrated mechanical and electrical system schematics and diagrams to permit operation and troubleshooting after acceptance of the system.

Troubleshooting, checkout, repair, and replacement procurement procedures.

Operating instructions including start-up and shut-down procedures.

Safety considerations including load limits, speed, temperature, and pressure.

Four copies of the above data shall be submitted 30 calendar days prior to onsite delivery, and shall be updated and submitted for final approval not later than 30 calendar days prior to contract completion. Test data shall be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear and legible. Pages for vendor data and/or the manuals shall be bound in three-ring, loose leaf binders and have 3/8-inch holes. Data shall be organized by separate index and tabbed sheets. Caution and warning indications shall be clear and well labeled.

1.3 MARKING

Marking shall be provided for each submittal to identify it by contract number, transmittal date, Contractor's, Subcontractor's, and supplier's name, address(es) and telephone number(s), submittal name; specification section and paragraph reference, drawing reference, and similar information to distinguish it from other submittals and to identify its contractual requirement source(s).

1.4 SAMPLES

As required by the various sections of these specifications, the Contractor shall furnish samples. Materials or equipment requiring sample approval shall not be delivered to the site or used in the work until approved in

writing by the Contracting Officer.

Samples shall conform to requirements listed below:

Samples shall be marked to show the name of the material, trade name of manufacturer, place of origin, contract number, name and location of the project where the material represented by the sample is to be used, and the name of the contractor submitting the sample.

Samples shall be accompanied by a letter to the Contracting Officer. This letter shall be addressed as stated in the paragraph entitled, "Addressing Correspondence" of Section 01011, and shall include descriptive literature, and reference the provisions of the specification or drawings requiring use of the material.

Samples not subjected to destructive tests may be retained until completion of the work, but thereafter will be returned to the Contractor if it so requests in writing, at its own expense. If no request for return of samples is made prior to contract completion, the samples shall become the property of the Government.

Samples shall be physically identical with the proposed material or product to be incorporated in the work, fully fabricated and finished in the specified manner, and full scale. Where variations in color, finish, pattern, or texture are inherent in the material or product represented by the sample, multiple units of the sample, showing the near-limits of the variations and the "average" of the whole range (not less than 3 units), shall be submitted. Each unit shall be marked to describe its relation to the range of the variation. Where samples are specified for selection of color, finish, pattern, or texture, the full set of available choices shall be submitted for the material or product specified. Sizes and quantities of samples shall represent their respective standard unit.

Before submitting samples, the Contractor shall assure that the materials or equipment will be available in quantities required for the project. Any proposed change or substitution shall be resubmitted and approved prior to use in the project.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. The Contractor shall replace such materials or equipment to meet contract requirements.

1.5 SUBMITTAL REQUIREMENTS

The following submittal summary chart itemizes the general and specific submittal requirements under this contract. The following letter codes designate the Government addressee(s) and Mail Stop(s):

A - Contract Administrator, Mail Stop 126

B - Contracting Officer Technical Representative, (COTR), Mail Stop 465

REPLACE 750 KVA UNIT SUBSTATION - B1208

- C - Safety and Facility Assurance Office, Mail Stop 429
- D - Construction Services Unit, Mail Stop 428
- E - Accounts Payable and Employee Services Branch, Mail Stop 175
- F - Environmental Management Office, Mail Stop 418

The number following the letter code, as shown in the submittal summary chart, specifies the number of copies to be provided, (e.g., B-6). The required number of all submittals shall be delivered prepaid to Langley Research Center, Hampton, Virginia 23681-0001 addressed to the appropriate recipient and Mail Stop number as shown above.

SUBMITTAL SUMMARY

<u>TITLE</u>	<u>FIRST SUBMITTAL</u>	<u>UPDATE</u>	<u>LTR CODE AND DISTRIBUTION</u>	<u>GOVERNMENT ACTION</u>	<u>SECTION</u>
SD-01, Data					
Project Submittal Schedules	**	---	B-6	Approval	01011
Equipment and Performance Data	**	---	B-6	Approval	16003,16286 16366
Manufacturer's Catalog Data	30 Days Before Installation	---	B-6	Approval	1612416286 16366
Single Conductor Non-Shielded Cable	30 Days Before Installation	---	B-6	Approval	16124
SD-04, Drawings					
Connection Diagrams	**	---	B-6	Approval	16366
Control Diagrams	**	---	B-6	Approval	01330
Elementary Diagrams	**	---	B-6	Approval	01330
Schematics	**	---	B-6	Approval	16286,16336
Equipment Room Layout Drawings	**	---	B-6	Approval	16366
Fabrication/Erection/Installation Drawings	30 Days Prior to Installation	---	B-6	Approval	16286,16366
As-Built Drawings	Prior to Contract Completion	---	B-1	Approval	01011
SD-06, Instructions					
Manufacturer's Instructions	**	---	B-6	Review	16366,16286
SD-08, Statements					
Material and	Before	---	B-6	Approval	01011

SUBMITTAL SUMMARY

<u>TITLE</u>	<u>FIRST SUBMITTAL</u>	<u>UPDATE</u>	<u>LTR CODE AND DISTRIBUTION</u>	<u>GOVERNMENT ACTION</u>	<u>SECTION</u>
Equipment Substitutions	Field Use				
Application for Making Connection to Utilities	**	---	B-5, C-1	Approval	01011,01060
List of Products Installed	**	---	B-5, C-1	Approval	16124,16366
Manufacturer's Certification of Qualification Switchgear Representative	**	---	B-5, C-1	Approval	16366
Utility Outage Requests	7 Days Before Desired Outage	---	D-2	Approval	01011,01060
Electrical Worker's Qualifications	Prior to Site Work	---	B-1, C-1	Approval	01011
Expert Installer's Qualifications	Prior to Site Work	---	B-1, C-1	Approval	16366
Safety Plan	Prior to Award	---	A-3	Approval	01060
Application for Work on Energized Circuits	Prior to Work Start	---	B-6	Approval	01060
Electrical Safety Worker's Qualifications	Prior to Work Start	---	B-5, C-1	Approval	01060
Energized Sub-stations Work Plan	**	---	B-6	Approval	01060
List of Riggers	14 Days Before Lifting Ops.	---	B-2, C-1	Approval	01060

SUBMITTAL SUMMARY

<u>TITLE</u>	<u>FIRST SUBMITTAL</u>	<u>UPDATE</u>	<u>LTR CODE AND DISTRIBUTION</u>	<u>GOVERNMENT ACTION</u>	<u>SECTION</u>
PCB Operational Procedures	**	---	B-2, F-1	Approval	01060
PCB Disposal Facility Identification and Qualifications	**	---	B-2, F-1	Approval	01060
PCB-Drained Equipment Certification Compliance	**	---	B-2, F-1	Approval	01060
List of PCB Items	**	---	B-2, F-1	Review	01060
Emergency Spill Plan	**	---	B-2, F-1	Approval	01060
Shipping Document	5 Days Before Removal	---	B-2, F-1	Approval	01060
List of PCB Operators and Qualifications	30 Days Before Work	---	B-2, F-1	Review	01060
Hazardous Waste Disposal Plan	30 Days Prior to Disposal	---	B-2, C-1	Approval	01060
Sewer Disposal Permit	30 Days Before Disposal	---	B-3	Approval	01060
SD-09, Reports					
Factory Test Report	Prior to Installation	---	B-6	Review	16366
Field Test Report	5 Days After Test	---	B-6	Review	16124,16286 16366
SD-13, Certificates					
Certificates of	30 Days	---	B-6	Review	16124,16366

REPLACE 750 KVA UNIT SUBSTATION - B1208

SUBMITTAL SUMMARY

<u>TITLE</u>	<u>FIRST SUBMITTAL</u>	<u>UPDATE</u>	<u>LTR CODE AND DISTRIBUTION</u>	<u>GOVERNMENT ACTION</u>	<u>SECTION</u>
Compliance	Before Installation				
SD-18, Records					
GFP Property Non Conformance Report	As Req'd	---	B-5, A-1	Review	01011
Invoices	Monthly	---	E-2	Approval	01011
Contractor Release Form	At Contract Completion	---	E-1	Review	01011
Price Breakdown for Modification Proposals	14 Days After Change or Proposal Request	---	A-2	Approval	01011
Price Breakdown for Progress Payments	10*	---	A-6	Approval	01011
Order Status Reports	**	---	B-3	Information	01011
Schedule of Construction	30*	---	A-1, B-5	Approval	01011
Monthly Progress Schedules	30* 15th Day of Each Month		A-1, B-5	Review	01011
Monthly Technical Progress Narratives	30* 15th Day of Each Month		A-1, B-5	Review	01011
Certified Payrolls	Weekly	---	D-2	Review	01011
SD-19, Operation and Maintenance Manuals	30 Days Prior to Onsite Const.	30 Days Prior to Contract Completion	B-4	Review	01011,16286 16366

* Calendar days given after date of receipt of Notice to Proceed

REPLACE 750 KVA UNIT SUBSTATION - B1208

** As required by specifying section with updates when significant changes occur

NOTE: Submittal Summary requirements are listed in Calendar Days.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

Technical Submittal Form

Date Received:

TO:

FROM:

Distribution:

Contract No.:

Title:

TO BE COMPLETED BY CONTRACTOR

Submittal

New

Previous

Submittal Number:

Previous Submittal Number:

Item #	Specification Section Para No./Dwg. No.	SD No.	Description of Material (Include Type, Model No., Catalog No., Mfg., Etc.)	Action Code	Initials

Contractor Representative:

Signature:

Date:

Government Action Codes:

A-Approved;

AC-Approved with corrections as noted;

R-Returned for corrections;

RE-Reviewed;

RC-Reviewed with comment

FOR GOVERNMENT USE ONLY

To Reviewer:

M/S:

To Reviewer:

From Reviewer:

Date:

Date:

Comments

Reviewer:

Signature:

Date:

Approval (*Name and Title*):

Signature:

Date:

REPLACE 750 KVA UNIT SUBSTATION - B1208

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

-- End of Section Table of Contents --

SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Reference publications are cited in other sections of the specifications along with identification of their sponsoring organizations. The addresses of the sponsoring organizations are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

444 N. Capital St., NW, Suite 249
Washington, DC 20001
Ph: 800-231-3475
Fax: 800-525-5562
Internet: www.aashto.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

11 West 42nd St
New York, NY 10036
Ph: 212-642-4900
Fax: 212-302-1286
Internet: <http://www.ansi.org/>

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
Ph: 610-832-9500
Fax: 610-832-9555
E-mail: cservice@astm.org

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

22 Law Dr., Box 2300
Fairfield, NJ 07007-2900
Ph: 800-843-2763
Fax: 201-882-1717
Internet: www.asme.org

CODE OF FEDERAL REGULATIONS (CFR)

Order from:
Government Printing Office
Washington, DC 20402

REPLACE 750 KVA UNIT SUBSTATION - B1208

Ph: 202-512-1800
Fax: 202-275-7703
Internet: <http://www.pls.com:8001/his/cfr.html>

FEDERAL SPECIFICATIONS (FS)

Order from:
General Services Administration
Federal Supply Service Bureau
470 L'Enfant Plaza, S.W.
Washington, DC 20407
Ph: 202-619-8925
Fax: 202-619-8978
Internet: <http://pub.fss.gsa.gov/h1-pub.html>

FEDERAL STANDARDS (FED-STD)

Order from:
General Services Administration
Federal Supply Service Bureau
470 E L'Enfant Plaza, S.W.
Washington, DC 20407
Ph: 202-619-8925
Internet: <http://pub.fss.gsa.gov/hi-pub.html>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

445 Hoes Ln, P. O. Box 1331
Piscataway, NJ 08855-1331
Ph: 800-678-4333
Fax: 908-981-9667
Internet: <http://stdsbbs.ieee.org>
E-mail: Stds-maillst@ieee.org
Note: Documents may also be ordered from:
Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112
Ph: 800-854-7179
Fax: 303-397-2740
Internet: global.ihs.com

IRON AND STEEL SOCIETY (ISS)

410 Commonwealth Dr.
Warrendale, PA 15086-7512
Ph: 412-776-1535, ext. 1
Fax: 412-776-0430
E-Mail: custserv@issource.org
Internet: www.issource.org

LANGLEY RESEARCH CENTER (LaRC)

100 Nasa Road
Hampton, VA 23681-2199

REPLACE 750 KVA UNIT SUBSTATION - B1208

Ph: 757-864-1000

MILITARY SPECIFICATIONS (MS)

Order from:
Standardization Documents Order Desk
Building 4, Section D
700 Robbins Ave.
Philadelphia, PA 19111-5094
Ph: 215-697-2179
Fax: 215-697-2978
Internet: www.dodssp.daps.mil

