

Nevada National Security Site (NNSS)

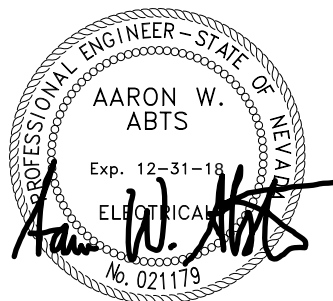
Substation 6-21

SPECIFICATION FOR METAL CLAD SWITCHGEAR PREFABRICATED EQUIPMENT ENCLOSURE

SPECIFICATION NO. 02119-SPC-E03



0	12/3/18	Issued for Solicitation		AWA		
REV.	DATE	REASON FOR REVISION	BY	CHK	EGS	PE



12/3/18

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ATTACHMENTS:

- A. Technical Requirements Data Sheet
 - a. Ratings and Requirements for Metal Clad Switchgear
 - b. Ratings and Requirements for Prefabricated Equipment Enclosure
- B. Engineering Document Requirements – Form FRM 1469
- C. Quality Verification Document Requirements - Form FRM-1470

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PART 1 - GENERAL

1.1 SCOPE

- A. This Specification covers the manufacturer, furnishing, delivering, and testing of a Prefabricated Equipment Enclosure and its accessories for installation at the Nevada National Security Site (NNSS). The Prefabricated Equipment Enclosure and accessories shall be in accordance with the following standards and supplements: American Society for Testing Materials (ASTM), Metal Building Manufacturers Association (MBMA), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) Standards insofar as consistent with these Specifications.
- B. Work in this Specification includes, the following items:
1. One (1) 15kV two (2) section Metal Clad Switchgear lineup.
 2. One (1) 120/240 VAC Panelboard.
 3. DC Power Cab 120.
 4. Protective Relays and Controls.
 5. Raceway system.
 6. Heating, ventilation, and cooling.
 7. Desk, chair and file cabinet.
 8. Combined RTU & Communication Enclosure.
- C. Related Work Specified Elsewhere: In addition to work described above the following items are included in the scope.
1. Special Tools necessary for installation, testing and maintenance.
 2. Necessary drawings, instructions and test reports in the English language.
 3. In addition to other Submittal requirements, final drawings shall be submitted as MicroStation V8i files on PC compatible CD-ROM.
 4. Maintenance equipment and spare parts.
- D. Description:
1. Metal Clad Switchgear shall have one (1) 15kV vacuum circuit breaker position with protective relay and controls, one (1) revenue meter, one set of (1) protective relays and controls for 34.5kV line, one (1) transformer differential protection relay, VT's and single ratio BCT as shown in Contract Documents.
 2. All necessary hardware for installing and testing shall be provided with Metal Clad Switchgear.
 3. Metal Clad Switchgear shall be mounted within the Prefabricated Equipment Enclosure.
 4. The Metal Clad Switchgear will be connected to a 34.5kV-12.47kV, 3.75MVA, 3 phase Transformer. Connection between the transformer and the switchgear will be underground cables, consisting of one (1) 2/0 AWG 15kV cable, per phase.
 5. The CONTRACTOR shall make provisions to interface the feeder breaker of the Metal Clad Switchgear with the low voltage side of the power transformer located within the substation.
 6. The MANUFACTURER shall provide a NEMA four-hole pad and insulating boots for incoming and outgoing cable connection of (1) 2/0 AWG 15kV cable, per phase.
 7. Furnish two (2) Sections with four compartments to contain the equipment specified in Contract Documents.
 8. The Circuit Breaker shall be designed, rated, tested, and manufactured in accordance with codes and standards stated herein, except that in event of contradictory requirements

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between IEEE, ANSI, or NEMA and this Specification.

9. Furnish relays, controls and associated accessories and hardware as required for a complete functional and operational system.

1.2 REFERENCES

A. Abbreviations for standard organization is as follows:

1. American National Standards Institute (ANSI)
2. American Society of Mechanical Engineers (ASME)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. National Electrical Manufacturers Association (NEMA)
5. Occupational Safety and Health Act (OSHA)
6. American Society for Testing and Materials (ASTM)

B. Design, construct, assemble and test all equipment furnished to conform with, but not limited to, the latest revisions of the following applicable Codes and Standards, (the latest revision of the following standards shall apply):

- ANSI/IEEE 32 - Requirements, Terminology and Test Procedure for Neutral Grounding Devices.
- ANSI/NEMA CC-1 – Electric Power Connection for Substations
- ANSI C12.1 - Code for Electricity Metering.
- ANSI C29.1 - Test Methods for Electrical Power Insulators.
- ANSI C29.9 - Wet-Process Porcelain Insulators (Apparatus, Post Type).
- ANSI/IEEE C37.30 - Requirements for High-Voltage Switches.
- ANSI/IEEE C37.32 - Switchgear - High-Voltage Air Switches, Bus Supports, and Switch Accessories – Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide.
- ANSI/IEEE C37.46 – Specifications for High-Voltage (>1000V) Expulsion and Current – Limiting Power Class Fuses and Fuse Disconnecting Switches.
- ANSI/IEEE C37.47 - Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses.
- ANSI C39.1 - Requirements for Electrical Analog Indicating Instruments.
- ANSI/IEEE C57.12.10 – Requirements For Liquid-Immersed Power Transformers.
- ANSI/IEEE C57.19.01 - Performance Characteristics and Dimensions for Outdoor Apparatus Bushings.
- ANSI/NETA MTS-2011 - AMERICAN NATIONAL STANDARD STANDARD FOR MAINTENANCE TESTING SPECIFICATIONS for Electrical Power Equipment and Systems
- IEEE C2 - National Electrical Safety Code.
- IEEE C37.04 - Rating Structure for AC High-Voltage Circuit Breakers.
- IEEE C37.06 - Switchgear - AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities.
- IEEE C37.09 - Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
- IEEE C37.12 – Guide for Specifications of High-Voltage Circuit Breakers (Over 1000 Volts).
- IEEE C37.010 - Applications Guide for AC High-Voltage Circuit Breakers

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- Rated on a Symmetrical Current Basis.
- IEEE C37.20.2 - Metal-Clad Switchgear.
- IEEE C37.40 Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories.
- IEEE C37.41 - Design Tests for High-Voltage (>1000V) Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories.
- IEEE C37.90 – Standard for Relays and Relay Systems Associated with Electric Power Apparatus.
- IEEE C37.90.1 – IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.
- IEEE C37.100 - Definitions for Power Switchgear.
- IEEE C57.12.00 - General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
- IEEE C57.12.28 – Pad-Mounted Equipment-Enclosure Integrity
- IEEE C57.12.90 - Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers.
- IEEE C57.13 - Requirements for Instrument Transformers.
- IEEE C62.11 - Metal-Oxide Surge Arresters for AC Power Circuits (>1kV)
- IEEE C62.22 - Application of Metal-Oxide Surge Arresters for Alternating-Current Systems.
- IEEE 1291 – Guide for Partial Discharge Measurement in Power Switchgear
- IEEE 386 – Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
- IEEE 4 – Techniques for High-Voltage Testing
- IEEE 450 – Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations.
- IEEE 484 – Recommend Practice for Installation Design and Installation of Large Lead Storage Batteries for Generating Stations and Substations.
- IEEE 485 – Recommend Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations.
- NEMA ICS 1 - Industrial Control and Systems.
- NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- NEMA LA 1 - Surge Arresters.
- NEMA SG 4 - Alternating-Current High Voltage Circuit Breaker.
- NEMA SG 5 - Power Switchgear Assemblies.
- NEMA SG 6 - Power Switching Equipment.
- NEMA SG 7 - Manufactured Labels for Switchgear Assemblies.
- NEMA 107 – Methods of Measurement of Radio Influence Voltage (RIV) of High Voltage Apparatus
- NEMA AB-1 – Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures
- NEMA EI 21.1 – Instrument Transformers for Revenue Metering (110kV BIL and Less)
- NEMA SG 2 – High-Voltage Fuses.

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- NEMA WC-3 – Rubber-Insulated Wire & Cable for the Transmission & Distribution of Electrical Energy.
- OSHA – 1970(84 Stat. 1593) Part 1910 Occupational Safety and Health Standards
- NFPA 70 - National Electrical Code.
- ASTM A36 – Carbon Structural Steel.
- ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- ASTM A283 - Low and Intermediate Tensile Strength Carbon Steel Plates.
- ASTM A663 - Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
- ASTM A675 - Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
- ASTM B5 –High Conductivity Tough-Pitch Copper Refinery Shapes.
- ASTM B187 - Copper Bus Bar, Rod, and Shapes.
- ASTM B188 - Seamless Copper Bus Pipe and Tube.
- ASTM B211 - Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
- ASTM B236 - Aluminum Bars for Electrical Purposes (Bus Bars).
- ASTM B317 - Aluminum-Alloy Extruded Bar, Rod, Pipe, Structural Profiles, and Profiles for Electrical Purposes (Bus Conductors).
- ASTM E84 – Test Methods for Surface Burning Characteristics of Building Materials.
- UL 67 - Panelboards.
- UL 506 - Specialty Transformers.
- UL 508 - Industrial Control Equipment.
- UL 857 - Busways
- UL 347 – Medium-Voltage AC Contactors.

REFERENCE DRAWINGS:

02119-E-6001	ONE LINE DIAGRAM
02119-E-6003 SH 1	THREE LINE DIAGRAM 34.5 KV
02119-E-6024	THREE LINE DIAGRAM - SECTION 1
02119-E-6025	THREE LINE DIAGRAM - SECTION 2

- C. All equipment shall be constructed such that when installed it will conform to the applicable rules of the National Electrical Safety Code & NEC.
- D. Local and State Ordinances shall also be adhered to for the equipment.
- E. Factory Tests:
1. The CONTRACTOR reserves the rights to witness factory testing. The MANUFACTURER shall notify the CONTRACTOR not less than two weeks prior to the starting date of the factory tests.
 2. Conduct factory tests of all equipment as required by applicable IEEE, ANSI, and NEMA standards including, but not limited to:
 - a. Breakers: ANSI/IEEE C37.09
 - b. Switchgear: ANSI/IEEE C37.20.2

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3. Conduct on all system components and subassemblies to assure that all devices and systems are in proper working order before delivery to jobsite.
4. Simulate actual system operation.
5. Submit test reports as specified.

1.3 SUBMITTALS

- A. Technical submittals shall be as specified in the Attachments to these Specifications:
- B. The CONTRACTOR shall provide a complete list of Engineering and Quality Document for the CONTRACTOR's tracking purposes, per Contract Documents. This list shall be comprised of all the documents to satisfy the requirements of Contract.
- C. Furnish the following types of drawings and documents:
 1. Furnish drawings necessary for design, erection, installation, and operation of all equipment and materials furnished including, but not limited to, the following:
 - a. Complete arrangement and outline drawings to an exact scale with complete dimensions, bill of material item numbers, phase and equipment number tag locations, and enlarged details for complete description of installation.
 - b. Side view drawings of the prefabricated equipment enclosure showing all wall mounted equipment.
 - c. Installation drawings.
 - d. Connection diagrams.
 - e. Complete bill of material including item numbers and MANUFACTURER's catalog numbers.
 - f. Complete drawings and descriptive bulletins for installation, adjustment, testing, maintenance, and operation of all equipment including bus weldments, connectors, insulators, etc.
 - g. General nameplate, and internal wiring diagrams and drawings of all equipment.
 - h. Three-line and Schematic diagrams showing all external electrical connection terminal numbers.
 - i. Catalog cut sheets.
 - j. Instrument transformer performance curves and data.
 - k. Insulator outline drawings.
 - l. Drawings showing additional detail, required for installation and maintenance.
 - m. List of identification tags, including dimensions and text for each tag.
 - n. Instruction, Operating, installation and maintenance manuals.
 - o. CONTRACTOR shall furnish catalog information and Material Safety Data Sheets (MSDS) for all materials where applicable.
 2. Separate schematic and wiring diagrams shall be submitted for each breaker furnished. "Typical" drawings covering several breakers will not be acceptable.
 3. Standard drawings of equipment which do not indicated clearly the exact size, model number, and optional items to be furnished will be returned to the VENDOR for this information before review by the CONTRACTOR.
 4. Table showing on each anchor bolt, forces due to Dead load, Live load, Operation loads, Wind loads (direction x-x), Wind loads (direction y-y), Seismic loads (direction x-x), Seismic loads (direction y-y).
 5. The center of gravity, location of the anchor bolts, base plates dimensions and information about the holes-diameter, edge distance from each side.
 6. Shipping drawings showing weight, lifting positions, bracing requirements and shipping

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instructions.

7. In addition to other Submittal requirements, final drawings shall be submitted as MicroStation V8i files on PC compatible CD-ROM.

