



UNIT SUBSTATION ENERGIZATION REQUIREMENTS

Prior to initial energization of a new unit substation, several checklists must be completed. These checklists include but are not limited to checklists of U-M Utilities Plant Engineering (UPE), the AEC Electrical Inspector and the Commissioning Authority. In addition, multiple Plant Operations and utility service request forms must be submitted to UPE.

Below is a compilation of the various energization requirements. This is a summary of the energization requirements so Project Managers and Contractors can complete all of the requirements in advance.

THROUGHOUT CONSTRUCTION PERIOD

TASK	REQUIREMENT
1.	Substation room is clean and shall remain so throughout the remainder of construction. Room is free of dirt, debris and stored materials.
2.	Equipment protected from dirt, dust, water and physical damage at all times.
3.	Equipment protected from moisture with internal heat sources per manufacturer's instructions.

SUBSTATION ROOM

TASK	REQUIREMENT
4.	Electrical Contractor notified Project Manager substation room is complete and secure per contract documents.
5.	Substation room dry and free of water infiltration.
6.	Masonry and drywall work complete.
7.	Fireproofing of steel complete.
8.	Fire stopping of floor, wall, ceiling and duct bank penetrations complete.
9.	Painting of floor and walls complete.
10.	Ventilation system complete and operational including clean filters (or temporary ventilation provided).
11.	Sprinkler system complete, passed pressure testing and operational.
12.	Ductwork and piping not serving room are routed outside of room or are segregated from room.
13.	Fire wrapping and labeling of primary cables complete.
14.	Lighting complete, levels are per NEC, fed from emergency circuits, and switched.
15.	Emergency lighting battery pack units complete.
16.	Receptacles complete and fed from emergency circuits.
17.	Fire alarm system complete (or temporary fire detection and sprinkler flow switch provided).
18.	MOSCAD complete or temporary DPSS notification system provided (for monitoring of the room smoke detectors and water flow switches via FA system).
19.	BAS DDC inputs and outputs complete (or temporary DDC monitoring and controls provided if required).
20.	IT data outlets complete (or temporary data communications provided if required).
21.	Proper egress door placement as required by NEC.
22.	Egress doors swing outward, are equipped with panic hardware and door sweeps, and lead to a path of egress.
23.	Doors contain NEC required signage ("DANGER - HIGH VOLTAGE - KEEP OUT!").
24.	Substation room complete and secured utilizing a U-M XW-7 lock core (XW-5 for UMHS installations).
25.	NEC working space around primary gear and transformers (5'-0" min. front and rear, 2'-0" min. sides, 6'-6" min. AFF).
26.	NEC working space around secondary gear (3'-6" min. front and rear, 2'-0" min. sides, 6'-6" min. AFF).
27.	If room is below grade, floor drain provided adjacent to wall with floor sloped towards it, complete and operational.
28.	If room is below grade, floor drain cleanout and backwater check valve provided outside, complete and operational.
29.	If room is below grade, water detector provided adjacent to wall and floor drain, and connected to DDC.
30.	Wood and glass framed copies of as-built one line diagram and riser diagram provided on front wall.
31.	Type ABC fire extinguishers provided at each exit door.



HOUSEKEEPING PAD

TASK	REQUIREMENT
32.	Housekeeping pad level within 1/8" overall, proper thickness, conforms to footprint of equipment, extends no more than 4" from equipment, and not in egress path.
33.	Leveling channels installed (if required).
34.	Equipment anchored to pad.

GROUNDING

TASK	REQUIREMENT
35.	Ground grid has been tested and results accepted.
36.	Substation room ground bus bar complete.
37.	Exothermic weld or non-reversible connections at room ground bus bar completed.
38.	Grounding electrode conductors sized per NEC and attached in substation and to room ground bus bar.
39.	Grounding electrode conductors connected to building steel, water pipe, ground grid, foundation steel, duct bank ground conductors and other available electrodes.
40.	Bonding of primary duct ends and cable trays complete.
41.	Bonding of mechanical equipment and piping complete.

SUBSTATION OVERALL ASSEMBLY

TASK	REQUIREMENT
42.	Shop drawings and O&M manuals submitted, reviewed, and approved by UPE Primary Systems Group (PSG) and Engineer, Commissioning Authority, and by A/E.
43.	Final short circuit, protective device coordination and preliminary arc flash study, and protective device settings table approved by A/E and submitted to Contractor and Commissioning Authority.
44.	Substation complies with approved shop drawings.
45.	Assembly complete and front aligned.
46.	Assembly free of damage.
47.	Mimic bus provided as specified and complete.
48.	Proper phasing from section to section (primary / transformer/secondary)
49.	Manufacturer and Contractor installed bus bar bolts torqued to manufacturer's recommendations (Contractor to mark each bolt with felt marker after checking torque).
50.	Barriers provide separation between sections (where required).
51.	Substation equipment is clean inside and outside (including top).
52.	Cubicles clean on inside (Contractor to mark with tape).
53.	Breaker lifting hoist complete and tested for lift and travel.
54.	Kirk Key system tested for proper operation.
55.	Extra Kirk Keys turned over to Commissioning Authority.
56.	Covers are in place and secured with full complement of bolts.
57.	Primary, transformer and secondary sections UL labeled and primary section labeled as service entrance equipment.
58.	Fire pump tap section has barriers separating it from other substation sections and has proper signage.