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

Publication(s) Available From
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
Ph: 202-783-3238

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

1300 N. 17th St., Suite 1847
Rosslyn, VA 22209
Ph: 703-841-3200
Fax: 202-457-8473
Internet: <http://www.nema.org/>
Order from:
Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5776
Ph: 800-264-3974
Fax: 303-397-7935
Internet: <http://global.ihs.com>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

One Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
Ph: 800-344-3555
Fax: 800-593-6372
Internet: <http://www.nfpa.org>

UNDERWRITERS LABORATORIES (UL)

333 Pfingsten Rd.
Northbrook, IL 60062-2096
Ph: 800-704-4050
Fax: 847-509-6249
Internet: <http://www.ul.com/>
Order from:

REPLACE 750 KVA UNIT SUBSTATION - B1208

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5776
Ph: 800-569-7128
Fax: 303-397-7945
Internet: <http://global.ihs.com>
E-mail: global@ihs.com

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16003

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS
- 1.4 CODES AND STANDARDS
- 1.5 COORDINATION
- 1.6 APPROVAL REQUIREMENTS
- 1.7 PREVENTION OF CORROSION

PART 2 PRODUCTS

- 2.1 IDENTIFICATION PLATES
- 2.2 WARNING SIGNS
- 2.3 ANCHOR BOLTS
- 2.4 PAINTING
- 2.5 INSTALLED EQUIPMENT DATA SHEETS

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 PAINTING APPLICATION
- 3.3 IDENTIFICATION PLATE INSTALLATION
- 3.4 CUTTING AND PATCHING
- 3.5 DAMAGE TO WORK
- 3.6 CLEANING
- 3.7 FIELD TESTING AND TEST EQUIPMENT

-- End of Section Table of Contents --

SECTION 16003

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

FEDERAL SPECIFICATIONS (FS)

FS W-J-800 (Rev F) Junction Box: Extension, Junction Box; Cover, Junction Box (Steel, Cadmium, or Zinc-Coated)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

MILITARY SPECIFICATIONS (MS)

MS MIL-T-704 (Rev K) Treatment and Painting of Material

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA Z 535 (1991) Safety Color Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL-05 (1997) Electrical Construction Materials Directory

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals", in sufficient detail to show full compliance with the specification:

SD-01 Data

Submit Installed Equipment Data Sheets in accordance with Paragraph 2.5, "Installed Equipment Data Sheets".

1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

REPLACE 750 KVA UNIT SUBSTATION - B1208

It is the intent of these specifications and the contract drawings to provide a complete and workable facility.

Design drawings are diagrammatic and do not show all offsets, bends, elbows, or other specific elements that may be required for proper installation of the work. Such work shall be verified at the site. Additional bends and offsets, and conduit as required by vertical and horizontal equipment locations or other job conditions, shall be provided to complete the work at no additional cost to the Government.

1.4 CODES AND STANDARDS

Equipment design, fabrication, testing, performance, and installation shall, unless shown or specified otherwise, comply with the applicable requirements of NFPA 70 and IEEE C2 to the extent indicated by the references.

1.5 COORDINATION

Installation of the electrical work shall be coordinated with the work of other trades.

1.6 APPROVAL REQUIREMENTS

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories (UL Inc.), the label of, or listing with re-examination, in UL-05 will be acceptable as sufficient evidence that the items conform to the requirements.

Where materials or equipment are specified to be constructed or tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized standards, a manufacturer's certificate of compliance indicating complete compliance of each item with the applicable NEMA, ANSI, ASTM, or other commercial standards specified will be acceptable as proof of compliance.

1.7 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given a rust-inhibiting treatment prior to painting. Aluminum shall not be used in contact with earth. Dissimilar metals in contact shall be protected by approved fittings, barrier material, and treatment. Ferrous metals such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123 for exterior locations and cadmium-plated in conformance with FS W-J-800 for interior locations.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

Identification plates shall be engraved to show white letters on a black background. Letters shall be uppercase. Identification plates 1-1/2 inches

high and smaller shall be 1/16-inch thick with engraved lettering 1/8-inch high. Identification plates larger than 1-1/2 inches high shall be 1/8-inch thick with engraved lettering not less than 3/16-inch high. Identification plates having edges of 1-1/2 inches high and larger shall be beveled.

In addition to standard manufacturer's identification plates, engraved laminated phenolic identification plates shall be provided for each electrical equipment connection. Identification plates shall designate the wording listed in the feeder area of one-line diagram (LD-1239926)

Example for 480 Volt Switchgear Unit Circuit Breaker identification plate:

PANEL D-100
Basement Rm. 5

2.2 WARNING SIGNS

Each item of electrical equipment operating at 480 volts and above shall be provided with conspicuously located warning signs conforming to the requirements of Occupational Safety and Health Agency (OSHA) standards.

Safety color coding for identification of warning signs shall conform to NEMA Z 535.

2.3 ANCHOR BOLTS

Stainless steel anchor bolts shall be provided for equipment placed on concrete equipment pads or slabs. All bolts, washers, and hardware shall be stainless steel type.

2.4 PAINTING

Enclosures of the following listed items shall be cleaned, primed, and factory-painted inside and outside in accordance with MS MIL-T-704 and the equipment sections of this specification.

ITEM	FINISH COLOR
Circuit Breakers	No. 61 gray (FED-STD 595)
Substations	No. 61 gray (FED-STD 595)
Switchgear	No. 61 gray (FED-STD 595)
Provide undercoating to underfloor and inside roof sections of outdoor switchgear per specification Section 16366, 2.3.2.	
Transformers	No. 61 gray (FED-STD 595)
Safety Switches	Manufacturer's standard
Panelboards	Manufacturer's standard
Control Components	Manufacturer's standard

2.5 INSTALLED EQUIPMENT DATA SHEETS

REPLACE 750 KVA UNIT SUBSTATION - B1208

The Contractor shall fill out and submit for approval, an Installed Equipment Data Sheet (See Attachment) for each installed item listed below:

Facility 1208 - 480V outdoor unit substation No. "2" consisting of the following: 1000 kVA transformer 2400 - 480/277 volt, secondary switchgear and each circuit breaker in the switchgear.

All equipment data sheets shall be submitted and approved prior to the contract completion date.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be accomplished by workers skilled in this type of work. Installation shall be made so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

3.2 PAINTING APPLICATION

Exposed conduit, supports, fittings, cabinets, pull boxes, and racks, if not factory painted, shall be thoroughly cleaned and painted, unless otherwise noted. Work shall be left in a neat and clean condition at final completion of the contract.

3.3 IDENTIFICATION PLATE INSTALLATION

Identification plates shall be provided for primary switch and circuit breaker numbers and switchgear compartment identification. Identification plates shall be fastened by means of corrosion-resistant steel or nonferrous metal screws. Hand lettering, marking, or embossed self-adhesive tapes are not acceptable.

3.4 CUTTING AND PATCHING

Contractor shall install its work in such a manner and at such time as will require a minimum of cutting and patching on the building structure.

Holes in or through existing masonry walls and floors in exposed locations shall be drilled and smoothed by sanding. Use of a jackhammer will be permitted only where specifically approved.

3.5 DAMAGE TO WORK

Required repairs and replacement of damaged work shall be done as directed by and subject to the approval of the Contracting Officer, and at no additional cost to the Government.

3.6 CLEANING

Exposed surfaces of wireways, conduit systems, and equipment that have become covered with dirt, plaster, or other material during handling and construction shall be thoroughly cleaned before such surfaces are prepared

for final finish or painting.

Before final acceptance, electrical equipment, including lighting fixtures and glass, shall be clean and free from dirt, grease, and fingermarks.

3.7 FIELD TESTING AND TEST EQUIPMENT

All Field testing specified in Division 16, "Electrical", shall be made with test equipment, provided by the Contractor, specially designed and calibrated for the purpose. Test equipment used shall be calibrated and certified by the approved testing laboratory. Date of last calibration and certification shall not be more than 90 days old at the time of field testing.

-- End of Section --

TRANSFORMER DATA SHEET

1. BUILDING

2. DESCRIPTION

3. LOCATION (ROOM NUMBER)

4. MANUFACTURER

5. MODEL NUMBER

16. TYPE FLUID

6. SERIAL NUMBER

17. FLUID CAPACITY

7. CLASS (OA)

18. TAP CHANGER
CAPACITY

8. WINDING CO
(DELTA/WYE)

19. TOTAL WEIGHT

9. KVA

20. WEIGHT OF FLUID

10. PHASE

21. WEIGHT OF CORE

11. INST. DATE

22. WEIGHT OF TANK

12. PRIMARY VOLTS

23. LTC STEPS

13. SEC. VOLTS

24. NLTC STEPS

14. FREQ. RATING

25. TEMP. RISE

15. INST. BOOK. NO.

26. IMPEDANCE

Note: All applicable items shall be completed by the Contractor.

Contractor _____

Contract No. _____

Address: _____

CIRCUIT SWITCHER DATA SHEET

1. BUILDING

2. DESCRIPTION

3. LOCATION (ROOM NUMBER)

4. MANUFACTURER

5 MODEL NUMBER

14 AMPS

6 SERIAL NUMBER

15 FUSE MFG.

7 CLASS

16 FUSE TYPE

8 TYPE

17 FUSE KV RATING

9 INSTALL DATE

18 FUSE INTER.
RATING

10 FUSE RATING

19 OIL CAPACITY

11 PHASE

20 WEIGHT

12 RATED VOLTS

21 INST. BOOK. NO.

13 RELAY MFG/TYPE

22 RELAY TEST
DEVICE

Note: All applicable items shall be completed by the Contractor.

Contractor _____

Contract No. _____

Address: _____

PROTECTIVE RELAY DATA SHEET

1. BUILDING NUMBER

2. CIRCUIT BREAKER NUMBER

3. RELAY DEVICE NUMBER ex. 50/51

4. RELAY MODEL NUMBER

5. RELAY MANUFACTURER ex. General Electric

6. RELAY DESCRIPTION ex. Phase Over Current

7. A PHASE RELAY SERIAL NUMBER

8. B PHASE RELAY SERIAL NUMBER

9. C PHASE RELAY SERIAL NUMBER

10. INSTALLATION DATE

11. INSTRUCTION BOOK NO.

12. CURRENT TRANSFORMER RATIO

13. TAP SETTING

14. TIME DIAL SETTING

15. INSTANTANEOUS SETTING

16. TIME DELAY @ 300%

17. TEST SET MANUFACTURER

18. TEST SET MODEL NUMBER

NOTES

Items 1 through 3 are to be filled out by the Government Technical Project Engineer.

Items 4 through 18 are to be completed by the Contractor as required.

CONTRACTOR: _____

CONTRACT NO. _____

ADDRESS: _____

PRIMARY SWITCH DATA SHEET

1. BUILDING

2. DESCRIPTION

3. LOCATION (ROOM NUMBER)

4. MANUFACTURER

5 MODEL NUMBER

13 AMPS

6 SERIAL NUMBER

14 FUSE MFG.

7 CLASS

15 FUSE TYPE

8 TYPE

16 FUSE KV RATING

9 INSTALL DATE

17 FUSE INTER.
RATING

10 FUSE RATING

18 OIL CAPACITY

11 PHASE

19 WEIGHT

12 RATED VOLTS

20 INST. BOOK. NO.

Note: All applicable items shall be completed by the Contractor.

Contractor _____

Contract No. _____

Address: _____

CIRCUIT BREAKER DATA SHEET

1. BUILDING

2. DESCRIPTION

3. LOCATION (ROOM NUMBER)

4. MANUFACTURER

5 MODEL NUMBER

16 OVERLOAD MANUF.

6 SERIAL NUMBER

17 CUR. TRANS. SET

7 TYPE

18 OVERLOAD MODEL

8 SWGR. DESIGN

19 LONGTIME P. U.

9 INSTALL DATE

20 SHORTTIME P. U.

10 PHASE

21 L.T. DELAY BAND

11 VOLTS

22 S.T. DELAY BAND

12 FRAME SIZE

23 INSTS. SET

13 INTERRUPT. CAP.

24 GFI P. U.

14 INST. BOOK. NO.

25 GFI DELAY

15 OPER. MECH. TYPE

Note: All applicable items shall be completed by the Contractor.

Contractor _____

Contract No. _____

Address: _____

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16124

MEDIUM VOLTAGE CABLE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
- 1.3 GENERAL REQUIREMENTS
- 1.4 SUBMITTALS
- 1.5 QUALIFICATIONS
- 1.6 CABLE VOLTAGE RATINGS
- 1.7 SHIPMENT

PART 2 PRODUCTS

- 2.1 CONDUCTORS
- 2.2 CABLE IDENTIFICATION
- 2.3 SINGLE-CONDUCTOR NONSHIELDED CABLES
 - 2.3.1 Ethylene-Propylene-Rubber-Insulated with PVC Jacket

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 EPR Cable Terminations
- 3.2 FIELD TESTING
 - 3.2.1 New Cable

-- End of Section Table of Contents --

SECTION 16124

MEDIUM VOLTAGE CABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

1.2 DEFINITIONS

Medium voltage power cables shall mean all cables rated above 600 to 35,000 volts.