D. Building Details:

1. Complete specifications including thermal insulating values of enclosure.
2. Detailed live load, seismic load, wind load, and snow load capabilities of enclosure wall, roof and floor.
3. Fabrication and erection drawings, floor plan, elevations, details, anchorage requirements, and layout.
4. Color chart for selection of panel and floor colors.
5. Paint specifications
6. Complete installation, erection, operation, and maintenance instructions.
7. Locations, magnitudes, and directions of resultant structural loads of the enclosures, including all necessary calculations, installed equipment loads and all design loads.
8. Shipping drawings showing weight, lifting positions, center of gravity, bracing requirements and shipping instructions.
9. Foundation requirements.
10. Structural framing-floor.
11. Structural framing-walls.
12. Building sections.
13. Interior layout.
14. Exterior layout.
15. Floor plan and equipment schedule.
16. Interior elevations.
17. Convenience power and lighting design.
18. Cable Tray and/or Raceway layout and support details.
19. Penetration details.

E. Electrical and Mechanical equipment:

1. Physical outline drawings.
2. Wiring diagrams.
3. Technical information such as overall dimensions, weight and rates, center of gravity.
4. Catalog cuts.
5. Nameplate engravings.
6. Instruction books.
7. Operations and maintenance manuals.

F. Product Certificate:

1. Letter of Design Certification: Signed and sealed by a qualified Professional Engineer. Include the following:
 - a. Name and location of Project.
 - b. Order number.
 - c. Name of MANUFACTURER.
 - d. Building dimensions including width, length, height, and roof slope.
 - e. Indicate compliance with IAS standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - f. Governing building code IBC2006.

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- g. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - h. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - i. Building-Use Category: Indicate category of building use and its effect on load importance factors.
 - j. IAS Certification for Category MB: Include statement that metal building system and components were designed and produced in an IAS-Certified Facility by an IAS-Certified MANUFACTURER.
 - G. Material Test Reports: Signed by MANUFACTURERS certifying that the following products comply with requirements of this Specification.
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
- 1.4 QUALITY ASSURANCE
- A. Quality Control assurance will be conducted in accordance with the requirements stated in the CONTRACTOR documents.
 - B. Comply with the applicable codes and standards referenced in this Specification. Compliance with Attachment C.
 - C. The CONTRACTOR reserves the right to inspect materials and workmanship at all stages of manufacture and to witness any or all tests including complete assembly as described in the respective sections.
- 1.5 DELIVERY, STORAGE AND HANDLING
- A. Metal Clad Switchgear section shall be shipped as part of the Prefabricated Equipment Enclosure.
 - B. Prefabricated Equipment Enclosure shall be delivered as one single section with no shipping splits.
 - C. Withdrawable circuit breaker shall be shipped separately from housing.
 - D. Preparation for shipment shall protect the Metal Clad Switchgear auxiliary devices accessories, etc. against corrosion, dampness, breakage or vibration injury during transportation and handling.
 - E. A copy of the operating instructions, along with packing slip, shall be forwarded with the equipment.

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- F. Boxing, crating, or otherwise protection of all shipped unassembled equipment shall be suitable for outdoor storage. Each item shall be tagged with the project number, MANUFACTURER number, bill of material number, and item number.
 - G. Labor and support for off-loading and assembly at the NNSS will be provided by others.
 - H. The CONTRACTOR shall be notified the day shipment is made, indicating carriers, routing, actual shipping height and weight of Prefabricated Equipment Enclosure listed on the freight bill. Refer to the Purchase Order for delivery date and exact destination.
 - I. The CONTRACTOR reserves the right to inspect the Metal Clad Switchgear at the MANUFACTURERs facility prior to shipping to prove compliance with this Specification.
 - J. No welding shall be required for field assembly.
 - K. The VENDOR shall provide the necessary storage and protection literature for the Metal Clad Switchgear.
 - L. Prior to packing, the equipment shall be cleaned to remove all dirt and waste material left from fabrication.
 - M. The shipping container shall be provided with supports, lifting eyes etc. to maintain alignment of parts during shipping, handling, hoisting, and installation. Location of lifting points shall be clearly marked on shipping container and on Contract Drawings. The shipping container shall have its weight and center of gravity clearly marked on the container.
 - N. Equipment and material shall be loaded and transported in such a manner that delivery will be made without damage.
- 1.6 PROJECT CONDITIONS
- A. Service Conditions: The equipment shall be suitable for operation at normal service conditions as described in Paragraph 2.01.A.3
- 1.7 FIELD TECHNICAL SERVICE (OPTIONAL PRICING)
- 1. Field service representative shall provide technical support during installation and initial startup of the equipment and appropriate training for operating and maintenance personnel, if required. These services shall be quoted as an option in the proposal.

PART 2 - PRODUCT REQUIREMENTS

2.1 PREFABRICATED EQUIPMENT ENCLOSURE

- A. General:
 - 1. The size and arrangement of the Prefabricated Equipment Enclosure shall be based on the layout provided in Contract Documents.

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2. The Enclosure furnished shall be completely weatherproof and vermin-proof in every detail.
3. Fabricate equipment enclosure of heavy steel panels and structural members to conform to Building and Other Structures category = IV (IBC2006 Table 1604.5), and suitable to withstand the following loads:
 - a. Wind load (3 second) , of 90 mph.
 - b. Wind Factor I_w of 1.15
 - c. Roof collateral load of 10 psf.
 - d. Snow load of 20 psf
 - e. Wind Exposure Category "C"
 - f. Seismic Factor I_e of 1.25
 - g. Use $S_s = 0.6$, $S_1 = 0.2$, and Site Class D
 - h. Outdoor ambient temperature range of -22° F to 122° F.
 - i. Indoor ambient temperature range of 68° F to 78° F.
 - j. Altitude of 3715 feet ASL
 - k. Static loading including all equipment and material to be installed within.
 - l. Live/Dead construction load.
4. Use MANUFACTURER's standard design as far as is consistent with the intent of this Specification and Contract Documents.
5. Factory fabricate and completely assemble and wire at Manufacturing location for CONTRACTOR inspection and witness test to assure accuracy of overall dimensions and operation. No welding shall be required to complete field assembly.
6. Ship prefabricated equipment enclosure completely assembled.
7. Supply with all necessary material such as bolts, nuts, washers, wiring materials, etc., as required for complete field assembly and installation. Provide clips, if required, for anchoring the prefabricated equipment enclosure to the foundation. Anchor bolts will be furnished by others but shall be specified by the MANUFACTURER.
8. Provide cable tray as required for factory wiring of VENDOR installed components. Cable tray shall be sized per NEC, with 50% spare space (based on design fill requirements plus 50%), for future control cable.
9. Provide separation of the following cable classes:
 - a. Power cable
 - b. Primary control cable
 - c. Instrumentation cable
10. Provide a outdoor duplex GFCI, 120 volt receptacle and light switch adjacent to personal door.
11. Provide an indoor receptacle near desk.
12. Provide an indoor receptacle under AC Panel.
13. Provide smoke detector(s) with relay contacts for alarm provisions. The AC power for the smoke detectors shall be from the building lighting circuit, with battery backup. Wire alarm outputs to RTU.
14. One (1) Exit sign shall be provided for door and shall be self-illuminating.
15. Provide one (1) fire extinguisher, mounted near doorway, suitable for fighting electrical fires.
16. Factory install all components of equipment except items specified as being furnished and installed by CONTRACTOR.

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17. Provide removable lifting I-beams, angles, and eyebolts for unloading, installing, removing and handling the enclosure. Normal lifting will be by crane. These materials are to remain the property of the CONTRACTOR.
 18. Provide interior energy efficient fluorescent lighting sufficient to provide 40 foot-candles of light at a level 3 feet above floor. One light fixture shall be supplied through an emergency ballast. See contract documents for the approximate location of the light fixtures in the enclosure. A light switch is to be located near door.
 19. The following items to be furnished and installed:
 - (1) One (1) RTU/Communication enclosure with dimensions as specified in Contract Documents.
 - (2) A 36" door swing area in the front and back of each cabinet.
 20. Provide one (1) industrial grade desk, minimum size 48" wide by 30" deep, and one (1) industrial grade office chair.
 21. Provide one (1) industrial grade file cabinet, minimum 16" wide by 24" deep full height, four-drawer file cabinet.
 22. Provide one strip heater in the breaker compartment, and two strip heaters in each power cable termination compartment.
 23. Provide all necessary termination equipment, including clamp-type cable supports for cable entering from below without requiring mechanical loading of current-carrying components of the cable system.
 24. Provide all necessary termination equipment for CONTRACTOR furnished 120/240V, single-phase AC source.
 25. Provide a removable 1/8" thick aluminum access plate split type in each power cable termination compartment.
 26. Provide one (1) industrial type portable eye wash station mounted near batteries.
 27. The dimensions of the Prefabricated Equipment Enclosure shall be as indicated in Contract Documents.
- B. Heating Ventilation and Cooling:
1. Provide an energy star efficient air conditioner and heating units to maintain the inside air temperature between 60 and 80 degrees Fahrenheit over the specified range of external ambient temperatures.
 2. Provide control by a remote low voltage heating/cooling accustat with design set points of 78 degrees Fahrenheit for cooling and 68 degrees Fahrenheit for heating. VENDOR to furnish and install accustat, with automatic changeover from heat to cool in condition space where it will be exposed to average air temperature.
 3. Furnish and install all control wire in electrical conduit.
 4. Wire heating and cooling unit to the AC panelboard.
 5. Test, balance, and adjust all component devices to achieve the stated system capacity.
 6. HVAC shall provide adequate air exchange to limit accumulation of hydrogen gas released by the batteries to less than 2% of the total volume of the enclosure, under worst case battery over-charging conditions.
 7. Provide a 1/4-horsepower ventilating fan on the end of the Prefabricated Equipment Enclosure to force air through the aisle. Fan shall be complete with dampers which are gravity operated under normal temperatures and spring loaded shut through a fusible link assembly set for closure when temperatures exceed 160 degrees F, a replaceable throw-away filter, and a slip-in winter panel.

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C. Base:

1. Shall be all welded construction, utilizing structural steel channels, sized and arranged for proper strength and durability to be able to withstand the resulting stresses when lifting and moving the completed assembly.
2. Shall be designed for installation on a concrete perimeter foundation.
3. Shall have removable lifting/jacking devices to facilitate handling and installation. Normal lifting will be done by crane.
4. Shall have two NEMA 4-hole grounding pads, connected by a copper cable located at opposite corners (near ends) of building.
5. Shall have a floor of 1/4" minimum smooth steel plate or equivalent with a load rating of not less than 250lbs. per sq. ft. It shall be cleaned, primed, and coated with a gray, nonskid and scuff-resistant epoxy coating.
6. Provide bottom access from the 15kV Metal Clad Switchgear to load side of XFMR.
7. Shall have floor cutouts with removable, split cover plates, where bottom access is required.
8. Shall be insulated to not less than R-11 with a fire-resistant insulation.
9. Exterior shall be smooth, clean, and coated with corrosion-resistant black mastic for protection against the environments.
10. All removable floor plates for openings shall be flush with the floor and screws shall be countersunk flush.
11. Floor needs to be constructed per switchgear requirements or shall not change more than 1/8" over entire surface whichever is more stringent.

D. Walls: Furnish walls as follows

1. The exterior wall shall be of paint quality 11-gauge steel.
2. The interior wall panel shall be 14-gauge steel.
3. Shall be insulated to a minimum of R-19 with a fire-resistant insulation.

E. Roof and Ceiling: Furnish roof and ceiling as follows

1. The roof shall be of paint quality 11-gauge steel.
2. The ceiling shall be paint quality 16-gauge steel.
3. The roof shall be rated for 85 psf and sloped to allow for adequate drainage.
4. The ceiling surface will be smooth and insulated to a minimum of R-30 with a fire-resistant insulation.
5. Roof penetrations are not permitted.

F. Doors: Furnish doors as follows

1. One (1) personnel door, 36" x 84", with magnetic gaskets and equipped with panic hardware type door openers and automatic door closers, shall be provided. The personnel door shall be of insulated, double wall, 18-gauge, steel construction with drip edge over door.
 - a. Inside panic exit shall allow the door to be opened from the inside.
 - b. Furnish with stops and padlock provisions.
 - c. Provide switch for intrusion alarm with one (1) form C contacts. Wire the intrusion alarm contact to the RTU.

