**SECTION 26 05 04**

**CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT**

**Based on DFD Master ELectrical SPEC Dated 03/01/23**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

***This section is to be used for the non-specialized work to be done by the Contractor's personnel. Work done by a specialized testing consultant normally will be handled as a separate contract directly with DFD.***

**PART 1 - GENERAL**

**SCOPE**

The work under this section includes the required cleaning, inspection, adjustment, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical and existing electrical equipment being furnished, modified, worked on or serviced by this contractor for this project. Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

PART 2 - PRODUCTS

 Not Used

PART 3 - EXECUTION

 General Inspection and Cleaning of All Electrical Equipment

 Grounding Systems

 Medium Voltage Switches

 Liquid (Oil) Filled Transformers

 Dry Type Transformers

 Lightning Arresters/Surge Suppression

 Metering and Instrumentation

 Battery Systems

 Mechanical and Electrical Interlock System

 Metal Enclosed Bus Duct

 Ground Fault Systems

 Switchboards (Low voltage)

 Panelboards

 Motor Starters and Motor Control Centers

 Cables

 Manholes

 Light Fixtures

 Occupancy Sensors

 Battery Pack Emergency Lighting

 UPS System

 Generators

 Automatic Transfer Switches

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 01 91 01 or 01 91 02 – Commissioning Process

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

***The consultant shall edit the remainder of this section and delete equipment that does not apply to this project.***

**General Inspection and Cleaning of all Electrical Equipment**

Inspect for physical damage and abnormal mechanical and electrical conditions.

Any item found to be out of tolerance, or in any other way defective as a result of the required inspection or testing, shall be reported to the DFD. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.

Compare equipment nameplate information with the latest single line diagram and report any discrepancies.

Verify proper auxiliary device operation and indicators.

Check tightness of accessible bolted electrical joints. Use torque wrench/ screw driver method.

Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.

Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.

Clean All Equipment:

Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, bus ducts, MCC's, and the exterior of all Communications and Electronic Safety and Security hardware and equipment.

Loosen attached particles and vacuum them away.

Wipe all insulators with a clean, dry, lint free rag.

Clean insulator grooves.

Re-vacuum inside surfaces as directed by the DFD Construction Representative or Inspector

Inspect equipment anchorage.

Inspect equipment and bus alignment.

Check all heater elements for operation and control.

Lubricate nonelectrical equipment per manufacturer's recommendations.

**GROUNDING SYSTEMS**

Inspect the ground system for adequate termination at all devices.

**MEDIUM VOLTAGE SWITCHES (5 kV and above)**

Check blade alignment and arc interrupter operation.

Check fuse linkage and element for proper holder and current rating.

Check each fuse holder for adequate mechanical support of each fuse.

Verify interlocks and proper key distribution.

Verify proper phase barrier, materials and installation.

**LIQUID (OIL) FILLED TRANSFORMERS**

Inspect bushings, cooling fins, and tank for oil leaks.

Measure secondary voltage phase-to-phase and phase-to-ground after final energization and prior to loading.

Verify and/or connect transformer "XO" to ground, load side of "WYE" systems.

**DRY TYPE TRANSFORMERS**

Test and adjust the cooling fans, controls and alarm functions.

Vacuum clean the transformer enclosure.

Measure secondary voltage phase-to-phase and phase-to-ground after final energization and prior to loading.

Verify and/or connect transformer "XO" to ground, load side of "WYE" systems.

**LIGHTNING ARRESTERS/SURGE SUPPRESSION**

Inspect for physical damage such as chipped or fractured porcelain. Wipe clean.

Perform a ground continuity test to grounding system.

Verify the proper mounting and adequate clearance.

Verify the voltage of the units with system one line diagram. Report any discrepancies.

Verify the electronic surge protection device is connected properly and status lights are normal.

**METERING AND INSTRUMENTATION**

Examine all devices for broken parts, damage and wire connection tightness.

Verify the electronic meter is connected properly and displaying proper voltage and power quantities.

Inspect nameplate information for compatibility with one-line drawings.

Verify the instrument transformer connections with the system requirements.

Verify tightness of all bolted connections and assure adequate clearances exist from primary circuits to secondary circuit wiring and to grounds.

Verify that all required grounding and shorting connections exist and that those connections make good contact; i.e. sufficient surface area, good cleanliness, and proper pressure.

Verify proper primary and secondary fuses and required sizes.

**BATTERY SYSTEMS**

Inspect for physical damage and evidence of corrosion. Clean units.

Measure system charging voltage and each individual cell voltage.