1.3 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-01 Data

Manufacturer's Catalog Data shall be provided for the following items:

Single-Conductor Non-Shielded Cables

SD-08 Statements

Listing of Products Installed shall be provided showing qualifications of Cable Splicers to the Contracting Officer prior to specified work.

SD-09 Reports

Test Reports for the following shall be in accordance with the paragraph entitled, "Field Testing," of this section.

Dielectric Absorption Tests
High-Voltage Tests

SD-13 Certificates

Certificates of Compliance shall be provided for the following showing that the manufacturer has made factory-conducted tests on each shipping length of EPR cable and lead cable potheads. Certified copies of test data shall show conformance with the referenced standards and shall be approved prior to delivery of cable.

Conductor Resistance
High-Voltage
Mechanical Integrity
Qualifications of Cable Splicers

1.5 QUALIFICATIONS

Personnel performing medium voltage cable terminations shall have 5 years experience in cable terminations. Once a termination has been started by a worker, the same person shall complete that particular termination. Each termination shall be started and completed in one continuous work period. The submittal of qualifications shall include the number and type of terminations made by the individual.

1.6 CABLE VOLTAGE RATINGS

Medium-voltage power cables shall include multiple- and single-conductor cables rated as follows, phase-to-phase, for grounded and ungrounded neutral systems:

Cables rated 5,000 volts at 133 percent insulation level, ungrounded neutral, shall be used on 2,400-volt, three-phase, 60-hertz distribution systems.

1.7 SHIPMENT

Cable shall be shipped on reels such that the cable will be protected from mechanical injury. Each end of each length of cable shall be hermetically sealed and securely attached to the reel.

Minimum reel drum diameter shall be 14 times the overall diameter of the cable.

PART 2 PRODUCTS

2.1 CONDUCTORS

Conductors shall be 100 percent copper conforming to ASTM B 3.

2.2 CABLE IDENTIFICATION

Cables shall have a tape placed immediately under the lead sheath or outer jacket showing the name of the manufacturer, the year in which the cable was manufactured, and a unique number for identification purposes. Information shall be closely grouped on the tape at 1-foot intervals to

permit complete identification.

2.3 SINGLE-CONDUCTOR NONSHIELDED CABLES

2.3.1 Ethylene-Propylene-Rubber-Insulated with PVC Jacket

Single-conductor, ethylene-propylene-rubber-insulated, polyvinylchloride-jacketed, shielded cable shall conform to NEMA WC 8.

PART 3 EXECUTION

3.1 INSTALLATION

Medium-voltage cables shall be installed in accordance with NFPA 70.

3.1.1 EPR Cable Terminations

Terminating of cables shall be expedited to minimize exposure and cable deterioration. Cable lugs shall be copper.

Cable end terminations and cables shall be secured to supports in such a manner as to prevent movement of the termination or cable at the support.

Cable terminations shall be taped with high voltage insulation tape after installing the new equipment.

3.2 FIELD TESTING

3.2.1 New Cable

New cables shall be subjected to dielectric-absorption and high-voltage tests after the installation of power cables has been completed, including splices, joints, and terminations, and before the cable is energized.

Test equipment, labor, and technical personnel shall be provided as necessary to perform the electrical acceptance tests.

Arrangements shall be made to have tests witnessed, approved and signed by the Contracting Officer and Government inspector.

Each power-cable installation shall be completely isolated from extraneous electrical connections at cable terminations and joints. Safety precautions shall be observed.

Each power cable shall first be given a full dielectric-absorption test with 2,500-volt insulation-resistance test set. The test shall be applied for a long enough time to fully charge the cable. Readings shall be recorded every 15 seconds during the first 3 minutes of test and at 1 minute intervals thereafter. The test shall continue until three equal readings, 1 minute apart, are obtained. Minimum reading shall be 200 megohms at an ambient temperature of 60 degrees F. Readings taken at other than 60 degrees F ambient temperatures shall be corrected accordingly.

Upon successful completion of the dielectric absorption test, the cable

REPLACE 750 KVA UNIT SUBSTATION - B1208

shall be subjected to a direct-current high-potential test for 15 minutes with test voltages as specified by the cable manufacturer and applied in accordance with NEMA WC 5.

Leakage current readings shall be recorded every 30 seconds during the first 2 minutes and every minute thereafter for the remainder of the test. If the leakage current continues to increase after the first minute, the test shall be immediately terminated and steps taken to find and correct the fault. If a second test becomes necessary, this test procedure shall be repeated.

Upon satisfactory completion of the high-potential test, the cable shall be given a second dielectric-absorption test as before.

Results of the second dielectric-absorption test shall agree with the first test and shall indicate no evidence of permanent injury to the cable caused by the high-potential test.

Test data shall be recorded and shall include identification of cable and location, megohm readings versus time, leakage current readings versus time, and cable temperature versus time.

Final acceptance shall depend upon the satisfactory performance of the cable under test. No cable shall be energized until recorded test data have been approved by the Contracting Officer.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16145

STANDARD WIRING SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS (Not Applicable)

PART 2 PRODUCTS

- 2.1 CONDUITS, RACEWAYS, AND FITTINGS
 - 2.1.1 Rigid Steel Conduit
 - 2.1.2 Electrical Metallic Tubing (EMT)
 - 2.1.3 Flexible Metallic Conduit
- 2.2 600V BUILDING AND CONTROL WIRE
- 2.3 SPLICES AND CONNECTORS
- 2.4 WIRING DEVICES
 - 2.4.1 Receptacles
 - 2.4.2 Switches
 - 2.4.3 Boxes
 - 2.4.3.1 Pull and Junction Boxes

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Installation of Rigid Metal Conduit
 - 3.1.2 Installation of EMT
- 3.2 INSTALLATION OF WIRING
- 3.3 SAFETY SWITCHES
- 3.4 BOXES AND FITTINGS
- 3.5 IDENTIFICATION PLATES
- 3.6 FIELD TESTING

-- End of Section Table of Contents --

SECTION 16145

STANDARD WIRING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C80.1 (1995) Rigid Steel Conduit - Zinc Coated
- ANSI C80.3 (1994) Electrical Metallic Tubing - Zinc-Coated

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B 173 (2001) Standard Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors
- ASTM B 3 (2001) Standard Specification for Soft or Annealed Copper Wire
- ASTM D 2301 (1999) Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

- NEMA FB 1 (2001) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

- UL 1 (2000) UL Standard for Safety - Flexible Metal Conduit
- UL 1581 (1997; 3rd Ed) UL Standard for Safety - Reference Standard for Electrical Wires, Cables, and Flexible Cords

UL 486C	(2000) UL Standard for Safety Splicing Wire Connectors
UL 50	(1995; 11th Ed) UL Standard for Safety - Enclosures for Electrical Equipment
UL 514A	(1996; 9th Ed) UL Standard for Safety - Metallic Outlet Boxes
UL 514B	(1997) UL Standard for Safety Fittings for Conduit and Outlet Boxes
UL 6	(2000) UL Standard for Safety - Rigid Metal Conduit
UL 797	(2000) UL Standard for Safety - Electrical Metallic Tubing

1.2 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

1.3 SUBMITTALS (Not Applicable)

PART 2 PRODUCTS

2.1 CONDUITS, RACEWAYS, AND FITTINGS

Conduit shall be 3/4-inch diameter minimum, except where specifically shown smaller on the contract drawings.

Conduit, connectors, and fittings shall be approved for the installation of electrical conductors.

2.1.1 Rigid Steel Conduit

Rigid steel conduit, including couplings, elbows, bends, and nipples, shall conform to the requirements of UL 6 and ANSI C80.1. Steel fittings shall be galvanized by the hot-dip process.

Fittings for rigid steel conduit shall be threaded and shall conform to NEMA FB 1.

Gaskets shall be solid for fittings sized 1-1/2 inches and less. Conduit fittings with blank covers shall have gaskets except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Covers shall have captive screws and shall be accessible after the work has been completed.

2.1.2 Electrical Metallic Tubing (EMT)

EMT shall be rigid metallic conduit of the thinwall type in straight

REPLACE 750 KVA UNIT SUBSTATION - B1208

lengths, elbows, or bends and shall conform to ANSI C80.3 and the requirements of UL 797.

Couplings and connectors shall be hex-nut expansion-gland type, cadmium-plated. Crimp, spring, or setscrew type fittings are not acceptable. Where EMT enters outlet boxes, cabinets, or other enclosures, connectors shall be the insulated-throat type, with a locknut. Fittings shall meet the requirements of NEMA FB 1.

2.1.3 Flexible Metallic Conduit

Flexible metallic conduit shall meet the requirements of UL 1.

Liquidtight flexible metallic conduit shall be provided with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

Fittings for flexible metallic conduit shall meet the requirements of UL 514B, Type I box connector, electrical, Type III coupling, electrical conduit, flexible steel, or Type IV adapter, electrical conduit.

Fittings for liquidtight flexible metallic conduit shall meet the requirements of UL 514B, Type I box connector, electrical, Class 3 liquidtight flexible metallic conduit connectors.

2.2 600V BUILDING AND CONTROL WIRE

Insulated current-carrying wire and grounding conductors shall be copper and shall conform to NFPA 70 and UL 1581. Wire bundles with cable ties shall be secured to the enclosure with sheet-metal screws. Self-sticking adhesive attachments are not acceptable.

Wire for use in conduits, raceways, and wireways shall be single-conductor, 600-volt, heat- and moisture-resistant insulated wire suitable for use in wet or dry locations.

Conductors AWG No. 10 and smaller shall be solid round copper wire. Conductors AWG No. 8 and larger shall be standard concentric stranded copper wire. Conductors shall be not less than AWG No. 12, except that AWG No. 14 shall be stranded copper wire and shall be used for control wiring.

Wire shall be Type THWN with insulation of PVC and nylon jacket, with a minimum temperature rating of 75 degrees C.

Wire used for instrument and control wiring on the back of hinged-front instrument panels shall be single-conductor, 600-volt, flame- and heat-resistant insulated wire not smaller than AWG No. 14 with a minimum temperature rating of 90 degrees C.

Conductors rigidly mounted on the back of instrument panels shall be solid round, soft or annealed, copper wire conforming to ASTM B 3. Hinge connections shall be rope-lay-stranded copper conductors, Class H, conforming to ASTM B 173. All wires before stranding shall conform to ASTM B 3 for soft or annealed copper wire.

Instrumentation wire shall be Type SIS with cross-linked thermosetting polyethylene insulation.

2.3 SPLICES AND CONNECTORS

Splices in building wire AWG No. 8 and smaller and multiple conductor cables shall be made with insulated Scotchlock, or equal, connectors or

with indenter crimp-type connectors and compression tools to ensure a satisfactory mechanical and electrical joint.

Splices in building wire AWG No. 8 and larger and single-conductor cables shall be made with indenter crimp-type connectors and compression tools.

Joints shall be wrapped with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor. Splices in rubber-insulated neoprene-jacketed wire and cables shall be watertight.

Vinyl-plastic electrical insulating tape shall meet the requirements of ASTM D 2301. Where pressure-sensitive tape is used, the surface shall be cleaned free of dust, sand, or other foreign material and a primer recommended by the tape manufacturer shall be applied prior to taping.

Terminal lugs for 10-AWG and smaller conductors shall be of solderless, insulated, tool-crimped type.

Terminal lugs for 8-AWG and larger conductors shall be a heavy-duty connector of cast high-copper alloy and have a conductor-clamping saddle secured by a brass or bronze hex-socket set screw. Lugs shall be of the Lockette Series for code copper conductors, as manufactured by Thomas and Betts Corporation, or equal.

Solid wiring shall be terminated with terminal blocks specifically designed for solid wire. Crimp type shall not be used on solid wire for termination.

Stranded wire shall use insulated fork tongue type lugs for termination on terminal blocks.

2.4 WIRING DEVICES

2.4.1 Receptacles

Convenience outlets installed in switchgear and outdoor damp or wet locations for connection to 120-volt ac single-phase circuits shall consist of duplex Ground Fault Circuit Isolation (GFCI) receptacles. Outdoor type shall be enclosed in weatherproof outlet boxes, with gasketed cast-aluminum plates and spring-loaded hinged lift covers. Springs and hinge pins shall be corrosion-resistant steel. Screws and spring covers shall be chromium or cadmium-plated brass. Rubber or neoprene gaskets shall provide a positive seal against the weather.