G. Cable Tray:

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A cable riser shall be installed on the outside of the Prefabricated Equipment Enclosure to provide an entry point for all remote control and low voltage circuits through a bulkhead on the side of the enclosure per the Contract Documents. The cable riser shall be fabricated from 11-gauge steel with the same protective finish and color as the exterior surfaces of the Prefabricated Equipment Enclosure. Refer to Contract Documents for dimensions, location, and details of the riser. The cable riser shall have removable covers on the outside that allow full access and are not more than three feet in height each. Each cover shall include two handles to facilitate easy removal and include bolted covers (minimum 4 bolts) on each. A ladder tray shall be installed inside the cable riser from the base to the bulkhead per Contract Documents. The cable riser shall be weatherproofed, and vermin proofed.

H. Combined RTU & Communications Enclosure:

1. The Combined RTU & Communication Equipment Enclosure will be provided as outlined below. The enclosure details and location will be as outlined in the Contract Documents. Two Category 5e patch cable (straight pinned, stranded, with boots, color "GRAY") shall be installed between the SEL-3530 unit and the Siemens Fiber Optic Multiplex unit, both located within the Combined RTU & Communications Enclosure. Store 2 feet of extra conductor patch cord within the noted enclosure, as conditions permit. See Contract Documents for Monitor and Control Unit Points List and Combined RTU & Communications Rack.
 - a. Remote terminal unit: Schweitzer Engineering Laboratories Inc. (SEL), SEL 3530 Communications Processor Unit, Part # 3530HB0DX211A0XXXXXX, with options, no substitute:
 - (1) Mounting: Horizontal Rack Mount, 3U
 - (2) Power Supply: 48/125 VDC; 120VAC
 - (3) Rear Ethernet Connections: Two 10/100BASE-T
 - (4) I/O Board: 8 Outputs, 24 Inputs; 125VDC/VAC
 - (5) Web Human Machine Interface (HMI): None
 - (6) Client Protocols: SEL, DNP3, Modbus, C37.118 Synchro phasors
 - (7) Server Protocols: SEL, DNP3, Modbus
 - (8) Peer-to-Peer Protocols: Mirrored Bits
 - (9) Rear Serial Ports: 33 EIA-232/EIA-485 Serial Ports
 - (10) Conformal Coat: None
 - b. SEL 2407 Satellite: Synchronized Clock, Part # 24070001B, with options, no substitute:
 - (1) Antenna: GPS Antenna (235-0113) with 75 feet (23m) of cable (C960)
 - (2) Mounting: 19" Horizontal Rack Mount with Bracket
 - (3) RG-6 Cable, TNC Connectors on Both Ends (Antenna to Clock; Maximum 150 Feet), Part # C960
 - (4) Gas Tube Coaxial Surge Protector, TNC Connectors, Part # 200-2005
 - (5) Mounting Bracket for Surge Protector, Part # 200-2006
 - (6) Bullet GPS Antenna, 5 V, 40 dB Gain, TNC Connector, Part # 200-2006
 - (7) Bullet GPS Antenna Mounting Kit, Part # 915900043
 - (8) RG-58 Cable, BNC Connectors on Both Ends (Clock Modulated or Demodulated Output)
 - c. Hoffman Rack, 19" wide, w/mounting holes, total of 45 available rack units, 7'-0" high, Catalog # EVR19FM45U
 - d. Four (4) Kwik Bolt II, 5/8" x 6", Hilti Catalog # 00045372

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- e. Panel Ground Bar, Copper, Panel Fabricator
 - f. Eight (8) Standoff Brackets, for mounting framing channel, Manufactured by Panel Fabricator
 - g. Four (4) Standoff Bracket Supports, Manufactured by Panel Fabricator
 - h. Two (2) Din Rails, Perforated, 1 1/4" x 72", Yellow Chromated Steel.
 - i. Six (6) Mounting Struts, 13/16" Wide x 13/32" Wide x 13/32" Deep x 20' Long, Brand determined by Panel Fabricator
 - j. Corning Fiber Patch Panel, Part # CCH-03U
 - k. Cat 6 Patch Panel, Part # Siemen HD6-24
 - l. Cable Management Tray for CAT 6 Patch Panel
 - m. Shelf, Cabinet, 12' Deep, 35LB Capacity, Steel, Rack Mount, Black Box Network SVC #RM001
 - n. Eight (8) 12 PT. Terminal Block Marathon 1512DJRC 72459
 - o. Battery Charger, 48VDC/120VAC Part # (TBD)
 - p. Battery, 48VDC Part # (TBD)
 - q. DC Fuse Panel, Telect Dual-Feed 20/20 PN:06004-11
 - r. One reel of coax cable CA RG59PVC #23AWG. Solid, Black Box, ETN59, 40 feet length.
 - s. Eighteen (18) BNC Connectors to terminate RG59 Cable.
 - t. Three (3) Converters BNC To Twisted Pair, Pomona Electronics 5051.
 - u. Three (3) BNC T-Adapter, Radio Shack, 278-112.
 - v. One (1) 50 Ohm BNC Terminator, SEL 240-1800.
- I. 120/240VAC Panelboard:
- 1. Furnish one (1) 42-pole, heavy duty type, 120/240-Volt, single-phase, 3-wire panelboard:
 - a. The main bus shall be copper.
 - b. Bus shall be rated 225 amperes.
 - 2. Provide panelboard meeting all applicable IEEE and NEMA standards and bearing the UL label.
 - 3. Circuit breakers shall be rated 10,000 amperes symmetrical interrupting capacity.
 - 4. Panelboard shall be provided with quantity of circuit breakers and size as indicated below and tagged per Contract Documents:
 - a. One 225-ampere, 2-pole, main breaker
 - b. Six 20-ampere, 2-pole, branch breaker
 - c. Fourteen 20-ampere, 1-pole, branch breaker
 - d. One 60-ampere, 2-pole, branch breaker
 - e. Three 30-ampere, 2-pole, branch breaker
 - f. Two 40-ampere, 1-pole, branch breaker
 - g. One 50-ampere, 2-pole, branch breaker
 - h. One 40-ampere, 2-pole, branch breaker
 - i. Two 30-ampere, 1-pole, branch breaker
 - 5. Furnish with NEMA 12 enclosure. Panelboard in code gauge, hot-galvanized sheet steel box for surface mounting, with trim made from code-gauge steel finished with two coats of ANSI No. 61 light gray paint where installed indoor.
 - 6. Panelboard shall be mounted as indicated in the Contract Documents.
 - 7. Provide a hinged door with lock and latch combination in the front trim of panelboard.

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8. Furnish with 225-ampere frame main circuit breaker shall be Cutler Hammer Type FD molded-case circuit breakers or ENGINEER approved equal.
 9. Furnish with 100-ampere frame size branch circuit breakers shall be Cutler Hammer Type BAB molded-case, bolt-in-type air circuit breakers or ENGINEER approved equal.
 10. Provide a phenolic nameplate approximately $\frac{3}{4}$ inch x 3 inch on front of panel engraved with the panelboard designation.
 11. Furnish Cutler-Hammer Type POW-R-Line 3a panelboard or ENGINEER approved equal.
 12. VENDOR shall wire all AC loads to the AC Panelboard.
- J. Cabinetized DC charger and battery system with internal distribution panel: DC system shall be completely enclosed in a self-contained cabinet and include charger, battery and distribution panel factory-wired so that only AC input and DC load connections are required to be made at Prefabricated Equipment Enclosure factory.
1. Standards: Charger, cabinet, circuit breakers and breaker panel shall each be listed by UL or other NRTL. Battery shall be UL recognized. Cabinet shall be rated for seismic zone 4.
 2. Cabinet design and construction: Cabinet shall include no locks on main door, distribution panel door and provision for viewing charger display and operating charger controls without opening door. Cabinet shall arrive fully assembled with battery, charger and distribution panel installed and pre-wired. Cable entry shall be from either top or bottom of the cabinet. Vermin proofing shall be provided. Cabinet material and finish will be Steel, ANSI 61 gray powder coat finish. Cabinet shall be lifted from top.
 3. Charger: EnerGenius IQ type Filtered 511, Microprocessor controlled, ruggedized SCR type designed for continuous duty. Input shall be 120/208/240 volts, field selectable, single-phase. Constant 125VDC voltage, current limited output shall be sufficient to power the continuous load and recharge a fully discharged battery within 12 hours. Combined line and load regulation shall be $\pm 0.25\%$ or better. Charging control shall include float charge mode, manual and automatic equalize charge modes and battery temperature compensation. Output shall be electronically current limited and protected by a redundant overvoltage shutdown system. 2-pole DC circuit breaker.
 4. Battery: AGM type VRLA battery shall deliver 10 years in float service at 77F and meet capacity requirements of IEEE 485. Front terminals shall be provided for safe testing and maintenance. Battery case shall be reinforced and meet safety requirements of UL94 V-0. Plates shall be tank-formed to insure even cell voltages and full capacity at system startup. Safety vents shall be self-sealing with flame arrestor. The battery shall be designed and sized to deliver power to all continuous and non-continuous loads during a twelve hour outage.
 5. Distribution panel: Charger and battery shall feed distribution panel through bolt on 2-pole breakers. Distribution breakers shall be 2-pole bolt on type with UL listed DC voltage rating equal to or higher than the charger's nominal voltage. Interrupting capacity shall be 14,000 amps or higher, DC rated. Panelboard shall be provided with 30 circuits with minimum number of 2-pole circuit breakers and size as indicated below and tagged per Contract Documents:
 - a. One 100-ampere main breaker
 - b. Thirty 30-ampere branch breakers

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6. Battery check system: Shall periodically and automatically validate the battery's ability to power the connected system load at user-specified intervals, and include manual control on the front panel.
7. Charger Display: Digital metering of DC voltage, DC current, AC voltage and ambient temperature, plus LED diagram showing charger and system status. Plain English text display of system status and alarm messages.
8. Adjustments: All charger parameters shall be adjustable by front panel keypad with configurable user access levels. No potentiometers are acceptable anywhere in the charge.
9. Charger Data logger: Data logging system shall regularly write records of alarms, input and output voltages, user adjustments and all internal charger parameters to high capacity storage media for later download and analysis. PC-based data analysis software shall be provided with the charger.
10. Environment: Charger shall be convection cooled with operating temperature -22°F to +122°F with overtemperature protection. Humidity to 95%, non-condensing. Circuit boards shall be treated to resist effect of extreme humidity. Transient protection to ANSI/IEEE C37.90, and IEC 61000-6-2.
11. VENDOR shall wire branch breaker feeder to all loads.
12. Provide cabinetized DC charger and battery system with internal distribution panel similar to Stored Energy Systems (SENS) DC PowerCab 120
13. Charger alarms: VENDOR shall connect extended Individual Form C alarm contacts for AC fail, charger fail, low battery volts, high battery volts, battery end of discharge, ground fault and battery check failure to RTU/COMM. Rack.
14. Include the following features and equipment:
 - a. Input AC insulated case circuit breaker.
 - b. Output DC insulated case circuit breaker.
 - c. Output DC voltmeter and ammeter, with 2 percent accuracy.
 - d. 12-72-hour manually adjustable equalizing timer to provide automatic return from equalizing charge rate.
 - e. Computer controlled for adjustment of float voltage to 2.15 volts per cell.
 - f. Computer controlled for adjustment of equalizing voltage to 2.20-2.33 volts per cell.
 - g. Surge suppression devices for protection against system transient voltages and able to avoid self-destruction upon disconnecting the load terminal momentarily.
 - h. Current limiting protection to limit current even on short circuit directly on charger output terminals.

K. Finish:

1. Apply finish to all steel surfaces of equipment.
2. Clean and treat surfaces with phosphatizing process or equal and apply all necessary fill before application of finish.
3. VENDOR to submit samples of interior and exterior color for CONTRACTOR approval.

2.2 METAL CLAD SWITCHGEAR

A. General:

1. Switchgear shall consist of breaker and auxiliary units, as indicated in Contract Documents, bolted together to form a rigid, self-supporting, metal-enclosed structure.
2. Switchgear units shall be arranged as shown in Contract Documents.