SUBSTATION PRIMARY SECTION(S)

TASK	REQUIREMENT
59.	Primary switches nameplate data complete, legible, and on front of equipment.
60.	Cables are installed, terminated and supported where required.
61.	Phasing is correct (A-B-C from front-to-back, left-to-right, top-to-bottom).
62.	Primary terminations inspected.
63.	Exposed bus taped or covered.
64.	Primary switches cleaned.
65.	Primary fuses installed and match size specified by A/E and reviewed by UPE Primary Systems Engineer.
66.	Spare primary fuses provided (typically in rear compartment of fused primary switch or in cabinet on wall).
67.	Spare fuses match fuses in primary switch.
68.	Primary equipment tested by Independent Testing Agency and reports approved by A/E and reviewed by UPE Primary Systems Engineer, and submitted to Commissioning Authority.
69.	Primary cable tested by Independent Testing Agency and reports approved by UPE Primary Systems Engineer, and submitted to Commissioning Authority.

SUBSTATION TRANSFORMER SECTION(S)

TASK	REQUIREMENT
70.	Transformer name plate data complete, legible, and on front of equipment.
71.	Bonding jumper installed from ground bus to neutral and verified separated in remainder of distribution system.
72.	Shipping bolts adjusted to comply with manufacturer's instructions.
73.	Transformers cleaned.
74.	Transformer temperature monitor mounted in specified case, tested and calibrated.
75.	Cooling fans operational.
76.	Transformer tested by Independent Testing Agency and reports approved by UPE Primary Systems Engineer, and submitted to Commissioning Authority.

SUBSTATION SECONDARY SECTION

TASK	REQUIREMENT
77.	Secondary nameplates data complete, legible, and on front of equipment.
78.	Phasing is correct (A-B-C from front-to-back, left-to-right, and top-to-bottom).
79.	Breakers and cubicles cleaned.
80.	Secondary equipment and cables tested by Independent Testing Agency and reports approved by A/E and submitted to Commissioning Authority.
81.	Independent Testing Agency labels installed on every breaker indicating the breaker has met the testing requirements and trip settings have been set.
82.	Breaker trip units set and tested by Independent Testing Agency to values provided by A/E and reports approved by A/E and submitted to Commissioning Authority.
83.	Contractor has installed breakers and verified settings after accepting delivery from testing agency. Breakers rack in and out smoothly, and can be operated.
84.	CT's located in secondary section with proper ratios and nameplates visible.
85.	CT wiring and associated connections completed and continuity tested.
86.	kWh meter mounted in specified case.
87.	KWh meter, ammeter, voltmeter, switches, PT's, CT's and CT shorting bars installed, connected, operational and calibrated.
88.	Neutral conductors terminated on neutral bus and grounding conductors terminated on ground bus with no interconnection.



SUBSTATION STARTUP

TASK	REQUIREMENT
89.	Protective device settings and coordination study submitted by A/E to U-M UPE Primary Systems Engineer and Commissioning Authority. Study shall include final short circuit and preliminary arc flash reports.
90.	Contractor furnished and install arc flash labels.
91.	Commissioning Authority verified fuses and equipment settings are correct.
92.	Electrical Contractor verified that substation is ready for energization and notified Project Manager.
93.	Factory test reports submitted to Commissioning Authority.
94.	O & M Manual submitted and approved UPE Primary Systems Engineer.
95.	Training plan submitted and training scheduled on equipment being energized. Training shall not occur within the days that UPE High Voltage is preparing for energization.
96.	Field testing of unit substation completed (Contractor).
97.	Field tests of unit substation approved by Project Engineer (A/E).
98.	Certification from vendor field service representative received.
99.	Approved test results submitted to U-M UPE Primary Systems Engineer.
100.	Operation of transfer controls and interlocks per controls sequences of operation.
101.	If entire substation will not be energized at this time, proper lock out / tag out procedures have been implemented and signage installed to prevent unintended energization of equipment.
102.	U-M Construction Management AEC Electrical inspection approval received.
103.	U-M Commissioning Authority approval received.
104.	U-M UPE approval received.
105.	Project Manager submitted a "Work Control Startup Request" a minimum of 10 days in advance.
106.	Signed "Service Request Form" submitted by Project Manager to U-M UPE EOE Manager a minimum of 10 days in advance.
107.	Start-up notification given to Commissioning Authority 10 days in advance of scheduled start-up.
108.	Substation temporary grounds removed.
109.	Electrical Contractor's Lockout/Tagout devices removed in compliance with Contractor's and UPE's Lockout /Tagout program.
110.	Control and operation of 15kV loop switches become the responsibility of U-M UPE High Voltage electricians.
111.	After substation is energized, the room shall not be used for material storage or coffee breaks. The room shall be kept locked and shall be accessible only to qualified personnel.

	Shading indicates items from UPE unit substation energization checklist.
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