2.4.2 Switches

Switches and receptacles shall be heavy-duty, general purpose type and shall match the wiring devices for which they are intended.

Plates for switches and receptacles shall be corrosion-resistant steel not less than 0.040-inch thick, with beveled edges and a brushed satin finish. Mounting screws shall be corrosion-resistant steel with oval countersunk heads finished to match the plate.

2.4.3 Boxes

Boxes shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of NFPA 70 and UL 514A. Boxes that are exposed to the weather or that are in normally wet locations shall be cast-metal with threaded hubs. Interior boxes shall be cadmium-plated or zinc-coated sheet metal.

2.4.3.1 Pull and Junction Boxes

Pull and junction boxes shall be fabricated from carbon steel and shall conform to UL 50. Box dimensions and conduit connections shall conform to NFPA 70.

Boxes shall be welded construction with flat removable covers fastened to the box with machine screws. Seams and joints at corners or back edges of the box shall be closed and reinforced with flanges formed of the same material from which the box is constructed or by other means such as continuous welding which provides a construction equivalent to integral flange construction.

Boxes intended for outdoor use shall be hot-dipped galvanized with threaded hubs and neoprene-gasketed covers.

Boxes intended for use in dry locations shall be sheet steel galvanized after fabrication conforming to UL 514A.

PART 3 EXECUTION

3.1 INSTALLATION

Conduit and raceway runs in or under concrete, in damp or outdoor locations, where subject to mechanical damage, or intended for conductors rated over 600 volts, shall be rigid steel conduit. Other locations shall be electrical metallic tubing (EMT), unless otherwise noted.

Power and other service systems and all related components shall be installed in accordance with NFPA 70, and shall be enclosed in separate conduit or separate conduit systems.

Any run of EMT or rigid conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall contain not more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting. Installed conduit and fittings shall be free of dirt and trash and shall not be deformed or crushed. Empty conduit shall have a pull rope installed.

Conduit shall be installed with a minimum of 3 inches of free air space separation from mechanical piping.

Conduit in finished areas shall be installed concealed. Conduit passing through masonry or concrete walls shall be installed in sleeves, and sleeves shall be regouted in place. Provide fire rated seal around conduit penetrations through fire rated walls. Sealant shall be 3M, or equal.

Conduit shall be securely clamped and supported at least every 10 feet vertically and 8 feet horizontally. Galvanized pipe straps shall be fastened to structure with bolts, screws, and anchors. Wooden masonry plugs shall not be used.

Conduit connections to boxes and fittings shall be supported not more than 36 inches from the connection point. Conduit bends shall be supported not more than 36 inches from each change in direction. Conduit shall be installed in neat symmetrical lines parallel to the centerlines of the building construction and the building outline. Multiple runs shall be parallel and grouped whenever possible on common supports.

Grounding bushings shall be provided on all underground conduit.

Horizontal conduit runs shall be installed as high as feasible. All conduit routings shall be approved by the Government electrical inspector prior to installation.

Wire or cable shall not be installed in conduit until the conduit system is completed; the inner surfaces of conduit shall be clean and dry.

3.1.1 Installation of Rigid Metal Conduit

Ends of conduit shall be cut square, reamed and threaded, and joints shall be brought butt-to-butt in the couplings. Joints shall be mechanically tight. Conduit shall be protected against damage and the entrance of water or foreign material during construction.

Ninety-degree bends of conduit with a diameter larger than 1 inch shall be made with factory-made elbows. Conduit elbows larger than 2-1/2 inches shall be long radius. Field-made bends and offsets shall be made with a hickey or conduit-bending machine. Changes in directions of runs shall be made with symmetrical bends or cast-metal fittings.

At connections to sheet metal enclosures and boxes, a sufficient number of threads shall project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be pulled up sufficiently tight to draw the bushing into firm electrical contact with the box. Conduit shall be fastened to sheet metal boxes and cabinets with two locknuts where required by NFPA 70 where insulating bushings are used, where bushings cannot be brought into firm contact with the box, and where indicated.

Watertight hubs (Meyers Hubs or equal) shall be used on top and side conduit installations on outside equipment.

Conduit joints shall be made with tapered threads set firmly. Each length of conduit cut in the field shall be reamed before installation. Where conduit is threaded in the field, each threaded end shall consist of at least five full threads. Corrosion-inhibitive compound shall be used on conduit threads in exterior areas.

3.1.2 Installation of EMT

EMT shall be cut square and reamed to remove burrs and rough surfaces.

Field-made bends and offsets shall be avoided where possible but, where necessary, shall be made with an approved hickey or conduit-bending machine. Changes in direction of runs shall be made with symmetrical bends or approved metal fittings.

3.2 INSTALLATION OF WIRING

Raceways shall be completely installed, with interiors protected from the weather, before proceeding with the installation of wires and cables. Conductors of special-service systems and power systems shall not occupy the same enclosure with each other. Conductors shall be continuous with splices and connections made in outlet, junction, or pull boxes only. All control wiring shall be continuous between components and/or terminal boards.

Phase conductors and the neutral conductor of each branch or feeder circuit shall be contained in a single enclosure or paralleled in separate enclosures to avoid overheating the raceway by electromagnetic induction. Conductors and conduit in parallel shall be the same length and size, shall have conductors of the same type of insulation, shall be terminated at both ends in a manner to ensure equal division of the total current among conductors, and shall have a separate neutral conductor in each conduit.

Sharing of a common neutral between single phase circuits, connected to different phases, shall not be permitted.

Conductors installed in heavy-wall rigid steel conduit and EMT shall have allowable current-carrying capacity and ampere ratings in accordance with NFPA 70. Larger-sized conductors shall be used to compensate for derating factors when more than three current-carrying conductors are installed in raceways and when conductors are installed in wet locations.

Conductors 600 volts and below shall be color coded in accordance with the following:

<u>CONDUCTOR</u>	120/208 <u>COLOR</u>	480/277 <u>COLOR</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	White/Gray
Equipment Grounds	Green	Green

Conductors up to and including AWG No. 10 shall be manufactured with colored insulating materials. Conductors larger than AWG No. 10 shall have ends identified with colored plastic tape in outlet, pull, or junction boxes. Control circuit conductors shall be identified at each connection

point.

Connectors and splices shall conform to UL 486C and shall be made in approved enclosures utilizing solderless pressure connectors and be insulated with vinyl-plastic electrical insulating tape per manufacturer's recommendations. Conductors and materials used in a splice, tap, or connection shall be thoroughly cleaned prior to makeup to ensure good electrical and mechanical connections. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking is not acceptable. Control-circuit terminals of equipment shall be properly identified by number-coded plastic self-sticking printed markers. Cable fittings shall conform to UL 514B; insulating tape shall conform to ASTM D 2301.

Where several feeders pass through a common pullbox, the feeders shall be tagged to clearly indicate the electrical characteristics, circuit number, and panel designation.

If existing secondary feeder cables or wires are too short to reach new breaker terminals at secondary switchgear, each shall be extended as necessary using crimp type butt copper connectors with connectors taped at each butt connection.

Grounding shall be provided in accordance with NFPA 70.

A copper conductor green insulated ground wire shall be installed in each conduit other than telephone circuits. This ground wire shall ground each electrical box and electrical equipment that is connected to the conduit. The ground wire shall be same 600 volt insulation and size as the phase wires, except for phase wires larger than No. 2 AWG that shall be at least No. 2 AWG or larger as required by NEMA 70.

Non-current carrying parts of substation incoming sections, transformers and outgoing sections shall be individually grounded to the existing substation grounding system using 4/0 stranded copper ground wire.

3.3 SAFETY SWITCHES

Switches shall be securely fastened to the supporting structure or wall utilizing a minimum of four 1/4-inch bolts. Sheet metal screws and small machine screws shall not be used for mounting. Switches shall not be mounted in an inaccessible location or where the passageway to the switch may become obstructed. Mounting height shall be 5 feet above floor level, when possible.

3.4 BOXES AND FITTINGS

Pullboxes shall be furnished and installed where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with more than three right-angle bends shall have a pullbox installed at a convenient intermediate location.

Boxes and enclosures shall be securely mounted to the building structure with supporting facilities independent of the conduit entering or leaving the boxes.

3.5 IDENTIFICATION PLATES

Provide identification plates in accordance with Section 16003.

3.6 FIELD TESTING

After completion of the installation and splicing, and prior to energizing the conductors, wire and cable shall be given continuity and insulation tests as herein specified before the conductors are energized. Existing cables shall be given insulation tests before and after installation.

Prior to disconnecting a conductor, the conductor shall be marked with a legible, waterproof tag noting the service and reconnection point. Such marking shall be suitable to provide positive identification for reconnecting the conductor.

Necessary test equipment, labor, and personnel shall be provided by the Contractor to perform the tests, as herein specified. Continuity tests shall be conducted using a dc device with bell or buzzer.

Wire and cable in each voltage classification shall be completely isolated from all extraneous electrical connections at cable terminations and joints. Substation and switchboard feeder breakers, disconnects in combination motor starters, circuit breakers in panel boards, and other disconnecting devices shall be used to isolate the circuits under test.

Insulation tests on circuits rated 480-volts and less shall be conducted using a 1,000-volt insulation-resistance test set. Readings shall be taken every minute until three equal and consecutive readings are obtained. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Insulation tests on circuits rated 240 volts or less, with conductor sizes 2 AWG and larger, shall be conducted using a 500-volt insulation-resistance test set. Readings shall be taken after 1 minute and until the reading is constant for 15 seconds. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Phase-rotation tests shall be conducted on all three-phase circuits using a phase-rotation indicating instrument. Phase rotation of electrical connections to connected equipment shall be clockwise, facing the source.

Final acceptance will depend upon the successful performance of wire and cable under test. No conductor shall be energized until the installation is approved.

-- End of Section --

REPLACE 750 KVA UNIT SUBSTATION - B1208

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16286

METERING, CONTROL AND OVERCURRENT PROTECTIVE AND CONTROL DEVICES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS

PART 2 PRODUCTS

- 2.1 INSTRUMENT TRANSFORMERS
 - 2.1.1 Current Transformers
 - 2.1.2 Potential Transformers
- 2.2 CIRCUIT BREAKERS
 - 2.2.1 Molded-Case Circuit Breakers (For 120 Volt Power)
 - 2.2.2 Switchgear Power Circuit Breakers
 - 2.2.3 Solid State Trip Devices For Switchgear Power Breakers
- 2.3 FUSES
 - 2.3.1 2.4 kV Primary Switch and 480V Switchgear Current Limiting Fuses
- 2.4 CONTROL DEVICES
 - 2.4.1 Control-Circuit Transformers
- 2.5 INDICATING INSTRUMENTS
 - 2.5.1 Solid State Metering Device

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD TESTING

-- End of Section Table of Contents --

SECTION 16286

METERING, CONTROL AND OVERCURRENT PROTECTIVE AND CONTROL DEVICES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-01 Data

Equipment and Performance Data shall be submitted for the following items including use life, system functional flows, safety features, and mechanical automated details.

Instrument Transformers
Power Circuit Breakers
Fuses
Solid State Metering Devices
Solid State Trip Devices
Indicating Instruments
Indicating Lights

Manufacturer's Catalog Data shall be submitted for the following items:

Instrument Transformers
Power Circuit Breakers
Fuses
Solid State Metering Devices
Solid State Trip Devices
Indicating Instruments
Indicating Lights

SD-04 Drawings

Schematic and Interconnection Diagrams shall be submitted showing the relations and connections of the following items by showing the general physical layout of all controls, the interconnection

REPLACE 750 KVA UNIT SUBSTATION - B1208

of one system (or portion of system) with another, and internal wiring and other devices.

- Power Circuit Breakers
- Control Devices
- Metering Devices

Installation Drawings shall be submitted for the following items in accordance with the paragraph entitled, "Installation".

- Control Devices
- Metering Devices

SD-06 Instructions

Manufacturer's Instructions shall be submitted for the following items, including special provisions required to install equipment components and system packages. Special notices shall detail, resistance impedances, hazards and safety precautions.

- Control Devices
- Metering Devices

SD-09 Reports

Test Reports shall be submitted for the following tests on control and protective devices in accordance with the paragraph entitled, "Field Testing, of this section.

SD-19 Operation and Maintenance Manuals

O & M Manuals shall be submitted for each Unit Substation and Secondary Switchgear.

1.3 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

PART 2 PRODUCTS

2.1 INSTRUMENT TRANSFORMERS

Instrument transformers shall comply with the interference requirements listed below, measured in accordance with IEEE C63.2, IEEE C63.4, and NEMA 107.