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3. For rigidity during fault conditions all connections to roll-out potential transformer trays shall be by rigid bus bars insulated to full voltage rating of switchgear assembly.
 4. Circuit breaker compartment shall be designed to house 15kV removable-element circuit breaker. Stationary primary disconnect contacts shall be silver-plated copper. Grounded metal safety shutters shall isolate all primary connections in compartment when breaker is withdrawn from connected position.
 5. Breaker unit shall contain three-pole, single-throw, horizontal draw out, trip-free, vacuum circuit breaker. Breaker shall be complete with all necessary operating mechanisms.
 6. Breaker shall be suitable for remote closing and tripping with local testing.
 7. Equipment shall be metal clad, draw out switchgear.
 8. Equipment shall be suitable for operation on a solidly grounded system rated 12470 volts line-to-line, 3-phase, 4-wire, 60 hertz.
 9. The MANUFACTURER shall furnish equipment and materials which will meet the specified ratings and performance at the altitude and ambient temperatures as specified in Contract Documents.
 10. The 12.47kV breaker shall be equipped with a SEL-351S overcurrent relay trip device and shall be as specified and mounted per Contract Documents.
 11. The 34.5kV standalone breaker on primary side of power transformer shall be equipped with a SEL-351S overcurrent relay trip device and shall be as specified and mounted per Contract Documents.
 12. The Transformer Differential Protection shall be equipped with a SEL-387 current differential relay device and shall be as specified and mounted per Contract Documents.
- B. Switchgear Ratings: The switchgear shall be designed per the latest revision of IEEE standard for Metal Clad Switchgear with the following electrical characteristics:
1. Rated Maximum Voltage, 15 kV rms
 2. Normal Frequency Withstand 36 kV rms
 3. Impulse Withstand Rating (BIL) 95 kV peak
 4. Rated Continuous Current 1200 A,rms
 5. Momentary rating 23 kA, rms
- C. Basic Structure:
1. The general arrangement of switchgear breaker and auxiliary units shall as indicated in Contract Documents.
 2. The switchgear enclosure shall be of welded construction and utilize 11-gauge steel minimum throughout. The breaker compartment shall be totally welded construction. Each switchgear compartment shall form its own solid box, such that there are two thicknesses of 11-gauge steel between vertical sections.
 3. Provide equipment of dead-front construction and design for heavy duty utility service.
 4. Provide front-hinged doors on which are mounted meters, relays, control switches, etc., and which open to permit removal of circuit breaker. Doors shall be capable of being completely closed with the breaker in the racked-out test and racked-in positions. Front panels shall be hinged on the left side.
 5. Connections to the voltage transformers shall utilize 15kV rated cable that is sized and supported to withstand the maximum fault and momentary current ratings of the switchgear.
 6. The circuit breaker compartment shall be designed to house a 15kV removable element vacuum circuit breakers. Stationary primary disconnect contacts shall be silver plated

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- copper. Grounded metal safety shutters shall isolate all primary connections in compartment when breaker is withdrawn from connected position.
7. Furnish nameplates for each device as indicated in Contract Documents. Nameplates shall be white letters on black background. Nameplates shall be fastened with screws. There shall be a master nameplate that indicates equipment ratings, MANUFACTURER's name, shop order number and general information. Interior devices labeled with lamacoid nameplates shall be provided with silicon adhesive or ENGINEER approved equal.
 8. Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of draw out equipment.
 9. Factory install all components of equipment except items specified as being furnished by the CONTRACTOR.
 10. Ventilation openings shall be furnished with a weatherproof hood to prevent the entrance of moisture from windblown rain. Externally removable filters shall be provided over each ventilation louver that are washable and reusable.
 11. All metering relaying and control equipment shall be accessible from the front of the switchgear.
 12. Switchgear power cable compartment doors shall be 11-gauge steel. Each door shall be provided with a stainless-steel lockable vault handle and internal three point latching mechanism and bolts. The internal latches shall utilize nylon rollers. The doors shall be provided with an automotive type weatherproof gasket, drip shield at the top and bolted at top and bottom.
 13. Provide red-painted, nonmetallic safety shutters covering the breaker bus connections.
 14. Provide internal compact fluorescent light fixture and grounded convenience receptacle and switch on the draw out side of each unit.
 15. Provide a 2-inch x 6-inch engraved (3/8-inch lettering) laminated, black with white core, phenolic nameplate for each cubicle door, front and rear, 125-volt DC emergency lighting control switch and panelboards. Provide a 3/4-inch x 3-inch engraved (1/8-inch lettering) nameplate of the same construction as above for each individual meter, instrument, relay, or control switch. Nameplates shall be provided for equipment both inside and outside switchgear as well as all field-mounted equipment. Engraving shall be as required by Contract Documents. Nameplates shall be secured with screws.
 16. Provide bolted removable access panels to permit access to power connections and bus.
 17. Provide drawout carriages with grounding device for mounting transformers.
 18. Provide entry for power cable conduit in the bottom of each switchgear unit.
 19. Provide hinged, latched rear doors with stops and padlock provisions, complete.
 20. Provide bolted removable access panels to permit access to power connections and bus.
 21. Provide drawout carriages with grounding device for mounting transformers and fuses.
 22. Strip heaters shall be provided and appropriately sized to prevent condensation in the switchgear sections. One strip heater shall be provided in each breaker cell. Two strip heaters shall be provided in each outgoing power cable compartment and incoming power cable compartment. Heaters shall be rated at 240VAC, but operated at 120VAC. A dedicated branch breaker shall provide power for the heaters in each compartment. An ammeter, mounted on the front door, shall be provided in the heater circuit to indicate all strip heaters are operating properly. A nameplate shall indicate the full load current when all strip heaters are working properly. In rear power cable compartments, one strip heater shall be energized at all times and one shall be energized when the humidity in the compartment reaches 60%. Each strip heater shall be provided with a protective guard.

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D. Buses and Connections:

1. Provide a copper main bus, 1200 ampere rating as indicated in Contract Documents with capacity to supply full rating to the circuit breakers without exceeding temperatures limits imposed by IEEE and ANSI standards, mechanically braced to withstand shocks and stresses imposed by short-circuit currents equal to the short-time rating of the breaker. Silver-plate contact surfaces of all joints in buses and bus connections. All bus supports for medium voltage conductors shall be wet process porcelain or cycloaliphatic epoxy.
2. Insulate all medium voltage bus with epoxy applied using the fluidized bed process. All bus shall be provided with removable access covers for inspection. Provide PVC boots with nylon hardware to insulate all bus joints and medium voltage connections, including the power cable terminations.
3. Voltage ratings of the main bus shall equal the breaker ratings.
4. Provide four-hole NEMA pads for the high-voltage power cables.
5. Provide a 1/4" x 2" copper ground bus extending full length of the switchgear. The ground bus shall be connected with bronzed grounding pads located in two opposite locations on the exterior of the switchgear. The ground pads shall be furnished with 1/0-500 kcmil lugs for connection of the ground cable and located near the cable entrance. Ground each compartment housing to this bus as well as each circuit breaker when in "operate" and "test" positions.
6. Ground bus joints (splice points) shall not be coincident with the bolts which support the ground bus. Connections to the ground bus should be made such that it is not necessary to open the ground bus or any other connection to the ground bus in order to remove any connection to the ground bus. Bolted connections to the ground bus should be separate from the support and joint bolts.
7. Extend the ground bus to a location near the access door of each power cable compartment for the grounding of the feeder's power cable shielding. Provide one #6-1/0 ground connector in each power cable compartment to ground the cable shield.
8. Provide a ground bus in each control cable compartment, extended from the switchgear ground bus, for the termination of control cable shields. This bus shall be at least 1"x1/8"x1' and drilled and tapped with 10-32 thread on one-inch centers with termination bolts provided.
9. Switchgear bus phase sequence shall be clearly identified in the breaker compartment in conformance with ANSI C37.20, Article 6.1.1.2, Phase Sequence.
10. The switchgear assembly shall have been design tested to withstand a BIL rating of 95kV.

E. Circuit Breaker Ratings and Specifications: Breaker shall be horizontal draw-out vacuum type. The breaker shall have the following characteristics:

1. Voltage:
 - a. Rated kV or nominal kV class: 13.8.
 - b. Maximum kV: 15.
 - c. Operating kV: 12.47
 - d. Rated voltage range factor (K): 1.30.
2. Current Ratings:
 - a. Continuous amperes: 1,200
 - b. Momentary, rms amperes (three-second): (23,000).

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- c. Short-circuit current at rated max kV: (18,000).
 - 3. Interrupting Ratings:
 - a. Three-phase rated MVA or nominal MVA class: (500).
 - b. Maximum symmetrical interrupting, amperes: (18,000).
 - c. Close and latch, peak amperes: (62,000).
 - 4. Frequency, hertz: 60.
 - 5. Rated interrupting time, cycles: 5.
 - 6. The breaker shall be provided with two (2) independent trip coils.
 - 7. Insulation Levels:
 - a. Low-frequency test voltage (60-hertz, dry 1-minute), kV: 36.
 - b. Basic impulse level (1-1/2x40 microseconds), kV crest: 95.
 - 8. Control Circuit Voltage:
 - a. Nominal voltage supplies: 125 volts DC for close and trip; 240 volts AC for spring charging motor.
 - b. Voltage range, closing, volts: 100-140 volts DC.
 - c. Voltage range, tripping, volts: 70-140 volts DC.
 - d. Charging motor voltage range, volts: 208-254 volts AC.
- F. Requirements:
- 1. 125 volts DC electric stored-energy-operated, mechanically and electrically trip free.
 - 2. Completely interchangeable with all other breakers furnished of the same rating.
 - 3. Self-aligning primary and secondary contacts.
 - 4. Suitable interlocks to positively prevent breaker withdrawal out of or insertion into operating position with breaker closed.
 - 5. Auxiliary contacts mounted in the breaker cell and operated by the breaker in both "operate" and "test" positions of the breaker. Furnish contacts in sufficient number for all interlocking functions as required for the control scheme designed for each breaker, and to provide a minimum of two spare "normally open" and two spare "normally closed" contacts for each breaker.
 - 6. Auxiliary contacts mounted on the removable breaker in sufficient number for all control, indicating, and alarm functions as required provide a minimum of two spare "normally open" and two spare "normally closed" contacts for each breaker. Secondary contacts shall be made in test position to eliminate need of jumper cable, where such option is permitted by MANUFACTURER's standard design.
 - 7. Means to prevent removing a charged breaker from the cubicle.
 - 8. Provide for manual stored energy closing, tripping, and spring recharge on loss of control power.
- G. Surge Arrestors:
- 1. Nominal system voltage (kV): 12.47.
 - 2. Provide intermediate class arresters consisting of MCOV 7.6kV, initially connect to provide the MCOV rating as shown on Contract Documents.
 - 3. For vacuum switchgear, furnish one metal oxide surge arrester for each phase terminal of load feeder circuit. Furnish arresters coordinated with insulation levels to provide complete protection of connected loads from surges created by vacuum interrupters.
- H. Voltage Transformers (VT):

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1. Each set of voltage transformers and their primary fuses shall be mounted in separate steel compartments. Primary connections to the transformers shall be insulated and enter the compartment through porcelain or cycloaliphatic epoxy bushings. Each set of voltage transformers and fuses shall be mounted on the tiltout steel carriage which will be capable of disconnecting the transformer fuses from their voltage source and removing them from the structure. This removing mechanism shall be so arranged that full access to the transformers cannot be accomplished until fuses are disconnected from the structure and grounded. When moved to a full out position, the transformer fuses and VT windings shall be automatically connected to a ground stud. Primary contacts shall be insulated from the structure by porcelain or cycloaliphatic epoxy supports, shall be self-aligning, and shall have silver to silver contact surfaces. VT's shall be of the ratio indicated on the Contract Drawings and shall comply with ANSI C57.13.
- I. Current Transformers (CT)
1. Current transformers shall be of the window type with ratios as indicated on the Contract Drawings. They shall have sufficient thermal and mechanical capacity to withstand the maximum momentary current rating of the breakers. The secondary terminals shall be of the solder-less clamp type. All current transformers shall be properly identified for polarity with standard marking symbols.
 2. CT's having a insulation rating of 15kV with fully insulated bus centered in the transformer window opening, are acceptable when corona, hypot, and impulse tests prove a satisfactory arrangement. Tests shall be performed on a similar CT installation in the switchgear MANUFACTURER's equipment and certified test reports shall be submitted with the approval drawings when requested.
 3. The minimum acceptable accuracy class for metering and relaying shall be in accordance with the latest edition of ANSI Standard C37.20.2 and C57.13.
 4. Phase CT's shall be mounted over stationary primary disconnects.
- J. Revenue Meter Socket:
1. Provide one KWH meter socket for Form 9S meter. KWH meter provided by others.
 2. Provide (1) Test Switch assembly, with (3) current test jack and short-circuiting current assemblies and (4) single-pole potential assemblies, similar to States Type FMS-10E2.
- K. Include the following control features:
1. Miscellaneous interlock contacts and auxiliary relays as required for the breaker control scheme.
 2. Two sets of control power circuit fuses for each breaker. Electrical control scheme shall be similar to ANSI C37.11, Figure 1, Diagram B, 2 with the trip and close circuits individually protected. Provide spare fuses for other control circuits (no less than two each).
 3. Cell switches in each compartment to bypass all breaker-mounted auxiliary switch "b" contacts when circuit breaker is removed. Include at least two spare "a" and two spare "b" contacts on each breaker cell position switch.
 4. All breaker auxiliary and cell switch spare contacts wired out to compartment external connection terminal block.
 5. Control designed such that breakers will not trip on interruption to DC control power.
 6. Furnish multicontact electric trip relays in the number and types as required to perform the tripping and interlocking features required of the relaying scheme.