Measure the electrolyte specific gravity and level.

Verify and compare measured values with manufacturer's specifications.

**MECHANICAL AND ELECTRICAL INTERLOCK SYSTEM**

Physically test each system to insure proper function, operation and sequencing.

Closure attempt shall be made on locked open devices.

Opening attempt shall be made on locked closed devices.

Key exchange shall be made with devices operated in off normal positions.

**METAL ENCLOSED BUS DUCT**

Bus shall be inspected for physical damage, cleanliness and proper connection in accordance with the single line diagram.

Inspect for proper bracing, suspension, alignment and enclosure ground.

Check tightness of bolted joints by calibrated torque wrench method.

Make close inspection for any indication of environmental influence on the bus enclosure (i.e. foreign material) which could affect insulation resistance by reducing clearance phase-to-phase or phase-to-ground.

**GROUND FAULT SYSTEMS**

Inspect for physical damage.

Inspect the neutral main bonding connection to assure:

Zero sequence system is grounded upstream of sensor.

Ground strap systems are grounded downstream from the sensing device.

Ground connection is made ahead of the neutral disconnect link.

**SWITCHBOARDS (LOW VOLTAGE)**

Visual and Mechanical Inspection:

Inspect for physical, electrical and mechanical conditions. Re-torque all bolted connections.

Compare equipment nameplate information with latest single line diagram and report discrepancies.

Inspect for proper alignment, anchorage and grounding

All doors, panels and sections shall be inspected for paint, dents, scratches, and fit.

Vacuum clean the switchboard enclosure.

All active components shall be exercised and cleaned where possible.

All indicating devices shall be inspected for proper operation.

**PANELBOARDS**

Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

Vacuum clean the panelboard enclosure.

**MOTOR STARTERS AND MOTOR CONTROL CENTERS**

Verify the control circuits. Confirm the fusing and the grounding of the control transformers. Torque all of the connections. Confirm the overload elements and the circuit breakers (fuse) for proper sizing. Verify all grounding. Operate and test each motor starter for proper operation.

**CABLES**

600 Volt cable:

Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections.

Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor terminations to manufacturer's recommendations.

Perform a 1000 Vdc megger test on all secondary cables from the substation transformers to the secondary switchboards and on all switchboard feeders.

Medium Voltage cable:

Inspect exposed sections for physical damage.

Inspect for visual jacket and insulation condition.

Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radii -- 12 times the diameter for tape shielded cables.

Inspect for proper shield grounding, cable support and termination.

Inspect for proper fireproofing in common cable areas.

Verify cable is supplied and connected in accordance with single line diagram.

There shall be NO tests performed on existing cable without specific direction from DFD.

Above 600 volt testing will be performed under a separate contract.

**MANHOLES**

Check cable racking and system grounding in all manholes.

Verify all cable labels.

**LIGHT FIXTURES**

Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips. Confirm operation of the fixture with the proper switch or sensor.

**OCCUPANCY SENSORS**

Confirm operation of the sensor per the manufacturer’s specification.

**BATTERY PACK EMERGENCY LIGHTING**

Verify the operation per the manufacturers spec and run all of the diagnostic steps. Confirm proper grounding and location.

**UPS SYSTEM**

Operate and test the system per the manufacturers spec. Confirm the batteries and liquid level along with the transfer scheme.

**GENERATORS**

Run the generator through the standard tests as recommended by the manufacturer including the load bank test. Test the automatic start circuits and run the full diagnostic tests. Check for fuel and coolant leaks.

Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.

After the generator has cooled down from the four hour test, shut it down and then simulate a power failure including operation of the transfer switch, automatic startup, shutdown and return to normal.

**AUTOMATIC TRANSFER SWITCHES**

Coordinate with the generator and the subsequent tests.

Check the automatic transfer switches and automatic start circuits for proper function.

**COMMUNICATIONS AND ELECTRONIC SAFETY AND SECURITY**

At equipment rooms:

Check all cable and connectors for proper installation and support.

Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections.

Confirm cable bends to comply with manufacturer's minimum allowable bending radii.

Inspect for proper shield grounding, cable support and termination.

Confirm all dust caps and blank panels are in place.

Wipe down all equipment racks and cabinets, enclosures, cable supports, cable organizers, termination hardware and related items.

Coordinate cleaning schedule to provide a secure, dust and contaminant-free environment as required to accommodate all trade’s equipment that will be positioned in the room. This condition likely will precede general occupancy.

Refer to Division 27 and 28 specification sections that may include additional requirements.

END OF SECTION