Insulation Class, kV	Basic Insulation Level, kV	Preferred Nominal System Voltage, kV	Test Voltage for Potential Transformers, kV	Test Voltage for Current Transformers, kV	Radio Influence Voltage Level, <u>Microvolts</u>	
					Dry Type	Oil Filled
0.6	10	0.76	250	250

REPLACE 750 KVA UNIT SUBSTATION - B1208

Insulation Class, kV	Basic Insulation Level, kV	Preferred	Test Voltage for Potential Transformers, kV	Test Voltage for Current Transformers, kV	Radio Influence Voltage Level, <u>Microvolts</u>	
		Nominal System Voltage, kV			Dry Type	Oil Filled
2.5	45	2.40	1.52	1.67	250	250
5.0	60	4.16 4.80	2.64 3.04	3.34	250	250

2.1.1 Current Transformers

Current transformers shall conform to IEEE C57.13 for installation in metal-clad switchgear. Standard 3-A secondary transformer shall be used.

Transformers shall be window type.

Transformers shall have single tap secondary winding.

Transformers shall be complete with secondary short-circuiting device.

Window-type current transformers shall be indoor dry type construction with secondary current ratings as indicated. Burden, frequency, and accuracy shall be as specified.

2.1.2 Potential Transformers

Potential transformers shall conform to IEEE C57.13 for installation in metal-clad switchgear. Standard 120-volt secondary transformers shall be used.

Transformers shall have single tapped secondary.

Burden, frequency, and accuracy shall be as required.

Disconnecting potential transformers with integral fuse mountings and current-limiting fuses shall be indoor dry type two-winding construction with primary and secondary voltage ratings as required.

2.2 CIRCUIT BREAKERS

Circuit breakers shall conform to UL 489, NEMA AB 1, and NEMA AB 3.

2.2.1 Molded-Case Circuit Breakers (For 120 Volt Power)

Circuit breakers shall be molded case, manually operated, trip-free, with inverse-time thermal-overload protection and instantaneous magnetic short-circuit protection as required. Circuit breakers shall be completely enclosed in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.

Thermal-magnetic tripping elements shall be located in each pole of the

circuit breaker and shall provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. Instantaneous magnetic tripping element shall be adjustable and accessible from the front of the breaker on frame sizes larger than 100 amperes.

Breaker size shall be as required for the continuous current rating of the circuit. Breaker class shall be as required.

Interrupting capacity of the panel and lighting branch circuit breakers shall be sufficient to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Circuit breaker interrupting capacities shall be a minimum of 22,000 amperes and shall conform to NEMA AB 3.

Multipole circuit breakers shall be of the common-trip type having a single operating handle and shall have a two-position on/off indication. Circuit breakers shall have temperature compensation for operation in an ambient temperature of 104 degrees F.

Breaker body shall be of phenolic composition. Breakers shall be capable of having such accessories as handle-extension, handle-locking, and padlocking devices attached where required.

2.2.2 Switchgear Power Circuit Breakers

Power circuit breakers rated below 600 volts for use in substation secondary switchgear shall be the air-break, draw-out type enclosed in ventilated housings. Current, voltage, and interrupting ratings shall be as required, but not less than that indicated on the contract drawings.

Power circuit breakers shall comply with ANSI C37.16 and IEEE C37.13.

Power circuit breakers shall be equipped with solid-state trip devices, long time/short time and instantaneous elements shown on the contract drawings. Breakers shall be electrically and mechanically trip-free in any position of the closing stroke. Ground fault protection shall be included for the 480 volt circuit breakers as designated on the contract drawings. Main contacts shall be silver-plated. Arcing contacts shall be sintered tungsten alloy. Closing shall be by manual operation.

Circuit breakers installed in switchgear for unit substation shall be the drawout type, three-pole, single-throw, manually operated, trip free, with primary and secondary disconnecting contacts, solid state trip devices, provisions for padlocking, removable operating handle, arc quenchers, manual stored-energy closing mechanism, position indicator, and equipment for mounting on the drawout mechanism in the circuit breaker compartment. Circuit breaker shall meet the requirements of UL 489. A solid state trip device test set shall be provided for the type of circuit breaker installed.

The operating mechanism shall be quick-make/quick-break on manual operation and shall be mechanically trip-free under overload and fault conditions. All poles shall operate simultaneously in manual operation.

The interrupting capacity of each circuit breaker shall be sufficient to

successfully interrupt the maximum short-circuit current imposed on the circuit breaker terminals, but not less than 50,000 amperes. Circuit breaker interrupting capacities shall conform to the requirements of UL 489.

Manual closing mechanism shall employ the stored energy principle by interposing an energy storage spring between the operator and the breaker contacts. The spring shall provide constant closing speed not influenced by the operator or control power voltage level.

Manually operated circuit breakers shall have front mounted handles for charging the closing springs. Closing the breakers shall be accomplished by depressing a mechanical close or by operating the breaker handle. Opening the breaker shall be accomplished by depressing a mechanical trip.

Interlocks shall be provided to prevent the complete withdrawal of the circuit breaker from the compartment when the stored energy mechanism is in the fully charged position. Circuit breakers shall be designed to prevent the release of stored energy unless the mechanism is fully charged.

2.2.3 Solid State Trip Devices For Switchgear Power Breakers

Solid state trip devices shall have individually adjustable settings.

Main circuit breakers shall have solid state trip devices with adjustable current sensor setting, adjustable long time pick-up setting, adjustable short time pick-up setting, adjustable ground fault pick-up setting and adjustable time delay bands.

Feeder circuit breakers shall have solid state trip devices with adjustable current sensor setting, adjustable long time pick-up setting, adjustable instantaneous pick-up setting, adjustable ground fault pick-up setting and adjustable time delay bands.

Switchgear 480 volt circuit breakers shall also have adjustable ground fault protection including a neutral current sensor. Ground-fault trip circuit shall have selective pickup points between approximately 320 to 960 amperes and a calibrated faceplate with adjustable captive thumbscrews shall be provided for pickup-current settings, time-delay band settings, and ground-fault current and time settings. A single thumbscrew shall adjust all three phase of the tripping circuit for any particular time-current characteristic. Tripping circuits shall be independent of each other in action and adjustment.

The device shall have as a minimum, three selectable time overcurrent characteristic curves: inverse, very inverse, and extremely inverse.

Solid state trip devices shall be furnished with required accessories and connected to low voltage control power as required. Trip devices that require the use of batteries are not acceptable. Programmed configurations and settings shall be stored in nonvolatile memory.

Targets shall be provided to indicate the setting that caused the breaker tripping. (Long time, short time, instantaneous or ground fault).

2.3 FUSES

Any fuse directly connected to the power bus shall be current limiting.

A complete set of fuses for all switches and switchgear shall be provided. Fuses shall have a voltage rating not less than the circuit voltage.

Provide 3 additional spare fuses for air switch 4432 per contract drawing.

Fuses rated 30 amperes, 125 volts or less shall be the nonrenewable cartridge type. Fuses rated above 30 amperes 600 volts or less shall be the renewable cartridge type with time-delay dual elements, except where otherwise indicated. Fuses shall conform to NEMA FU 1.

Power fuses on ac systems above 600 volts shall be in accordance with NEMA SG 2.

Fuses shall be labeled showing UL class, interrupting rating, and time-delay characteristics, when applicable.

Fuse holders field-mounted in a cabinet or box shall be porcelain. Field installation of fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber shall not be used.

2.3.1 2.4 kV Primary Switch and 480V Switchgear Current Limiting Fuses

Replace clip lock (CL 13) fuses in existing primary switch as indicated on plans. Each feeder circuit breaker for the 480 volt switchgear shall have a current limiting fuse in series with each pole of the circuit breaker. These 480V switchgear fuses shall be contained with the circuit breaker as part of the drawout feature of the circuit breaker. Provide 3 additional spare fuses for each feeder circuit breaker.

Fuse sizes shall be as indicated on contract drawings.

Spare fuses shall be stored in indicated location.

2.4 CONTROL DEVICES

2.4.1 Control-Circuit Transformers

Transformer shall be encapsulated dry type, single-phase, 60-hertz, with a 120-volt (or 24-volt) isolated secondary winding.

Rated secondary current of the transformer shall be not less than continuous-duty current of the control circuit.

Voltage regulation of the transformer shall be such that, with rated primary voltage and frequency, the secondary voltage shall not be less than 95 percent nor more than 105 percent of rated secondary voltage.

Secondary winding of the transformer and control-circuit wiring shall be protected against overloads and short circuits with fuses selected in accordance with JIC-01. Secondary winding of the control-circuit

transformer shall be grounded in accordance with JIC-01.

2.5 INDICATING INSTRUMENTS

2.5.1 Solid State Metering Device

The electrical metering device shall be solid state type, full function, easy to use, panel mounted type. The unit shall have 2-line LCD display unit (16 characters per line minimum), capable of interfacing with the watt-transducer included in the switchgear equipment and displaying as a minimum, the following metering functions: volts (L-L, L-N), amperes for each phase, Kwatts, Kvolt-amperes, power factor, Kwatt-hours, current demand, peak current, watt demand, peak watt demand, frequency and total harmonic distortion (voltage and current) The device shall be capable of modbus Remote Terminal Unit (RTU) communications and support RS485 protocols. The output protocol shall in both cases, be fully integratable with an existing Square D data collection system utilizing Powerlogic System Manager 3000 software. Local and remote programmed configurations and settings shall be stored in nonvolatile memory, and shall be programmable from the front face of the metering device. Metering devices which require the use of batteries are not acceptable.

The unit shall have the following electrical characteristics:

Current Inputs:

Current Range	0-10 A ac
Nominal Current	5 A ac
Burden	0.15 VA

Voltage Input:

Voltage Range	20-600 V ac
Nominal Voltage	208/120, 480/277

Accuracy:

Current	0.25%
Voltage	0.25%
Power	0.5%
Energy	0.5%
Demand	0.5%
Power Factor	1.0%

The metering device shall be Square "D", Model PM-620. The display unit shall be Model PMD-32.

PART 3 EXECUTION

3.1 INSTALLATION

Control and protective devices not factory installed in equipment shall be installed in accordance with the manufacturer's recommendations and shall be field adjusted and tested for operation. Installations shall conform to NFPA 70, NEMA ICS 1, NEMA ICS 2, and NEMA ICS 3 requirements for installation of control and protective devices.

3.2 FIELD TESTING

Control and protective devices shall be demonstrated to operate as indicated.

Circuit breakers and trip devices shall be mechanically and electrically tested and trip units set before the breakers are energized, in accordance with the manufacturer's written instructions.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16366

SECONDARY UNIT SUBSTATION

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 QUALIFICATIONS FOR MANUFACTURERS
- 1.5 DELIVERY, HANDLING, AND STORAGE
- 1.6 MANUFACTURER'S SERVICE REPRESENTATIVE
- 1.7 PROTECTIVE DEVICE COORDINATION SPECIALIST
- 1.8 SHOP DRAWINGS
- 1.9 PRELIMINARY SUBSTATION PLAN VIEW DRAWINGS

PART 2 PRODUCTS

- 2.1 EQUIPMENT STANDARDS
- 2.2 ELECTRICAL CHARACTERISTICS
 - 2.2.1 Ratings
 - 2.2.2 Insulation Class
 - 2.2.3 Basic Impulse Insulation Levels
- 2.3 INCOMING SECTION
 - 2.3.1 Cable Terminations
 - 2.3.2 Switchgear and Auxiliary Equipment Compartments
 - 2.3.3 Switchgear Assemblies
- 2.4 TRANSFORMER SECTION
 - 2.4.1 Transformers, Outdoor Oil Cooled
 - 2.4.2 High Temperature Transformer Oil
 - 2.4.3 Metal-Enclosed Bus, Secondary Transition Section
- 2.5 OUTGOING SECTION
 - 2.5.1 Switchgear and Auxiliary Equipment Compartments
 - 2.5.2 Switchgear Assemblies
- 2.6 SWITCHGEAR COMPONENTS
 - 2.6.1 Power Circuit Breakers
 - 2.6.2 Molded-Case Circuit Breakers
 - 2.6.3 Instruments and Instrument Transformers
 - 2.6.4 Control-Power Circuit Overcurrent Protection
 - 2.6.5 Service and Maintenance Devices
 - 2.6.6 Hoist for Power Circuit Breakers
 - 2.6.7 Protective Relays and Devices
 - 2.6.8 Solid State Metering Devices
- 2.7 SPACE HEATERS
- 2.8 WEATHERPROOF ENCLOSURES WITH MAINTENANCE AISLES

REPLACE 750 KVA UNIT SUBSTATION - B1208

- 2.9 PAINTING
- 2.10 FACTORY TESTING

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD TESTING
 - 3.2.1 Preliminary Inspection and Testing
 - 3.2.2 Transformer Testing
- 3.3 SYSTEM COORDINATION RELAY SETTINGS AND TESTS
- 3.4 GROUNDING RESISTANCE TESTS
- 3.5 WATER FIELD TEST
- 3.6 ENERGIZING SECONDARY UNIT SUBSTATION
- 3.7 FINAL ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16366