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7. Include all auxiliary relays and auxiliary timing relays as required.
 8. Provide an auxiliary relay for each circuit breaker for a remote alarm upon failure of the DC supply to each of the closing and tripping circuits. These auxiliary relays are to be paralleled and terminated in a convenient location for the CONTRACTOR furnished alarm circuit. The auxiliary relay shall be an Agastat 7000 Series or ENGINEER approved equal with a five-second time delay. The auxiliary relays shall be installed so that there are no 125V DC molded case circuit breakers between them and the tripping circuit.
- L. Include the following control wiring:
1. Completely factory-install all internal control wiring.
 2. Switchgear secondary wiring shall be multi-stranded, tinned, copper conductor, type SIS, 600 volt, VW-1 rating. Minimum wire size shall be #14 AWG, 41 strand. BCT wiring shall be #10 AWG. Signal wiring (transducer outputs, etc.) shall be #22 twisted shielded pair. RTU connections shall be #18 AWG, 18 strand, type SIS. Splicing or tapping is not permitted.
 3. Wiring between hinged and stationary panels shall be supported to prevent undue stress and shall be protected from contact with metal edges by suitable protective wrap. All wiring between the door and compartment shall cross the hinge at a point above the height of the circuit breaker to eliminate the possibility of interference with the breaker element.
 4. All wiring shall be firmly bundled and secured to ensure it will remain in its intended location and not interfere with the operation of any device. Wire bundles shall be secured with cable ties attached to welded studs. Adhesive type hold-down clamps are not acceptable.
 5. Make all connections at equipment studs or heavy-duty terminal blocks. Terminate all Bushing Current Transformer (BCT) leads on 4-point shorting-type terminal blocks similar to States NT Part No. M-25104-G or ENGINEER approved equal.
 6. Terminate all points requiring external wiring connections at points on terminal blocks conveniently grouped to receive external cables with color-code order as approved by the ENGINEER. All terminal blocks, except the short-circuiting type, to be twelve-point straight-strap terminal blocks with white marking strip or ENGINEER approved equal. Points on terminal blocks shall bear alphanumeric designations which indicate unit number, block letter, and terminal number (such as 2B1, 3C2, 4D3, etc.). Letters I, O, and S shall not be used as terminal block designations.
 7. Furnish terminal blocks for external wiring connections in sufficient numbers to provide at least 15 percent spare terminals (terminals having no connections or designated field future connections), arranged with no less than two spare terminals on each 12-point block. Furnish all spare terminal blocks with proper nuts and/or screws with flat washers in each cabinet.
 8. Use No. 14-gauge or larger stranded, tinned copper wire insulated for 600 volts, equal to General Electric Type SIS Specification SI-47275, or ENGINEER approved equal. Any wiring subject to movement, e.g., wiring mounted to swing panels, shall be of extra-flexible conductor.
 9. Control power buses for AC or DC shall extend through each switchgear assembly. The buses shall be adequately sized for the control power load but shall not be less than No. 6 AWG.

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10. Use preinsulated compression-type connectors with ring tongue for all control connections. No more than two wires shall be terminated at any one connection point. Make all circuits continuous between termination points. No butt splices shall be allowed. All control connectors shall be applied using a ratcheting type lugging tool that cannot be released until the lug is properly crimped.
 11. Connect to agree with schematic and connection drawings that have been approved by the CONTRACTOR.
 12. Factory check and functionally test for proper operation of all relays, meters, instruments, switches, lights, and interlocks.
 13. Label all cables at equipment studs and terminal blocks with wire numbers conforming to wire numbers shown on the MANUFACTURER's drawings.
 - a. The identification shall be by the application of heat-shrinkable or plastic sleeve markers approved by the CONTRACTOR in writing. The wire tags shall be heated only to extent required to conform to the wire size. It is recommended that the heat-shrinkable tag be loose enough to turn for proper orientation but tight enough not to turn accidentally.
 - b. The number shall be properly oriented so that it is visible.
 - c. Individual wire identification for each wire shall be included in schematic diagrams to be submitted. All wires shall be labeled at both ends and at any intermediate point where the wires may terminate. The label on each end of each internal wire shall be the destination identification of the other end of the wire. The label on each end of each wire in an external cable shall be the individual wire identification as indicated on the schematic diagram.
 - d. At terminal blocks, the incoming and outgoing wires must both be labeled. The labels must be permanent and in accordance with wire identification shown on approved wiring and interconnection drawings.
 - e. All wires originating from the same electrical node or point shall carry the same wire number.
 - f. Wire numbers shall be typewritten, or machine stamped on the plastic sleeve markers. Handwritten wire numbers are not acceptable.
 14. Mount all terminal blocks in the same units requiring the connections.
 15. Arrange terminal block wiring to receive field cable with one wire per terminal.
 16. All devices within each switchgear enclosure including test switches and terminal blocks shall be shown in their approximate physical location and shall be represented on a single connection diagram. Wiring devices and methods shall be in accordance with details contained within this Specification and Contract Documents.
- M. Protective Relays: Furnish protective relays to provide the general plan of relaying as indicated and specified in Contract Documents and fully coordinate to provide the highest degree of system protection and security in conformance with this plan:
1. Include relays as specified and indicated in Contract Documents and the one line diagram.
 2. Furnish relays of the MANUFACTURER as required by the Contract Documents.
 3. Protective relays and lockout relay shall be provided with test switches that isolate all used inputs and outputs.
 4. Instruments, relays and control devices mounted on the switchgear front doors shall be semi-flush panel mounted.

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Specification for Metal Clad Switchgear Prefabricated Equipment Enclosure

5. The main contacts of all switching devices shall be silver plated. The contact surfaces of secondary disconnecting devices and relays shall be silver plated.
 6. Furnish auxiliary relays in the number and types as required to perform the tripping and interlocking features required of the relaying scheme.
 7. Furnish relays in semi flush rack mount type cases, rear-connected.
 8. Relays shall be exact type and manufacture indicated in Contract Documents.
 9. Wire all microprocessor-based multifunction relays to the relaying communications processor(s) installed in the RTU cabinet.
- N. 15kV Breaker Section – Unit 1
1. This lower compartment (A2) shall contain as a minimum, the following:
 - a. One 1200 Amp vacuum circuit breaker, ratings per Contract Documents.
 - b. One mechanism operated cell (MOC) auxiliary switch, 15 stage, mounted on the floor of the cell.
 - c. One truck operated cell (TOC) switch, 4 stage, mounted on the floor of the cell.
 - d. Three sets of three toroidal current transformer sets, with all secondaries brought out to a short-circuiting terminal block for convenient tap selection. One 200/5 single-ratio C50 current transformer shall be on the line side. Two (2) 600/5 multi-ratio C200 current transformer shall be on the bus side.
 - e. One strip heater, 250 watt, 240VAC, single phase. The strip heater shall be operated at 120VAC.
 2. Mounted on the upper compartment (A1) hinged front panel:
 - a. One Overcurrent relay, Device No. 50/51 N – (Schweitzer Engineering Laboratories Cat. SEL-351, part number 0351S5X3D3A54X1), with cable No. SEL-C273A for connection to SEL-3530 RTU, no substitution.
 - b. Provide one KWH meter socket for Form 9S meter.
 - c. Two (2) Test Switch assembly, with (10) single pole potential assemblies, similar to States Type FMS-10A for SEL-351S.
 - d. One (1) Test Switch assembly, with (3) current test jack and short-circuiting current assemblies and (4) single-pole potential assemblies, similar to States Type FMS-10E2 for SEL-351S.
 - e. One (1) Test Switch assembly, with (3) current test jack and short-circuiting current assemblies and (4) single-pole potential assemblies, similar to States Type FMS-10E2 for Itron Meter.
 - f. Two (2) 4-point shorting blocks, similar to States Type NT, Part # M-25104-G
 - g. One strip heater, 250 watt, 240VAC, single phase. The strip heater shall be operated at 120VAC.
 - h. One panel ammeter to monitor status of strip heaters with a nameplate that indicates the full load current when all strip heaters are operating.
 3. Mounted in the power cable termination area:
 - a. Three surge arresters, intermediate class, consisting of a stacked assembly of MCOV 7.6kV arresters.
 - b. Two strip heaters, 250 watt, 240VAC, single phase. The strip heaters shall be operated at 120VAC.

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- c. Provisions for bottom exit of 15kV power cables, consisting of a NEMA 4-hole pad for connection of (1) 2/0 AWG per phase.
 - d. One Thermostat.
- O. Auxiliary Section -Unit 2
 - 1. The upper compartment (B1) shall contain, as minimum, the following:
 - a. Three voltage transformer(s), drawout tray mounted, 7200-115/67volt ratio, wye connected, complete with primary and secondary current limiting fuses.
 - b. One strip heater, 250 watt, 240VAC, single phase. The strip heater shall be operated at 120VAC.
 - 2. Mounted on the upper compartment (B1) hinged front panel:
 - a. Transformer Differential Protective Relay, Device No. 87 – (Schweitzer Engineering Laboratories Cat. No. SEL-387 part number 0387003X5HXX4XX), with cable No. SEL-C273A for connection to SEL-3530 RTU Cabinet, No substitution.
 - b. One Overcurrent relay, Device No. 50/51 N – (Schweitzer Engineering Laboratories Cat. SEL-351, part number 0351S5X3D3A54X1), with cable No. SEL-C273A for connection to SEL-3530 RTU Cabinet, no substitution.
 - c. Two (2) Test Switch assembly, with (3) current test jack and short-circuiting current assemblies and (4) single-pole potential assemblies, similar to States Type FMS-10E2 for SEL-387
 - d. One (1) Test Switch assembly, with (10) single pole potential assemblies, similar to States Type FMS-10A for SEL-387.
 - e. Two (2) Test Switch assembly, with (3) current test jack and short-circuiting current assemblies and (4) single-pole potential assemblies, similar to States Type FMS-10E2 for SEL-351S.
 - f. One (1) Test Switch assembly, with (10) single pole potential assemblies, similar to States Type FMS-10A for SEL-351S.
 - g. Three (2) 4-point shorting blocks, similar to States Type NT, Part # M-25104-G
 - h. One panel ammeter to monitor status of strip heaters with a nameplate that indicates the full load current when all strip heaters are operating.
 - 3. The bottom compartment (B2) shall contain, as minimum, the following:
 - a. One strip heater, 250 watt, 240VAC, single phase. The strip heater shall be operated at 120VAC.
 - 4. The bottom compartment (B2) hinged front panel shall be empty.
 - 5. Mounted in the power cable termination area:
 - a. Two strip heaters, 250 watt, 240VAC, single phase. The strip heaters shall be operated at 120VAC.
 - b. Provisions for bottom entry of 15kV power cables, consisting of a NEMA 4-hole pad for connection of (1) 2/0 AWG per phase.
 - c. One Thermostat.
- P. Recommended Spare Parts List: The manufacturer shall submit a complete equipment parts list that shall cross-reference all the Manufacturer or Sub-Manufacturer assigned part numbers

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back to the original manufacturer's part number. The Manufacturer shall make a notation of quantities of these items recommended or required for continuous operation during one normal overhaul cycle. This Recommended Spare Parts List (RSPL) shall include items requiring replacement under the following conditions (which condition to be noted)

1. Wear, corrosion, or erosion during normal operation.
 2. Failures that cause a shutdown of equipment.
 3. Damage or breakage during routine maintenance or inspections of equipment.
 4. Long lead time or operational insurance items.
 5. Time-compliance limits on time-in-service due to age-related deterioration.
- Q. The parts list shall include cross-sectional or assembly-type drawings, part numbers, material, and estimated delivery lead time. Part numbers shall identify each part for interchangeability purposes. The parts list shall contain prices for all RSPL components.
- R. The following switchgear accessories and spare parts shall be supplied and stored inside the Equipment Enclosure:
1. Tube of contact lubricant
 2. A remote racking device shall be provided including push-button station, motor operator, and 25 feet of cable.
 3. One test cabinet complete with secondary contacts, test jumper, control relays, and push buttons-mounted on interior wall.
 4. One set of special wrenches, removable hand cranks, and manual spring recharge and maintenance slow closing devices.
 5. Provide list of other accessories normally furnished by MANUFACTURER for CONTRACTOR review and approval.
 6. Furnish one set of spare fuses for all fuses installed.
 7. Two quarts of touch-up paint of each finish color.
 8. One trip coil.
 9. One close coil.
 10. One 52X auxiliary relay complete.
 11. One 52Y auxiliary relay complete.
 12. One breaker spring charge motor.
 13. Two spare LED bulbs of each type installed.
 14. Two spare indicating light assemblies.
 15. One set of test plugs.
- S. Finish
1. Apply a protective epoxy powder finish to all steel surfaces of equipment. Uncoated surfaces are not permitted or acceptable. All coated surfaces shall be completely cured in a oven prior to installation or assembly. The epoxy powder is to be applied electrostatically to ensure all surfaces receive a uniform coating.
 2. Clean and treat surfaces with phosphatizing process or equal and apply all necessary filler before application of finish.
 3. The exterior of the prefabricated equipment enclosure shall be provided with at least two exterior finish coats of high gloss CONTRACTOR selected color.
 4. The interior walls and ceiling shall high be coated high visibility white.
 5. The interior of the switchgear shall be coated high visibility white.
 6. The switchgear front doors shall be ANSY 61 grey.