SECONDARY UNIT SUBSTATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C57.12.10 (1997) Transformers-230 kV and Below
833/958 Through 8333/10,417 kVA,
Single-Phase, and 750/862 Through
60,000/80,000/100,000 kVA, Three-Phase
Without Load Tap Changing; and 3750/4687
Through 60,000/80,000/100,000 kVA With
Load Tap Changing - Safety Requirements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 345 (1998) Standard Specification for
Flat-Rolled Electrical Steels for Magnetic
Applications

ASTM A 36/A 36M (2001) Standard Specification for Carbon
Structural Steel

ASTM A 366/A 366M (1996) Standard Specification for Steel,
Sheet, Carbon, Cold-Rolled, Commercial
Quality

ASTM A 570/A 570M (1998) Standard Specification for Steel,
Sheet and Strip, Carbon, Hot-Rolled,
Structural Quality

ASTM B 48 (2000) Standard Specification for Soft
Rectangular and Square Bare Copper Wire
for Electrical Conductors

ASTM D 877 (2000) Standard Test Method for Dielectric
Breakdown Voltage of Insulating Liquids
Using Disk Electrodes

ASTM D 92 (2001) Standard Test Method for Flash and
Fire Points by Cleveland Open Cup

ASTM D 924 (1999) Standard Test Method for A-C Loss
Characteristics and Relative Permittivity
(Dielectric Constant) of Electrical

Insulating Liquids

FEDERAL STANDARDS (FED-STD)

FED-STD 595 (Rev B) Colors Used in Government Procurement

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

IEEE C37.20.1 (1993) Standard for Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear

IEEE C37.20.3 (2001) Metal-Enclosed Interrupter Switchgear

IEEE C57.12.00 (2000) Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

IEEE C57.12.80 (1978; R 1992) Standard Terminology for Power and Distribution Transformers

IEEE C57.12.90 (1999) Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

IEEE Std 4 (1995) Standard Techniques for High Voltage Testing

IRON AND STEEL SOCIETY (ISS)

ISS PC95/211 (1991) Hot Rolled Structural Steel Shapes, H Piles and Sheet Piling

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA SG 5 (1995) Power Switchgear Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1062 (1997; R 2001) UL Standard for Safety Unit Substations

UL 467 (1993; 7th Ed) UL Standard for Safety Grounding and Bonding Equipment

1.2 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-01 Data

Equipment and Performance Data shall be submitted for the following items including life, test, system functional flows, safety features, and mechanical automated details.

Incoming Sections
Transformer Sections
Outgoing Sections
Switchgear Components

Manufacturer's Catalog Data shall be submitted for the following items:

Incoming Sections
Transformer Sections
Outgoing Sections
Switchgear Components
Waterproof Enclosures
Paint Materials
Transformer Oil

SD-04 Drawings

Schematic and Connection Diagrams shall be submitted indicating the relations and connections of the following items by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices. Drawings shall show wiring with individual wire numbers for each section and/or cubicle in the unit substation. Schematic and interconnection drawings showing one typical circuit breaker or section will not be acceptable.

Incoming Sections
Transformer Sections
Outgoing Sections
Switchgear Components

Fabrication Drawings shall be submitted for the following items consisting of fabrication and assembly details to be performed in the factory.

Incoming Sections
Transformer Sections
Outgoing Sections
Switchgear Components

Plan View Drawings showing new equipment within existing substation area shall be submitted for all equipment prior to selecting the manufacturer for the new substations and switchgear.

Installation Drawings shall be submitted for the Secondary Unit Substation that shall include complete details of equipment layout and design. These layouts shall be received and approved by the Government prior to fabrication. Dimensions to fences, other equipment, building structures, and all conduit entrances shall be clearly indicated.

SD-06 Instructions

Manufacturer's Instructions shall be submitted for the Secondary Unit Substation including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

Manufacturer's original Time-Current Characteristic Curves (11 x 17 inch) for all Fuses and Solid-State Trip Devices on translucent paper.

SD-08 Statements

Listing of Product Installations for Secondary Unit Substations shall include identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. List shall include purchaser, address of installation, service organization, and date of installation.

Manufacturer's Certification of Qualifications for the on-site Switchgear Representative.

SD-09 Reports

Test Reports shall be submitted for the following tests on secondary unit substations in accordance with the paragraphs entitled, "Factory Testing" and "Field Testing," of this section.

Transformer Factory Tests
Electrical Acceptance Tests
High Voltage Tests
Insulation Resistance Tests
Water Field Test
Electrical Tests
Ratio and Polarity Tests
Ground Resistance Field Tests

In lieu of factory tests on actual units furnished certified copies of previous tests on similar units under actual conditions, not simulated, shall be submitted for impulse tests, temperature rise tests, sound tests, power-factor tests, bushing tests, and short circuit tests.

SD-13 Certificates

Certificates of Compliance shall be submitted for Secondary Unit Substations including the following:

Certificates of conformance verifying that the materials and structural design comply with the roof live load, floor live load and wind pressures specified under the paragraph entitled, "Weatherproof Enclosures with Maintenance Aisles" (Subpart 2.8).

SD-19 Operation and Maintenance Manuals

O & M Manuals shall be submitted for the Switchgear Assemblies.

1.4 QUALIFICATIONS FOR MANUFACTURERS

Material and equipment to be provided under this specification shall be the standard catalog product of a manufacturer regularly engaged in the manufacture of secondary unit substations and their component parts and equipment. Equipment shall be of the latest standard design for indoor or outdoor service and shall have been in repetitive manufacture for at least 150 units.

1.5 DELIVERY, HANDLING, AND STORAGE

Subassemblies of secondary-unit substations shall be delivered, stored, handled, and installed in a manner that will not damage the equipment. Temporary connection to space heaters shall be provided during storage onsite.

During installation, equipment shall be protected from the weather.

1.6 MANUFACTURER'S SERVICE REPRESENTATIVE

The Contractor shall furnish the services of qualified manufacturer's representative(s) to supervise the installation, site testing and initial operations of the secondary switchgear and associated controls. The representative shall be employed by the switchgear manufacturer or certified in writing by the switchgear manufacturer as qualified to determine the correctness of the installation, circuit breaker mechanical and electrical tests, perform relay trip unit settings and control system operations in accordance with contract drawings, specifications and manufacturer's requirements. The representative's qualifications shall be submitted for approval 30 days prior to start of work.

Each assembly shall be carefully aligned, leveled, and secured to the concrete floor under the direct supervision of the equipment manufacturer's authorized technical representative who shall be given full authority in

the determination of installation procedures. Cost of such service shall be included as a part of this contract. The representative shall be present at the site during the two days of each weekend installation.

1.7 PROTECTIVE DEVICE COORDINATION SPECIALIST

Services of an outside engineering/testing firm specializing in setting relays and coordinating systems associated with electric-power apparatus to coordinate and adjust all circuit-interrupting devices before the substation is energized.

1.8 SHOP DRAWINGS

Schematic, wiring, and interconnection drawings shall be drawn and submitted for approval. The drawings shall show wire identification numbers, terminal block numbers and equipment/component identification numbers as a minimum. All power and control wiring between the primary switch, transformers, secondary switchgear and remote panels shall be clearly identified on the drawings. These drawings shall be submitted for approval prior to starting work.

1.9 PRELIMINARY SUBSTATION PLAN VIEW DRAWINGS

The Contractor shall submit to the Government, for approval, Plan View drawings with dimensions showing outlines of the new unit substations and switchgear in position on the existing concrete pads. The drawings shall show, in detail, the relationship between the new equipment cable entry space and the existing conduit stub-ups. The drawings shall show clearances for door swings and distances from existing fences, etc. The drawings shall be transmitted to the Government prior to approval of the new equipment.

PART 2 PRODUCTS

2.1 EQUIPMENT STANDARDS

Secondary unit substation shall conform to the standards indicated separately for each section (incoming, transformer, outgoing) in this specification. Substation primary switch, transformer and secondary switchgear sections shall be configured to align with existing primary and secondary cable penetrations in existing concrete foundation slabs. Above grade secondary conduits shall be modified as indicated on the contract drawings to accommodate the new switchgear configuration.

2.2 ELECTRICAL CHARACTERISTICS

2.2.1 Ratings

Ratings for unit substations shall be as indicated on the contract drawings and these specifications.

2.2.2 Insulation Class

Incoming and transformer primary windings shall be insulated for

5,000-volts for connection to 2,400-volt three-phase, 60-hertz, power-distribution system.

2.2.3 Basic Impulse Insulation Levels

Basic impulse insulation levels of the incoming and transforming sections of complete secondary-unit substations shall be in accordance with UL 1062 for the voltage levels specified.

2.3 INCOMING SECTION

2.3.1 Cable Terminations

Cable terminations shall be installed in accordance with specification Section 16124.

2.3.2 Switchgear and Auxiliary Equipment Compartments

Switchgear and auxiliary equipment of the incoming section shall comprise a metal-enclosed switchgear assembly in self-contained, self-supporting, ventilated-unit sheet metal compartments joined together to form a continuous structure with front-hinged panels and hinged rear covers. Units located outdoors shall have NEMA 3R weatherproof enclosures.

Barriers between adjacent compartments and the major components of each circuit within a compartment shall be sheet steel not less than 11 gage. Other covers, barriers, panels, and doors shall be not less than 14 gage.

Sheet metal barriers and enclosures shall be constructed from cold-rolled carbon-steel sheets of commercial quality with stretcher-level flatness conforming to ASTM A 366/A 366M. Each compartment shall be reinforced with structural members and welded together. Welds shall be ground to a smooth flat surface before painting.

Compartments shall be completely bused with insulated rigid silver-plated copper solid bus bar of rectangular cross section. Arrangement of main buses and bus tap connections shall be uniformly positioned and phase-sequenced in accordance with IEEE C37.20.3.

Buses shall be supported and braced to withstand the maximum short-circuit stresses that would be incurred under the most severe fault conditions. Contact surfaces of main bus and tap connections shall be silver plated and bolted together to ensure maximum conductivity.

The main bus shall be readily accessible for connection of future switchgear assemblies at either end.

The voltage rating and insulation level of switchgear assemblies be in accordance with IEEE C37.20.3.

Temperature limits for insulating materials used in switchgear assemblies shall be in accordance with IEEE C37.20.3.

Temperature limits for buses and bus tap connections in switchgear

assemblies shall be in accordance with IEEE C37.20.3.

A continuous rigid copper ground bus shall extend throughout the entire incoming-line section and shall ground the stationary structure and equipment. Ground bus shall be capable of carrying the rated short-circuit current of the protective device in the switchgear assembly for a minimum period of 2 seconds.

Underfloor and inside roof section of the outdoor switchgear and auxiliary compartments shall be undercoated with a heavy plastic or rubberized protective sealing material at least 1/32-inch thick. Sealing material containing asbestos shall not be used.

Each compartment of the switchgear assembly shall be identified with the manufacturer's standard identification plate engraved with switch number and system voltage (example: 2400 volt, three phase, 60 Hertz).

2.3.3 Switchgear Assemblies

General arrangement of the incoming section, the number of compartments, and each compartment's components shall be as follows.

Incoming-line switchgear compartments shall include the following:

- Metal-enclosed compartment for housing cable termination to primary side of transformer

- Provision for terminating cable

- 6 Power fuses (3 spare)

- Fuse holders on inside of front door to store spare fuses

- Key interlock between existing switch and secondary main breaker

Incoming-line bus entrance compartment shall include an insulated rigid silver-plated copper bus for direct connection of the incoming cables to the main bus, with provision for terminating cables.

Auxiliary transition compartment shall include an insulated rigid silver-plated copper bus for direct connection of adjacent auxiliary or switchgear compartments to the throat of the transformer section. Rigid copper bus shall be supported to withstand a 50,000-ampere rms short circuit and shall be rated for 65-degree C temperature rise.

2.4 TRANSFORMER SECTION

2.4.1 Transformers, Outdoor Oil Cooled

Transformer in the transformer section of secondary unit substations shall be the two-winding, three-phase, 60-hertz, oil-immersed, 55/65 degrees C rise, self-cooled, Class OA outdoor-type conforming to IEEE C57.12.00, ANSI C57.12.10, and IEEE C57.12.80.

REPLACE 750 KVA UNIT SUBSTATION - B1208

Transformer shall include a core-and-coil assembly enclosed in a sealed, airtight and oiltight tank with accessories and auxiliary equipment.

Core shall be built up with laminated, nonaging, high-permeability, grain-oriented, cold-rolled, silicon sheet steel. Laminations shall be coated with an insulating film or finish to minimize eddy-current losses. Sheet steel shall conform to ASTM A 345.

High- and low-voltage coil sections shall consist of insulated copper conductors wound around the core. Coil sections shall be concentric to counteract forces incurred under short-circuit conditions and shall be provided with oil ducts to dissipate the heat generated in the windings. Coil sections shall be electrically connected together and to the respective terminal bushings of the transformer. Copper conductors in the high- and low-voltage coil sections shall conform to ASTM B 48, Type B for applications involving edgewise bending.

Walls, bottom, and cover of the transformer tank shall be fabricated from hot-rolled steel plate, with cooling tubes or radiators vertically mounted to the side walls of the tank. Transformer tank shall be welded construction with a base designed for using rollers or skidding in any direction. Tank shall have a manhole or handholes.

Transformer base shall be designed to provide natural draft ventilation under the transformer tank when the transformer is placed on a flat concrete foundation. Bottom of the transformer tank shall be undercoated with a heavy rubberized protective sealing material at least 1/32-inch thick. Sealing material containing asbestos shall not be used.

Cooling tubes shall be welded into headers which in turn shall be welded into the transformer tank wall.

A sealed tank oil preservation system shall be provided to seal the interior of the transformer from the atmosphere throughout a top oil temperature range to 100 degrees C. Gas and oil volume shall remain constant with internal gas pressure not exceeding 10 pounds per square inch, gage (psig) positive, or 8 psig negative. Provision shall be made for the relief of excessive internal pressure in the transformer tank.

Tank shall have a handhole in the cover. Circular handholes shall be not less than 9 inches in diameter. Rectangular handholes shall be not less than 4-1/2-inches wide and shall have an area of not less than 65 square inches.

The transformer shall be capable of withstanding full vacuum without damage. The transformer tank shall be capable of withstanding 15 psi positive pressure without damage.

The transformer tank shall be equipped with a pressure relief device with minimum pressure relief capacity in accordance with the Underwriters Laboratory listing requirements.

Transformers shall be provided with throats or flanges for the enclosure of side-wall bushings and their connections to the incoming enclosure and

outgoing sections of the unit substation, as required. Secondary neutral of the transformer shall be brought out through the wall of the tank into the secondary throat with a bushing identical to the secondary line bushings. All bushings shall have copper current carrying conductors.

One set of spare mounting gaskets shall be provided for bushings, handholes, and the gasket between the relief cover and flange on the mechanical relief device.

Primary winding of the transformer shall be equipped with four 2.5 percent full-capacity taps, two above and two below normal voltage, brought out to an externally operated manual tap changer. Tap-changer handle shall be capable of being padlocked in each tap position and shall be operated only when the transformer is deenergized.

Air terminal compartment shall be provided and sized per manufacturer's recommendation to accommodate connection between primary switch and transformer high voltage terminals.

Lifting, moving, and jacking facilities shall conform to ANSI C57.12.10.

Transformer accessories shall include a liquid-level indicator, liquid-temperature indicator, pressure/vacuum gage, drain with sampling port and filter valves, ground pads, and identification plate. Transformer accessories and their location shall conform to ANSI C57.12.10.

Transformer kilovolt-ampere (kVA) ratings are continuous and shall be based on temperature rise. Temperature limits shall not be exceeded when the transformer is delivering rated kVA output at rated secondary voltage, with or without tap connections, in accordance with IEEE C57.12.00.

Percent impedance voltage at the self-cooled rating shall be in accordance with ANSI C57.12.10.

Transformer sound level in decibels (dB) shall not exceed the following values: (Transformer nameplate shall indicate sound level of transformer).

<u>RATED kVA</u>	<u>WITHOUT FANS</u>
1,000	58 dB

Transformer shall be capable of withstanding, without injury, the mechanical and thermal stresses caused by short circuits on the external terminals of the low-voltage windings, in accordance with IEEE C57.12.00.

2.4.2 High Temperature Transformer Oil

The coolant oil shall be new, not reconditioned or reprocessed oil, in accordance with ASTM D 5222, Standard Specification for High Fire-Point Mineral Electrical Insulating Oils. The dielectric coolant shall be Underwriters Laboratory Classified "less-flammable" fluid meeting the requirements of the National Electrical Code (NFPA 70), Section 450-23 and the requirements of the National Electrical Safety Code (IEEE C2), Section 15. The coolant shall have a minimum fire point of 300 degrees Centigrade

in accordance with the ASTM D 92 Cleveland Open Cup Test Method. The fluid shall be non-toxic, biodegradable, and non-bioaccumulating and shall be Factory Mutual approved. Dielectric strength shall be 56 kV at 25 degrees Centigrade in accordance with ASTM D 1816 and shall be 43 kV at 25 degrees Centigrade in accordance with ASTM D 877. The Relativity Permittivity (dielectric constant) shall be 2.2 at 25 degrees Centigrade and the Dissipation Factor (Power Factor) shall be 0.10 percent at 100 degrees Centigrade in accordance with ASTM D 924.

A Material Safety Data Sheet (MSDS) shall be submitted for review. If requested by the Government, a list of customers that have successfully used this coolant in transformers shall be submitted for review.

A label shall be attached to the transformer stating that only high temperature cooling oil shall be used in the transformer.

Provide one spare 55 gallon drum of High Temperature (R-Temp) transformer oil and turn over to the Government.

2.4.3 Metal-Enclosed Bus, Secondary Transition Section

A transition compartment shall be provided to include an insulated rigid silver-plated copper bus for direct connection to the throat of the transformer section.

Metal-enclosed bus shall be nonsegregated group phase construction and shall include rigid insulated conductors and supports in a grounded metal enclosure with associated ventilation and space-heater enclosures, condensation barriers, expansion and connection joints, and fittings in accordance with IEEE C37.20.1.

Enclosures shall be completely bused with an insulated solid rigid copper bus bar of rectangular cross section. Bus bar and connections shall be uniformly positioned and phase sequenced within the enclosure for adaptation to metal-clad switchgear assemblies and power transformers, in accordance with IEEE C37.20.1.

Bus bar shall be supported and braced to withstand short-circuit stresses with momentary current ratings, in accordance with IEEE C37.20.1. Surfaces of all bus connections shall be silverplated and bolted together to ensure maximum conductivity. Voltage and current ratings shall conform to IEEE C37.20.1.

Insulating supports shall consist of track-resistant, flame-retardant IEEE Class 130 electrical insulating materials. Voltage rating and insulation level shall conform to IEEE C37.20.1.

Sheetmetal weatherproof enclosures shall be constructed from carbon steel sheets of commercial quality, not less than 14 gage. Each vertical section of the switchgear shall be reinforced with structural members and welded together. Complete assembly shall be structurally supported as indicated.

Temperature limits for a metal-enclosed bus shall conform to IEEE C37.20.1.

2.5 OUTGOING SECTION

2.5.1 Switchgear and Auxiliary Equipment Compartments

Switchgear and auxiliary equipment of the outgoing section shall be a metal-enclosed, low-voltage power circuit switchgear assembly in a self-contained self-supporting unit with sheet metal compartments joined together to form a continuous structure.

Substation No. 2 is located outdoors and shall have NEMA 3R weatherproof enclosures with maintenance aisles in accordance with the paragraph entitled, "Weatherproof Enclosure With Maintenance Aisle", except a common aisle shall be provided as indicated on the contract drawings and as designed by the Contractor with Government approval.

Unit sheet metal housing shall enclose one or more vertically mounted power circuit breakers or auxiliary equipment in individual sheet metal compartments and a full height rear compartment. Housing shall be approximately 90 inches high with individual ventilated front-hinged panels and bolted top and rear hinged covers. Rear compartment shall contain the main bus, main bus tap connections, cable connections, and instrument transformers.

Barriers between a sectionalized bus with bus sectionalizing breakers in a compartment shall be sheet steel not less than 11 gage. Other covers, barriers, panels, and doors shall be not less than 14 gage.

Sheet metal barriers and enclosures shall be constructed from cold-rolled carbon-steel sheets of commercial quality with stretcher-level flatness conforming to ASTM A 366/A 366M. Each compartment shall be reinforced with structural members and welded together. Welds shall be ground to a smooth flat surface before painting.

Removable elements of the same type and rating in the switchgear assembly shall be physically and electrically interchangeable in corresponding compartments.

Low voltage penetrations between cubicle barriers shall be insulated with rubber grommets or neoprene bushings.

Front-hinged panel shall be suitable for mounting instruments, relays, control switches, and indicating lamps.

Switchgear compartments shall be completely bused with insulated rigid silver-plated copper solid busbar of rectangular cross section. Main buses and bus-tap connections shall be uniformly positioned and phase sequenced in accordance with IEEE C37.20.1.

Buses shall be supported and braced to withstand the maximum short-circuit stresses that would be incurred under the most severe fault conditions. Surfaces of all main bus and tap connections shall be silver plated and bolted together to ensure maximum conductivity.

Main bus shall be readily accessible for connection of future switchgear

assemblies at either end.

Voltage rating and insulation level of switchgear assemblies shall conform to IEEE C37.20.1.

Temperature limits for buses and bus-tap connections in switchgear assemblies shall be in accordance with IEEE C37.20.1.

A continuous rigid copper ground bus shall extend throughout the entire outgoing-line section and shall ground the stationary structure and equipment. Ground bus shall be capable of carrying the maximum rated short-circuit current of the protective device in the switchgear assembly for a minimum period of 1.0 second. The ground shall be clearly visible and accessible from the rear cable entrance compartments.

Low-voltage wiring for controls and accessories shall be run to terminal blocks having numbered points, as indicated, to identify all circuits. All low-voltage wiring shall be run in conduit, raceways, or wiring troughs to isolate the wiring from high-voltage circuits.

Each compartment of the switchgear assembly shall be identified with the manufacturer's standard identification plate engraved with circuit and function designations. Compartments shall be completely wired with cable terminals, cable clamps, control bus, control power switch, and terminal blocks. Terminal blocks shall be readily accessible for the external connections of metal-clad switchgear.

Each compartment door shall be supported with adjustable continuous hinges. The hinges shall be sized to support the door and any control components, new or future, to be mounted on the door.

Low voltage control wiring from door mounted equipment shall be protected and arranged to prevent chafing when opening and closing the door. Wire harness ties shall be installed on all low voltage wiring and shall be fastened with sheet metal screws to the compartment steel.

2.5.2 Switchgear Assemblies

General arrangement of the outgoing section, the number of compartments, and each compartment's components shall be as indicated on the contract drawings.

Secondary switchgear compartments shall include the following equipment:

- Metal-enclosed low-voltage main drawout type power circuit breaker with key interlock to incoming air interrupter switch.

- Metal-enclosed low-voltage feeder drawout type power circuit breakers

- Provisions for terminating cables (all lugs shall be copper)

- Solid-state relay trip unit with current sensors

- Current transformers

Control power transformer and primary fuses and secondary breakers for 120 volt receptacles and lights

Potential transformers

Solid-state metering devices as specified in Section 16286 of this specification

Switchgear compartments for future use shall be fully equipped to receive the removable element with complete bus connections, disconnecting devices, bus, and cell interlocks.

Main and feeder power circuit breakers shall be fully rated and arranged for selective trip systems in accordance with NEMA SG 5.

Each electric circuit breaker shall have a compartment terminal block and a master terminal block located near incoming feeder conduits that shall be completely wired and labeled for remote trip and close control and remote open and close light indication whether remotely wired or not. New electric control and indication functions shall operate properly using existing remote wiring. Provide schematic and wiring diagrams for each type electric circuit breaker.

All secondary feeder circuit breakers shall be provided with cast copper lugs for existing and future cable or wire connections. Compression type shall be provided for cables above 500 kcmil.

Filler compartments incidental to the switchgear assembly shall be empty compartments with bolted cover plates.

Main and feeder power circuit breakers shall be fully rated and arranged for selective trip systems in accordance with NEMA SG 5.

Where an existing switchgear connection is to be made, flexible copper bus connections shall be provided, including all connectors to assure proper alignment and connection. Also, all metal connections shall include new gasket and bolt hardware.

2.6 SWITCHGEAR COMPONENTS

2.6.1 Power Circuit Breakers

Power circuit breakers shall conform to the applicable requirements of Section 16286, "Overcurrent Protective Devices."

2.6.2 Molded-Case Circuit Breakers

Molded-case circuit breakers shall conform to the applicable requirements of Section 16286, "Metering, Control and Overcurrent Protective and Control Devices."

2.6.3 Instruments and Instrument Transformers

Indicating instruments, protective relays, current and potential transformers, instrument transfer switches, control-power transformers, and the like shall conform to the applicable requirements of Section 16286, "Overcurrent Protective Devices."