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2.3 IDENTIFICATION DEVICES

- A. Provide nameplates on all internal and front panel mounted devices. Front panel nameplates shall be attached with stainless self-tapping screws.
- B. Nameplate shall be engraved laminated black face with white core.
- C. Provide 2" x 6" with 3/8" lettering panel nameplates for Relay and Control Compartments.
- D. Provide 2" x 6" with 3/8" lettering panel nameplates for 120/240VAC Distribution Panelboard.
- E. Provide 2" x 6" with 3/8" lettering panel nameplates for 125 VDC Distribution Panelboard.
- F. Provide 2" x 6" with 3/8" lettering panel nameplates for Battery Charger.
- G. All other nameplates shall be 3/4" x 3" with 1/8" lettering.
- H. All nameplates to be submitted for CONTRACTOR review and approval.

2.4 SOURCE QUALITY CONTROL

A. QUALITY ASSURANCE:

- 1. Details of Inspection and Testing requirements will normally be detailed on a supplier standard Form. In addition it should detail requirements with respect to:
 - a. Workmanship
 - b. Compliance with Contract Documents
 - c. Quality Control Manual
 - d. Manufacturing Record Book
 - e. Mark Tagging
- 2. Quality Conformance Inspections shall comply with the following:
 - a. The witnessing of the pre-shipment operational test by the CONTRACTOR does not relieve the VENDOR of any responsibility regarding the quality of the component provided.
- 3. General Testing and Inspection:
 - a. The CONTRACTOR or authorized representative shall have access to the VENDOR's shop procedures, schedules, testing, and inspection procedures and documents.
 - b. The VENDOR shall verify by test that the complete electrical system with its components complies with all its performance requirements.
 - c. Except where more stringent industry standards are to be performed, all VENDOR's normal quality control tests shall be performed.
- 4. Source Quality Control:
 - a. Use VENDOR's standard design whenever consistent with the intent of these Specifications.
 - b. Use only new, unused equipment and materials.

B. TESTING

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Specification for Metal Clad Switchgear Prefabricated Equipment Enclosure

1. The VENDOR shall assume full responsibility for wiring accuracy, electrical operation, sequence and wiring tests shall be conducted in strict accordance with approved design documents. ANSI describes two methods of verification, both should be used. The individual circuit continuity checks using electrical testers should be performed from terminal progressively rather than from end to end of the circuit. The functional checks shall ascertain that all instruments, relays and devices are functionally operable and in the intended sequence. Test all BCT shorting contacts on test switches and on relay cases. Rated power shall be applied, and the protective relay contacts manually operated, to complete associated device circuit function.
2. The VENDOR shall perform all necessary operational tests to assure proper operation of the component and performance in accordance with the requirements of this Specification. In addition, the VENDOR shall perform those electrical tests (including continuity) which are consistent with this class of equipment, in accordance with the latest revision of applicable ANSI standards.
3. Factory tests shall be made with the breaker assembled, as it will be used in the field.
4. The VENDOR shall provide certified test reports for all tests performed. Notify CONTRACTOR of any unusual event or damage occurring during the fabrication of the Metal Clad Switchgear and of any test that do not meet the specified values.
5. The VENDOR shall provide test certificates that the design and rating of Metal Clad Switchgear for Type and Routine tests carried out. Tests shall be those listed in the relevant standards. The tests shall be for the precise compartment configuration proposed, including any adaptor units between switchgear and control equipment. The VENDOR shall certify that the equipment and components are free of defects and perform at the ratings assigned at the specified condition of service.
6. The CONTRACTOR reserves the right to inspect Metal Clad Switchgear and witness all tests at the VENDOR's works prior to the shipment to prove compliance with the Specification. The VENDOR shall notify the CONTRACTOR 10 working days in advance of the commencement of the tests.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Manufacture complete as specified or required for operation and continuous service at the location indicated in the Contract Documents.
- B. Provide all openings in floors, walls, and other structures necessary for complete equipment installation, unless such openings are specifically indicated as being provided by others.
- C. Make all internal connections as required.
- D. Check all internal connections, especially current transformer secondary short circuiting jumpers, and torque to MANUFACTURER's recommendation.

3.2 ERECTION

- A. Erect equipment enclosure and all components plumb, true, and conforming to MANUFACTURER's printed instructions.

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Specification for Metal Clad Switchgear Prefabricated Equipment Enclosure

- B. Provide all openings in floors, walls, and other structures necessary for complete equipment installation, unless such openings are specifically indicated as being provided by others.
- C. Roof penetrations shall not be permitted.
- D. Level, shim, and anchor the prefabricated equipment enclosure to the foundation in accordance with the MANUFACTURERS instructions.
- E. Replace any panels or components bent or otherwise damaged as result of CONTRACTORS operations, or repair if damage is minor.

3.3 MANUFACTURER'S FIELD SERVICES (OPTIONAL PRICING)

- A. Drawout Circuit Breakers: Test and Checks
 - 1. Megger each pole of breaker for freedom from grounds.
 - 2. Operate the breaker manually and visually inspect the breaker.
 - 3. Adjust the gap of the primary contacts as per MANUFACTURER's instructions.
 - 4. Check for proper clearances of all items.
 - 5. Check for proper lubrication.
 - 6. Inspect all bushings.
 - 7. Check all secondary contacts for proper operation.
 - 8. With breaker in switchgear, operate the breaker electrically and check for proper operation.
 - 9. Check continuity of breaker frame ground.
 - 10. The OWNER will perform other field testing under a separate contract, including:
 - a. Field high-potential test of each breaker.
 - b. Check of each breaker electrical operation for conformance with electrical schematics.
 - c. Recording of breaker operation counter reading.
- B. Metal Clad Switchgear: Test and Checks
 - 1. Check all safety interlock mechanisms for proper lubrication, adjustment and operation.
 - 2. Megger all power buses with a 1,000-volt megger. Grounded AC circuits, instruments and fuses should not be meggered.
 - 3. Inspect all buses and insulators.
 - 4. Inspect control and instrument switches and adjust contacts if required.
 - 5. Check all fuses.
 - 6. Check connections to instruments and adjust instrument indicating pointers.
 - 7. Check operation of switchgear alarm contacts.
 - 8. Initial check of proper breaker tripping by manual or electrical operation of protective relay contacts.
 - 9. Check all circuit breaker cell interlocks for conformance with these Specifications.
 - 10. Check all internal electrical interlocks and automatic transfer sequences for specified operation.
 - 11. The OWNER will perform other field testing under a separate contract, including:
 - a. Field high-potential test of switchgear.
 - b. Check and measure equipment grounds.
 - c. Check operation of heaters in switchgear.

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- d. Conduct polarity tests on current and potential transformers.
- e. Bench testing of all protective relays and setting of values specified by the CONTRACTOR.
- f. Protective relay trip testing of breakers by high current tests or other electrical means, and energized checks on relaying circuits as required by the CONTRACTOR.
- g. Verify the HVAC is operating properly.
- h. Check operation of Smoke Alarm.
- i. Check operation of Door Alarm.

Description of Specification	Requirements	Units
Application	Outdoor	
Controlled Environment	Yes	
Drawing Size	24 X 36	Inch
Usable Drawing Area	23-1/2 X 35-1/2	Inch
CAD Drawing Required	Yes	
CAD System required from Subcontractor	MicroStation V8i	
CAD System Used by Contractor	MicroStation V8i	
Border Title Block File Provided by	CONTRACTOR	
Equipment Enclosure Arrangement Drawing Provided by	VENDOR	
Equipment Enclosure Fabrication Details Provided by	VENDOR	
Engraved Nameplate List Provided by	VENDOR	
Control/Relay Switchboard Connection Diagram Provided by	VENDOR	
Number of Shipping Splits	0	Unit
Number of Shipped Assemblies	1	Unit
Finish Color	Provide Samples	Color
Doors	One (36"X 84")	
Nominal Height	122	Inch
Depth	152	Inch
Width	195	Inch
Panel Material	Roof interior 16-gauge, Roof exterior 11-gauge, Wall interior 14-gauge, Wall exterior 11-	Gauge
Minimum Distance from Floor to Lowest Device	12	Inch
Floor Sill Framing and Anchoring Channel Required	Yes	
External Control Cable Entrance	Side Chase Raceway	
Laminated Phenolic Screw-on Nameplate	Black with white core	Material/color
Interior Lighting Controlled by Door Switch On/Off	Energy Efficient Fluorescent (120VAC). Supply One with Emergency Ballast	Volts
DC Power System	SENS DC Power Cab 120	
Available Power Supply		
Volts	125	VDC
Volts	120/240	VAC
Phases	Single	

Description of Specification	Requirements	Units
Wire	3	
Frequency	60	Hz
Wire Size		
Voltage rating	600	Volts
Power Circuits	8	AWG
Control Circuits	12 and 14	AWG
Trip and Close	12	AWG
CT Circuit	10	AWG
Instrument Circuit	16 Shielded twisted pair	
Desk/Chair Required	Yes	
HVAC Unit	VENDOR	kW/BTU
File Cabinet Required	Yes	
Environmental		
Outdoor Ambient Temp Range	-22 to +122	Degrees Fahrenheit
Indoor Ambient Temp Range	60-80	Degrees Fahrenheit
Altitude	3715	FT
Max Ice Loading	1	Inch
Wind Velocity	90	MPH
Seismic and wind loading per	IBC-2006	
Ground Motion	Ss=0.6, S1=0.2, Ie=1.25	
Site Classification	"D"	
Wind Exposure Category	"C"	
Soil Type	Site Class C	
Weather Hood above doors	VENDOR	

Description of Specification	Requirements	Units
Application	Outdoor	
Controlled Environment	Yes	
Drawing Size	24 X 36	Inch
Usable Drawing Area	23-1/2 X 35-1/2	Inch
CAD Drawing Required	Yes	
CAD System required from Subcontractor	MicroStation V8i	
CAD System Used by Contractor	MicroStation V8i	
Border Title Block File Provided by	CONTRACTOR	
One Line Diagram Provided by	CONTRACTOR	
Tripping Block Diagram Provided by	CONTRACTOR	
Three Line Diagram Provided by	CONTRACTOR	
Schematic Diagram Provided by	CONTRACTOR	
Bill of Materials	CONTRACTOR	
Metal Clad Switchgear Arrangement Drawing Provided by	VENDOR	
Metal Clad Switchgear Fabrication Details Provided by	VENDOR	
Metal Clad Switchgear Engraved Nameplate List Provided by	VENDOR	
Metal Clad Switchgear Connection Diagram Provided by	VENDOR	
Number of Sections	2	Unit
Number of Shipped Assemblies	1 (Included as part of Prefabricated Equipment Enclosure)	Unit
Total Number of Compartments	4	Unit
Finish Color	Gray Exterior and White Interior	Color
Breaker Type	Drawout type VCB	
Number of Independent Trip Coils	2	EA.
Current Transformers		
Quantity per pole	1	
Relaying Ratio	600/5	
Multi ratio	Yes	
Relaying Accuracy	C200	
Thermal Rating	1.5 or higher	
Metering Current Transformer		
Quantity	1	

Description of Specification	Requirements	Units
Single Ratio	Yes	
Thermal Rating	1.5 or higher	
Doors (Per Section)	One For Rear Door and Two For Front panels.	
Nominal Height of Section	95	Inch
Depth of Section	96	Inch
Width of Section	36	Inch
Panel Material	Steel, 1/8 or 11 Gauge	Inch/Gauge
Minimum Distance from Floor to Lowest Device	12	Inch
Floor Sill Framing and Anchoring Channel Required	Yes	
External Control Cable Entrance	Top	
Laminated Phenolic Screw-on Nameplate	Black with white core	Material/color
Interior Lighting Controlled by Door Switch (Per Section)	Energy Efficient Fluorescent (CFL) (120VAC) (1) Front and (1)	Volts
Each Section and Compartment Physically Separable	Yes	
Available Power Supply		
Volts	125	VDC
Volts	120/240	VAC
Phases	Single	
Wire	3	
Frequency	60	Hz
Wire Size		
Voltage rating	600	Volts
Power Circuits	8	AWG
Control Circuits	12 and 14	AWG
Trip and Close	12	AWG
CT Circuit	10	AWG
Instrument Circuit	16 Shielded twisted pair	
Environmental		
Outdoor Ambient Temp Range	-22 to +122	Degrees Fahrenheit
Indoor Ambient Temp Range	60-80	Degrees Fahrenheit
Altitude	3715	FT
Max Ice Loading	1	Inch
Wind Velocity	90	MPH
Seismic and wind loading per	IBC-2006	
Ground Motion	Ss= 0.6, S1= 0.2, Ie=1.25	
Site Classification	"D"	
Wind Exposure Category	"C"	