2.6.4 Control-Power Circuit Overcurrent Protection

Branch-circuit breakers shall provide circuit overload protection to compartment heater, lights, convenience outlets, transformer fans, and other substation devices. All convenience outlet shall have ground fault circuit interrupter type receptacles.

2.6.5 Service and Maintenance Devices

The following service and maintenance devices shall be included as a part of the substation:

A manual handle for operating the power circuit breaker isolating mechanism

Removable manual maintenance closing devices for power circuit breakers

Facilities for operating power circuit breakers in the test or removed position

Sliding hoist or other device for withdrawing power circuit breakers for inspection or maintenance. Hoist shall be permanently mounted at the top of the section inside weatherproof housing.

Test set or device for setting solid-state trip units. The device shall show current and time for setting solid state relay devices.

2.6.6 Hoist for Power Circuit Breakers

On outdoor units, a hoisting means shall be provided for lifting each circuit breaker out of its compartment with capability of lowering or lifting each breaker to any compartment and down to floor level. Hoist motor, power, control, track, etc., shall be furnished and demonstrated for an operational system. The hoist continuous track shall be supported from the weatherproof structure and shall be level so that the hoist will remain steady without rolling to either end of the track. Hoist shall be enclosed inside weatherproof maintenance aisle.

On indoor units, track lifting arrangement and hoist shall be supported from the switchgear roof and shall avoid top entrance conduits by rearranging conduits and wires inside or by other means.

2.6.7 Protective Relays and Devices

Protective relays and devices shall comply with Section 16286, "Metering, Control and Overcurrent Protective and Control Devices."

2.6.8 Solid State Metering Devices

Solid state metering devices shall comply with Section 16286.

2.7 SPACE HEATERS

Each section of the outdoor secondary unit substation, including the primary switch, and the secondary switchgear assemblies, shall be equipped with space heaters to provide approximately 4 watts per square foot of outer surface area. Heaters shall be such that the power density does not exceed 4 watts per square inch of heater element surface. Heaters shall be rated at 240 volts for connection to 120 volts.

Heaters shall be accessible and located at the lowest portion of each space to be heated. Terminals shall be mounted on standoff insulated posts and covered using insulated covers. Perforated stainless steel protective cover shall be provided to cover the heater. Thermostats with adjustable knob shall be used to regulate the temperature. Heaters and any other devices shall not be mounted on or from the substation ground bus.

All heaters shall be installed and operable at the time of shipment so that the heaters can be operated immediately upon arrival at the site, during storage, or before installation. Connection locations shall be marked prominently on drawings and shipping covers and shall have temporary leads for storage operation. Leads shall be easily accessible without having to remove shipping protection.

2.8 WEATHERPROOF ENCLOSURES WITH MAINTENANCE AISLES

Weatherproof enclosures for switchgear assemblies with enclosed maintenance aisles shall be constructed in accordance with IEEE C37.20.1 and shall consist of indoor switchgear and auxiliary compartments installed in a sheet metal, weatherproof housing, with operating aisle space for the inspection, operation, and maintenance of equipment.

Weatherproof enclosures shall consist of framed sheet metal roof sections; front, rear, and side panels; front or side hinged doors, rear hinged doors, floor plates; and supporting floor channels. Ventilated access doors shall be located as indicated with safety latches conforming to ANSI C156.2 that permit quick release from the inside even when the doors are locked on the outside. Doors shall be flanged and shall close against rubber or similar weatherproof gasketing material. Ventilated openings shall be provided with filtered louvers and screened vents.

Each switchgear compartment shall include a removable steel floor plate which shall be drilled for conduit and cable during installation. Inside roof and floor of the weatherproof enclosure shall be undercoated with a heavy rubberized protective sealing material at least 1/32-inch thick. Asbestos sealing material shall not be used.

Weatherproof enclosures shall be equipped with electric space heaters (to minimize condensation), interior lighting, and utility outlets (GFCI type) with circuit overload protection.

Structural members and exterior coverings shall be constructed in accordance with ISS PC95/211.

Hot-rolled steel sheet plate and strip 1/8-inch thick and thicker shall conform to the requirements of ASTM A 36/A 36M. Hot-rolled steel sheet and strip less than 1/8-inch thick shall conform to the requirements of ASTM A 570/A 570M, Grade 36.

Enclosure shall be clear-span shed-roof design with a roof slope of not less than 1 inch in 12 inches of horizontal run. Structure shall be designed to withstand a roof live load of not less than 20 pounds per square foot and wind pressures of not less than 35 pounds per square foot. Interior floor plates and supporting floor channels shall be designed to withstand live loads of 250 pounds per square foot with deflections not exceeding 1/240 of the clear span.

2.9 PAINTING

After fabrication, exposed ferrous-metal surfaces of secondary-unit substations and components equipment shall be prepared and painted.

Cold-rolled steel sheet and plate shall be cleaned of dirt, rust, grease, and oil.

Hot-rolled steel sheet and plate shall be sand-, shot-, or grit-blasted to white metal to obtain a completely clean surface.

An undercoating compound of zinc-rich primer shall be applied with an intermediate coat of epoxy or polyurethane, oven cured and air dried, applied over the primer (minimum 3 mils thickness).

One final epoxy finish coat shall be applied overall (minimum 2 mils thickness).

The final coat shall be gray in accordance with FED-STD 595 and Specification Section 16003.

2.10 FACTORY TESTING

Factory tests on transformers and switchgear assemblies shall be made in accordance with the applicable provisions of the referenced standards.

Tests on transformers shall include resistance measurements of windings, ratio tests, polarity and phase-rotation tests, no-load loss at rated voltage, excitation current at rated voltage, impedance voltage and load-loss at rated current, and dielectric tests. Tests shall be conducted in accordance with IEEE C57.12.90.

Tests on switchgear assemblies shall include mechanical operational tests, electrical operation and control-wiring tests, relaying and metering circuit performance tests, and dielectric tests. Tests shall be conducted in accordance with IEEE Std 4.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installation shall conform to IEEE C2 and NFPA 70.

Each complete assembly shall be electrically and mechanically connected together at the site from coordinated subassemblies shipped in complete sections from the manufacturer. Installation shall be carefully aligned, leveled, and secured to the concrete foundation in accordance with the manufacturer's written instructions under the direct supervision of the equipment manufacturer's authorized technical representative who shall be given full authority in the determination of installation procedures. Cost of such service shall be included as a part of this contract.

Minimum size ground grid to switchgear ground connection shall be 4/0 AWG, copper ground wire, and shall also be connected to the switchgear ground bus.

All noncurrent-carrying parts and enclosures of the substation shall be bonded together and grounded to the substation ground pad with number 4/0 AWG, copper ground wire. Maximum resistance to ground of 10 ohms. All connections shall be exothermically welded in accordance with UL 467.

3.2 FIELD TESTING

All tests shall be performed by the Contractor in the presence of the Government Inspector. All test data shall be recorded, signed and submitted for approval by the Contractor. All tests shall be witnessed and signed by the Government Inspector.

Test equipment, labor, and technical assistance shall be provided to perform the electrical acceptance tests.

3.2.1 Preliminary Inspection and Testing

The following items shall be included in the field tests on the switchgear and submitted for approval:

Equipment shall be inspected for damage or maladjustment caused by shipment or installation. Wedges, ties, blocks, and other packing material installed by the manufacturer to prevent damage in shipment shall be removed.

Circuit breakers, circuit trip devices, metering devices, fuses and instrument transformers shall be verified to be of the proper type and range.

Electrical continuity tests shall be performed on current, potential, and control circuits.

Ratio and polarity tests shall be performed on current and potential transformers.

Insulation tests shall be performed on wiring, instrument-transformer secondary windings, and instruments.

Phase rotation shall be verified on each secondary switchgear prior to energizing outgoing feeder circuits.

The Contractor shall tag all secondary outgoing feeder circuits prior to disconnecting from the existing switchgear and shall verify all connections to the new switchgear. Care shall be taken to retag all extended (spliced) circuits to prevent connecting cables back to incorrect circuit breaker terminals.

3.2.2 Transformer Testing

The following transformer tests shall be performed in the presence of the Contracting Officer:

- Turns Ratio Test
- Phase Rotation Test
- Insulation Resistance Test
- Oil Dielectric Test

Transformer windings and main bus of secondary-unit substations shall be subjected to insulation resistance and high-voltage, 60-hertz withstand tests after installation is completed and ready for operation.

Test equipment, labor, and technical assistance shall be provided to perform the electrical acceptance tests.

Incoming section main bus and primary winding of the transformer shall be disconnected from the power supply and primary feeder cables, and the secondary windings of the transformer and switchgear enclosure shall be grounded before the insulation and high-voltage tests are conducted.

Outgoing section main bus and secondary winding of the transformer shall be disconnected from the secondary feeder cables and the primary winding of the transformer disconnected from the power supply and primary feeder cables. Primary windings and switchgear enclosure shall be grounded before conducting insulation and high-voltage tests.

Current-transformer secondary windings involved in the test shall be shorted and grounded. Potential- and control-power transformer fuses involved in the test shall be removed and the compartment grounded.

Primary winding of the transformer and the main bus of the incoming section shall be given an insulation-resistance test with a 2,500-volt insulation-resistance test set for the 2400-volt system and a 5,000-volt insulation-resistance test set for the 6600 and 6900 volt systems.

480-volt secondary winding of the transformer and the main bus of the outgoing section shall be given an insulation-resistance test with a 1,000-volt insulation-resistance test set and 1000 volt insulation-resistance test set for the 208-volt system.

208-volt secondary winding of the control power transformer and the main bus of the outgoing section shall be given an insulation-resistance test with a 500-volt insulation-resistance test set.

Test shall be applied for not less than 5 minutes and until three equal consecutive readings, 1 minute apart, are obtained. Readings shall be recorded every 30 seconds during the first 2 minutes and every minute thereafter. Minimum acceptable resistance reading shall be 100 megohms.

Transformer oil dielectric test shall be completed before transformers are energized in accordance with ASTM D 877. The breakdown voltage shall be not less than 25,000 volts.

3.3 SYSTEM COORDINATION RELAY SETTINGS AND TESTS

All circuit-interrupting devices shall be properly coordinated by the Contractor before the substation is energized. Protective relays shall be thoroughly inspected and adjusted at the site in the presence of and at the discretion of the Contracting Officer.

Trip ratings for all protective relays will be determined by the protective device coordination specialist and will be set in the presence of the Contracting Officer at the construction site.

After inspection of the circuit breakers and satisfactory manufacturer's tests have been completed on all active relay circuits under a no load condition, each solid state relay trip function shall be determined by primary current injection and each circuit breaker shall be given an operational test for all trip functions by primary current injection.

Trip ratings for all protective devices will be determined and submitted for approval by the Contractor. The relay trip settings shall be coordinated with the next up-line breaker and set to protect the outgoing feeder. The relay trip functions for each circuit breaker shall be set and tested by the Contractor in the presence of the Government Inspector prior to each weekend outage, using the manufacturer's recommended test device. The Contractor shall submit all necessary data and circuit breaker settings, along with a time-current characteristic curve showing the coordination of all protective devices and transformer inrush and damage points, 30 days prior to site work. The Government will provide up-line circuit breaker settings and all necessary short circuit values upon request by the Contractor. The Government will provide upstream trip settings to coordinate fuses, and transformer breaker trip setting should not change.

3.4 GROUNDING RESISTANCE TESTS

Each unit substation shall be tested for ground resistance after reconnecting existing ground wires. The substation resistance to ground shall not exceed 10 ohms.

3.5 WATER FIELD TEST

The Contractor shall perform a water field test on the completely assembled deenergized outdoor switchgear and medium voltage switch, using a 5/8 inch diameter or larger garden hose, not longer than one hundred feet from a Government owned hose bib that is connected to city water type pressure.

REPLACE 750 KVA UNIT SUBSTATION - B1208

The Contractor shall furnish all test equipment from the hose bib. Adjust garden hose nozzle for a spray rate of between two and four gallons per minute. Test roof and each side, at approximately ten feet from each surface, at a spray angle of 75 degrees, for duration of five minutes for each surface tested. The equipment shall meet the following conditions:

- a) No water on primary or secondary insulation
- b) No water on any electrical components or mechanisms of the assembly
- c) No water shall enter the structure

The equipment shall be reworked by the Contractor until these conditions are obtained.

3.6 ENERGIZING SECONDARY UNIT SUBSTATION

Secondary unit substations shall not be energized until completely installed, tested, and all test data approved by the Government.

3.7 FINAL ACCEPTANCE

Tests and procedures for testing shall be in accordance with the manufacturer's recommendations, as approved by the Contracting Officer.

Final acceptance shall depend upon the satisfactory performance of the equipment under test. Substation shall not be energized until recorded test data have been approved by the Contracting Officer.

-- End of Section --