Description of Specification	Requirements	Units
Soil Type	Site Class C	
External Power Cable Entrance	Bottom Rear Section B2	From XFMR
External Power Cable Exit	Bottom Rear Section A2	Feed to DAF
Metal Clad Switchgear (Two Sections with Four Compartments)	1	EA.
Ratings		
System nominal voltage	12.5	kV
Rated Maximum Voltage	15	kV rms
Rated Continuous Current	1200	A, rms
Basic Impulse Level (BIL)	95	kV peak
Normal Frequency Withstand	36	kV, rms
Frequency	60	Hz
Momentary Rating	23	kA, rms
Shipping Label		
Project Title	Nevada National Security Site (NNSS) – Substation 6-21, Area 6	
Specification No.	02119-SPC-E03	
Equipment Type	Metal Clad Switchgear	
P. O. Item No.	See Purchase Order	
Device Location	Substation 6-21 Area 6	

MSTS

ENGINEERING DOCUMENT REQUIREMENTS

1. Document Category Number	2. Specification Paragraph Reference	3. Document Description	4. Permission To Proceed Required		5. Submittal Schedule	6. Quantity Required		7. Kind of Copies	8. Remarks
			Yes	No		Initial	Final		
8.0	1.03.D.2	Building Design	X		15	6R	6R/1E	R,E	Prelim also w/Proposal
1.0	1.03.D.10	Structural	X		15	6R	6R/1E	R,E	Prelim also w/Proposal
11.0	1.03.D.1	Enclosure Specification		X	30	6R	6R/1E	R,E	
1.2	1.03.D.3,6	Building Drawings	X		30	6R	6R/1E	R,E	
1.2	1.03.D.9	Foundation Requirements	X		30	6R	6R/1E	R,E	
11.0	1.03.D.4,,5,2.01.K 3	Painting		X	30	6R	6R/1E	R,E	
1.0	1.03.D.8,1.05	Shipping Drawings		X	45	6R	6R/1E	R,E	1 Copy also w/Shipment
1.0	1.03.D.10,,11,,12,, 13,,14,,15,,16	Building Structure	X		45	6R	6R/1E	R,E	
1.1	1.03.D.1 and 1.03.D.17,,18,,19	Outline Drawings	X		30	6R	6R/1E	R,E	
1.4	1.03.E.2	Schematic Diagram	X		45	6R	6R/1E	R,E	
1.4	1.03.E.3	Wiring Diagram	X		45	6R	6R/1E	R,E	
4.0	1.03.E.6	Instruction Manual		X	30	6R	6R/1E	R,E	
4.0	1.03.E.7	Operation and Maintenance Manual		X	30	6R	6R/1E	R,E	
24.0	2.04.A.3.b	Testing Procedure	X		30	6R	6R/1E	R,E	
1.1	1.03.E.5,2.03.H,2. 02.C.16,2.03.H	Nameplate Engraving		X	45	6R	6R/1E	R,E	
11.0	1.03.E.4	Catalog Cuts	X		15	6R	6R/1E	R,E	
2.0	2.02K.2,2.02.N.7, 2.02.R.5	Spare Parts	X		15	6R	6R/1E	R,E	
9. Forward Copies To: Special Instructions (See Attachment C)									
10. Project and Client Information			11. Job No 02119					Sheet B1 of B7	
			12. Spec. Number 02119-SPC-E03					Revision No. 0	

ENGINEERING DOCUMENT REQUIREMENTS INSTRUCTIONS

- A. PURPOSE:** The FRM-1469 form is completed by MSTS Engineering to define the various engineering documents which a supplier must provide for MSTS review and approval at specified points in the procurement process.
- B. GENERAL INFORMATION:** Instructions for filling out the FRM-1469 form are provided in Section E. Document category numbers and abbreviated descriptions to be used in completing the FRM-1469 form are found in Section F. Detailed engineering document descriptions are found in FRM-1469 Supplement A.
- C. DISTRIBUTION:** Engineering documents required by the FRM-1469 form to be submitted shall be forwarded to the group(s) and destination(s) described under entry #9, "Forward Copies To."
- D. DEFINITION OF TERMS:**

Supplier – This is comprehensive term and includes seller, vendor, contractor, subcontractor, sub-supplier, etc.

Original – The initial document from which copies are to be made, i.e., handwritten copy, typed copy, printed matter, tracings or drawings, or photographs

Reproducible – A master copy which can be legibly duplicated by either microreproduction, diazo, or electrostatic process. Diazo sepias may be submitted only if they meet and satisfy MSTS microfilming or scanning requirements.

Microfilm – Film containing an image reduced in size from the original and capable of being enlarged to a clear reproduction of the original

Permission to Proceed Required – MSTS review required prior to use of documents in the design, fabrication, installation, or other work processes.

Initial – First submittal of a document in accordance with the schedule mutually agreed to by MSTS and the supplier.

Final – The submittal that reflects the required resolution of review comments or completion of the submittal requirements. Drawings submitted as final shall show MSTS's job title, job number, procurement document number, line, equipment, tag or code number, and the manufacturer's serial number(s).

E. MSTS ENTRY INSTRUCTIONS

Field	Information Required	Field	Information Required
1.	Enter document category number.	M	Microfilm
2.	Enter specification paragraph reference.	R	Reproducible
3.	Enter the abbreviated document description corresponding to the category number.	O	Original.
4.	Check appropriate box to indicate whether or not Project review is required prior to use of documents in the design, fabrication, installation, or other work processes.	E	Electronic
5.	Enter the following codes as applicable: D – Before design F - Before fabrication I – Before installation S - Before shipment W – With shipment P - Before final payment Submittal schedule can also be stated in calendar days after notice of award.		Indicate any preferred electronic file format, e.g., Microstation, AutoCAD, Adobe, etc.
6.	Enter the number of copies to be provided as part of initial and final document submittals.	8.	Enter remarks as appropriate; supplier to use to indicate its submittal schedule if different than specified in #5 and agreed to by The Project.
7.	Enter code(s) from the following list to denote the required submittal media:	9.	Enter name(s) and address(es) to which documents are to be forwarded as well as any special handling instructions that may be required.
		10.	Project may pre-print or type project and client identification.
		11-12.	Enter the information required, including FRM-1469 form page numbering and revision number.

F. DOCUMENT CATEGORY NUMBERS AND ABBREVIATED DESCRIPTIONS

Engineering documents are to be identified on the FRM-1469 as follows; FRM-1469 Supplement A further defines each category:

Doc. Category No.	Abbreviated Document Description	Doc. Category No.	Abbreviated Document Description
1.1	DWGS	11.0	MAT DESCRPT
1.2	OUTLINE DIM, SERVICES & FDN/MTG DETS	12.0	WLDG PROC & QUALF
1.3	ASSEMBLY DWGS	13.0	MATERIAL CONT PROC
1.4	SHOP DET DWGS	14.0	REPAIR PROC
1.5	WIRING DIAGS	15.0	CLNG & CTG PROC
1.6	CONT LOGIC DIAGS	16.0	HEAT TR PROC
1.7	P&IDs	17.0	UT PROC
2.0	PARTS LIST AND COST	18.0	RT PROC
3.0	COMP DATA SHT	19.0	MT PROC
4.1	INSTRUCTIONS	20.0	PT PROC
4.2	EREC/INSTL	21.0	EDDY CURR EXAM PROC
4.3	OPERATING	22.0	PRESS TEST – HYDRO, AIR, BUBBLE – VAC TEST PROC
4.4	MAINTENANCE	23.0	INSPECTION PROC
4.5	SITE STOR & HDLG	24.1	PRFM TEST PROC
5.0	SCHED – ENGRG & FAB/EREC	24.2	MECH TEST
6.0	QA MNL/PROC	24.3	ELEC TEST
7.0	SEISMIC DATA REPORT	25.0	PROTOTYP TEST REPORT
8.0	ANALYSIS & DESIGN REPORT	26.0	PERSONL QUAL PROC
9.0	ACST DATA RPRT	27.0	SPLR SHPNG PREP PROC
10.1	SAMPLES	28.0	(OPEN)
10.2	TYP QUAL VERIF DOC	29.0	(OPEN)
10.3	TYP MAT USED	30.0	(OPEN)

DOCUMENT CATEGORY NUMBERS & DOCUMENT DESCRIPTIONS

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(E) Engineering Documents: This term comprises procedures, drawings, specifications, QA plans, prototype qualification test reports, and other similar documents that require MSTs permission to proceed prior to fabrication, or prior to use of the document on the design, fabrication, installation, or other work progress. The term is also applied to price lists, and instructions for erection/installation, operation, maintenance, and site storage and handling.

1.0 DRAWINGS

- 1.1 Outline Dimensions, Services, Foundations and Mounting Details – Drawings providing external envelope, including lugs, centerline(s), location and size for electrical cable, conduit, fluid, and other service connections, isometrics and details related to foundations and mountings.
- 1.2 Assembly Drawings – Detailed drawings indicating sufficient information to facilitate assembly of the component parts of an equipment item.
- 1.3 Shop Detail Drawings – Drawings which provide sufficient detail to facilitate fabrication, manufacture, or installation. This includes pipe spool drawings, internal piping and wiring details, cross-section details and structural and architectural details.
- 1.4 Wiring Diagrams – Drawings which show schematic diagrams, equipment internal wiring diagrams, and interconnection wiring diagrams for electrical items.
- 1.5 Control Logic Diagrams – Drawings which show paths which input signals must follow to accomplish the required responses.
- 1.6 Piping and Instrumentation Diagrams – Drawings which show piping system scheme and control elements.

2.0 PARTS LIST AND COST – Sectional view with identified parts and recommended spare parts for one year's operation or specified with unit cost.

3.0 COMPLETED MSTs DATA SHEETS – Information provided by a supplier on data sheets furnished by MSTs

4.0 INSTRUCTIONS

- 4.1 Erection/Installation – Detailed written procedures, instructions, and drawings required to or install material or equipment.
- 4.2 Operating – Detailed written instructions describing how an item or system should be operated.
- 4.3 Maintenance – Detailed written instructions required to disassemble, reassemble and maintain items or systems in an operating condition.
- 4.4 Site Storage and Handling – Detailed written instructions which define the requirements and time period for lubrication, rotation, heating, lifting or other handling requirements to prevent damage or deterioration during storage and handling at jobsite. This includes return shipping instructions.

5.0 SCHEDULES – ENGINEERING AND FABRICATION/ERECTION – Bar charts or critical path method diagrams which detail the chronological sequence of activities.

- 6.0 QUALITY ASSURANCE MANUAL/PROCEDURES** – The document(s) which describe(s) the planned and systematic measures that are used to assure that structures, systems, and components will meet the requirements of the procurement documents.
- 7.0 SEISMIC DATA REPORT** – The analytical or test data which provides data and demonstrates suitability of material, component or system in relation to the conditions imposed by the stated seismic criteria.
- 8.0 ANALYSIS AND DESIGN REPORT** – The analytical data (stress, electrical loading, fluid dynamics, etc.) which demonstrates that an item satisfies specified requirements. Calculations are included in analysis.
- 9.0 ACOUSTIC DATA REPORT** – The noise, sound and other acoustic vibration data required by the procurement document.
- 10.0 SAMPLES**
- 10.1 Typical Quality Verification Documents – A representative data package which will be submitted for the items furnished as required in the procurement documents.
 - 10.2 Typical Material Used – A representative example of the material to be used.
- 11.0 MATERIALS DESCRIPTION** – The technical data describing a material which a supplier proposes to use. This usually applies to architectural items, e.g., metal siding, decking, doors, paints, coatings.
- 12.0 WELDING PROCEDURES AND QUALIFICATIONS** – The welding procedure, specification and supporting qualification records required for welding, hard facing, overlay, brazing and soldering.
- 13.0 MATERIAL CONTROL PROCEDURES** – The procedures for controlling issuance, handling, storage and traceability of materials such as weld rod
- 14.0 REPAIR PROCEDURES** – The procedures for controlling material removal and replacement by welding, brazing, etc., subsequent thermal treatments, and final acceptance inspection.
- 15.0 CLEANING AND COATING PROCEDURES** – The procedures for removal of dirt, grease or other surface contamination and preparation and application of protective coatings.
- 16.0 HEAT TREATMENT PROCEDURES** – The procedures for controlling temperature and time at temperature as a function of thickness, furnace atmosphere, cooling rate and method, etc.
- 17.0 UT – ULTRASONIC EXAMINATION PROCEDURES** – Procedures for detection of presence and certain characteristics of discontinuities and inclusions in materials by the use of high frequency acoustic energy.
- 18.0 RT – RADIOGRAPHIC EXAMINATION PROCEDURES** – Procedures for detection of presence and certain characteristics of discontinuities and inclusions in materials by x-ray or gamma ray exposure of photographic film.

- 19.0 **MT – MAGNETIC PARTICLE EXAMINATION PROCEDURES** – Procedures for detection of surface (or near surface) discontinuities in magnetic materials by distortion of an applied magnetic field.
- 20.0 **PT – LIQUID PENETRANT EXAMINATION PROCEDURES** – Procedures for detection of surface discontinuities in materials by application of a penetrating liquid in conjunction with suitable developing techniques.
- 21.0 **EDDY CURRENT EXAMINATION PROCEDURES** – Procedures for detection of discontinuities in material by distortion of an applied electromagnetic field.
- 22.0 **PRESSURE TEST – HYDRO, AIR, LEAK, BUBBLE OR VACUUM TEST PROCEDURES** – Procedures for performing hydrostatic or pneumatic structural integrity and leakage tests.
- 23.0 **INSPECTION PROCEDURE** – Organized process followed for the purpose of determining that specified requirements (dimensions, properties, performance results, etc.) are met.
- 24.0 **PERFORMANCE TEST PROCEDURES** – Tests performed to demonstrate that functional design and operational parameters are met.
 - 24.1 Mechanical Tests – e.g., pump performance data, valve stroking, load, temperature rise, calibration, environmental, etc.
 - 24.2 Electrical Tests – e.g., impulse, overload, continuity, voltage, temperature rise, calibration, saturation, loss, etc.
- 25.0 **PROTOTYPE TEST REPORT** – Report of a test which is performed on a standard or typical example of equipment or items and is not required for each item produced in order to substantiate the acceptability of equal items. This may include tests which result in damage to the item(s) tested.
- 26.0 **PERSONNEL QUALIFICATION PROCEDURES** – Procedures for qualifying welders, inspectors and other special process personnel.
- 27.0 **SUPPLIER SHIPPING PREPARATION PROCEDURE** – The procedure used by a supplier to prepare finished materials or equipment for shipment from its facility to the jobsite.
- 28.0 (OPEN)
- 29.0 (OPEN)
- 30.0 (OPEN)

MSTS

QUALITY VERIFICATION DOCUMENT REQUIREMENTS

1. Document Category Number	2. Specification Paragraph Reference	3. Document Description	4. Remarks	5. Document Supplier Page Count
13.0	1.03.G	Material Verification Reports		
18.0	1.03.F	Design Certification		
18.0	1.04B	Code Compliance		
6. Supplier's Order No.	7. Supplier's Part No.	8. Supplier's Part Name	9. Quantify	
10. MSTS Req.P.O. No.	11. MSTS Line/Equip Tag or Code No.	12. MSTS Part Name	13.	
14. Supplier's Conformance Statement (We certify that the work and required documents meet the requirements of the procuring documents.)				
_____ _____ _____ Authorized Supplier Signature Title Date				
15. Forward Copies To MSTS 2621 Losee Rd, NLV Building B-3 North Las Vegas, NV 89030		Special Instructions		
16. Project and Client Information		17. Job No. 02119	Sheet C1 of C6	
		18. Spec. Number 02119-SPC-E03	Revision No. 0	

QUALITY VERIFICATION DOCUMENT REQUIREMENTS INSTRUCTIONS

- A. PURPOSE:** The FRM-1470 is initially prepared by Project Engineering and completed by the supplier when providing quality verification documents to the Project in support of the work. The FRM-1470 is a multi-purpose form to:
- (1) Transmit quality verification documents from the supplier.
 - (2) Provide a Conformance Statement from the supplier.
 - (3) Provide evidence of a Field Inspection check of the quality verification documentation received at the installation site. A receiving inspection report (FRM-0644) is completed by the user/requester. In lieu of a signature from the MSTS Field Inspector, a Receiving Inspection Report (FRM-0644) number may be referenced and a copy of the signed FRM-0644 form attached to the FRM-1470.
- B. GENERAL INFORMATION:** Instructions for filling out the FRM-1470 form are found in Section E. Document category numbers and abbreviated descriptions to be used in completing the FRM-1470 form are found in Section F. Detailed quality verification document definitions are found in FRM-1470 Supplement A.
- C. DISTRIBUTION:** After receipt inspection, the completed Quality Verification Documents required to be provided per the FRM-1470 shall be forwarded to the group(s) and destination(s) designated under entry #15, "Forward copies to." A completed copy of Form FRM-1470 and copies of supporting quality verification documents shall accompany the hardware."
- D. DEFINITIONS OF TERMS:** (Also see Document Category Definitions, FRM-1470 Supplement A).

Supplier – This is a seller, vendor, contractor, subcontractor, sub-supplier, etc.

MSTS Field Inspector – MSTS project member who performs the receipt inspection. The MSTS Field Inspector is the user/requester of the procured item and may be from Engineering or another department. When the MSTS Field Inspector is not from Engineering, the PE (or designee) shall reference a Receiving Inspection Report (FRM-0644) number in the MSTS Field Inspector Blocks on the FRM-1470 form and attach a signed copy of the FRM-0644 Form.

E. PROJECT ENTRY INSTRUCTIONS

Entry No.	Information Required	Entry No.	Information Required
1.	Enter document category number	14.	To be signed by an employee of the supplier identified in its QA Manual or by supplier's letter as authorized to sign such documents.
2.	Enter specification paragraph reference.	15.	Enter name(s) and address(es) to whom items or documents are to be forwarded.
3.	Enter abbreviated document description corresponding to the document category number.	16.	Project may pre-print or type project and client identification
4.	Enter "Remarks" as appropriate. When an authorized deviation has occurred, describe the deviation(s) and reference the deviation authorization document(s) in this column, and include the authorization document(s) in the verification package. (The deviation authorization document is typically a Project-approved Supplier Deviation Disposition Request [SDDR]; see OP-NENG-022, "Supplier Deviation Disposition Request.")	17.	Project may pre-print the Project job number
5.	Enter total number of pages in the quality verification document being submitted corresponding to the units being released.	18.	Enter specification number and FRM-1470 form page numbering and revision number.
6-8.	Enter information required.		
9.	Enter the quantity of units covered by the quality verification documents being submitted. For each shipment being released, provide a separate copy of this completed form and the supporting quality verification documents.		
10-12.	Enter information required.		
13.	Open – This space to be identified and used for traceability. If or when appropriate, enter identification numbers, serial numbers, heat numbers, etc.		

F. DOCUMENT CATEGORY NUMBERS AND ABBREVIATED DESCRIPTIONS

Quality verification documents are to be identified on the FRM-1470 as follows; FRM-1470 Supplement A further defines each category:

Doc. Category No.	Abbreviated Description	Doc. Category No.	Abbreviated Description
12.0	WELD & QUALF VERIF DOC	19.0	UT – REPORT
13.0	MAT VERIF RPRT	20.0	RT – REPORT
14.0	MAJ REPAIR VERIF RPRT	21.0	MT – REPORT
15.0	CLNG & CTG VERIF RPRT	22.0	PT – REPORT
16.0	HEAT TRT VERIF RPRT	23.0	EDDY CUR EXAM & VERIF RPRT
17.1	MAT PROP RPRT	24.0	PRESS TEST – HYDRO, AIR, BUBBLE – VAC TEST REPORT
17.2	MAT TEST RPRT	25.0	INSP & VERIF RPRT
17.3	IMP TEST DATA	26.1	PRFM TEST REPORT
17.4	FERRITE DATA	26.2	MECH TEST
17.5	MAT CERT OF COMPL	26.3	ELEC TEST
17.6	ELEC PROP RPRT	27.0	PROTOTYP TEST REPORT
18.0	CODE COMPL		

QUALITY VERIFICATION DOCUMENT CATEGORY DEFINITIONS

FRM-1470 SUPPLEMENT A

- (V) Quality Verification Documents. This term comprises material test reports, heat treatment charts, welding records, NDE results, performance test reports, and similar document(s), which demonstrate or verify conformance to the technical or inspection requirements of the procurement documents.
- 12.0 WELDING AND QUALIFICATION VERIFICATION REPORTS – A verification report of welds performed including the identification of the qualified weld(s), and certification that the weld(s) were qualified.
- 13.0 MATERIAL VERIFICATION REPORTS – Reports relative to material which confirm, substantiate or assure that an activity or condition has been implemented in conformance with code and material specifications imposed by the procurement documents.
- 14.0 MAJOR REPAIR VERIFICATION REPORTS – Verification reports may include weld repair locations (maps), material test reports for filler metal, pre- and post-weld treatment records, NDE records, etc. The resolution of whether a repair is major or not is a Project responsibility.
- 15.0 CLEANING AND COATING VERIFICATION REPORTS – Verification reports include certification of visual examination for surface preparation, surface profile, materials, etc., humidity data, temperature data and coating thickness data as required by the procurement documents.
- 16.0 HEAT TREAT REPORTS – Verification reports normally include furnace charts or similar records which identify and certify the item(s) treated, the procedure used, furnace atmosphere, time at temperature, cooling rate, etc.
- 17.1 MATERIAL PROPERTY REPORTS
- 17.2 Material Test Reports (MTR) – These reports include all chemical, physical, mechanical, and electrical property test data required by the material specification and applicable codes. This is applicable to cement, concrete, metals, cable jacket materials, rebar, rebar splices, etc.
- 17.3 Impact Test Data – Results of Charpy or drop weight tests including specimen configuration, test temperature and fracture data.
- 17.4 Ferrite Data – Report of the ferrite percentage for stainless steel materials used, including castings and welding filler metals as deposited.
- 17.5 Material Certificate of Compliance – Verification document which certifies conformance to the requirements of the applicable material specification.
- 17.6 Electrical Property Reports – Report of electrical characteristics, e.g., dielectric, impedance, resistance, flame tests, corona, etc.
- 18.0 CODE COMPLIANCE – Verifying documents (such as data Forms U-1, N-2, State, etc.), which are prepared by the manufacturer or installer and certified by the Authorized Code Inspector.
- 19.0 UT – ULTRASONIC EXAMINATION AND VERIFICATION REPORTS – Examination results of presence and certain characteristics of discontinuities and inclusions in material by the use of high frequency acoustic energy.

- 20.0 RT – RADIOGRAPHIC EXAMINATION AND VERIFICATION REPORTS – Examination results of presence and certain characteristics of discontinuities and inclusions in materials by x-ray or gamma-ray exposure of photographic film.
- 21.0 MT – MAGNETIC PARTICLE EXAMINATION AND VERIFICATION REPORTS – Examination results of surface (or near surface) discontinuities in magnetic materials by distortion of an applied magnetic field.
- 22.0 PT – LIQUID PENETRANT EXAMINATION AND VERIFICATION REPORTS – Examination results of surface discontinuities in materials by application of a penetrating liquid in conjunction with suitable developing techniques.
- 23.0 EDDY CURRENT EXAMINATION AND VERIFICATION REPORTS – Examination results of discontinuities in material by distortion of an applied electromagnetic field.
- 24.0 PRESSURE TEST – HYDRO, AIR, LEAK, BUBBLE OR VACUUM TEST AND VERIFICATION REPORTS – Results of hydrostatic or pneumatic structural integrity and leakage tests.
- 25.0 INSPECTION AND VERIFICATION REPORTS – Documented findings resulting from an inspection.
- 26.1 PERFORMANCE TEST AND VERIFICATION REPORTS – Report of test results.
 - 26.2 Mechanical Tests, e.g., pump, performance data, valve stroking, load, temperature rise, calibration, environment, etc., Electrical Tests, e.g., load, impulse, overload, continuity, voltage, temperature rise, calibration, saturation, loss, etc.
- 27.0 PROTOTYPE TEST REPORT – Report of the test which is performed on a standard or typical example of equipment, material or item, and is not required for each item produced in order to substantiate the acceptability of equal items. This normally includes tests which may, or could be expected to, result in damage to the item(s) tested.
- 28.0 (OPEN)
- 29.0 (OPEN)
- 30.0 (OPEN)