

UNIT SUBSTATION ENERGIZATION REQUIREMENTS

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

Below is a compilation of the various checklist requirements. **THIS IS NOT A MASTER CHECKLIST.** This is just a summary of the pre-energization checklist requirements so Construction Managers and Contractors can prepare for the checklists in advance.

THROUGHOUT CONSTRUCTION PERIOD

TASK	REQUIREMENT
1.	Substation room clean and 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.
4.	Cleaning products stored in original containers with warning information clearly legible and adhered to.
5.	Proper ventilation provided for cleaning product fumes as indicated on containers.
6.	Cleaning rags removed on a daily basis if they create a combustion risk.

SUBSTATION ROOM

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

HOUSEKEEPING PAD

TASK	REQUIREMENT
35.	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.
36.	Leveling channels installed (where required).
37.	Equipment anchored to pad.

GROUNDING

TASK	REQUIREMENT
38.	Ground grid has been tested and results accepted.
39.	Substation room ground bus bar complete.
40.	Exothermic weld connections at room ground bus bar inspected with hammer.
41.	Grounding electrode conductors sized per NEC and attached in substation and to room ground bus bar.
42.	Grounding electrode conductors connected to building steel, water pipe, ground grid, foundation steel, duct bank ground conductors and other available electrodes.
43.	Bonding of primary duct ends and cable trays complete.
44.	Bonding of mechanical equipment, ductwork and piping complete.

SUBSTATION OVERALL ASSEMBLY

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

SUBSTATION PRIMARY SECTION(S)

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

SUBSTATION TRANSFORMER SECTION(S)

TASK	REQUIREMENT
72.	Transformer name plate data complete, legible, and on front of equipment.
73.	Bonding jumper installed from ground bus to neutral and verified separated in remainder of gear.
74.	Shipping bolts adjusted to comply with manufacturer's instructions.
75.	Transformers cleaned.

76.	Transformer temperature monitor mounted in specified case, tested and calibrated.
77.	Cooling fans operational.
78.	Transformer tested by Independent Testing Agency and reports approved by A/E and Plant Electrical Operations and Engineering, and submitted to Commissioning Authority.

SUBSTATION SECONDARY SECTION

TASK	REQUIREMENT
79.	Secondary nameplates data complete, legible, and on front of equipment.
80.	Breakers are installed and rack in and out smoothly, and can be operated.
81.	Phasing is correct (A-B-C from front-to-back, left-to-right, top-to-bottom).
82.	Breakers and cubicles cleaned.
83.	Secondary equipment and cables tested by Independent Testing Agency and reports approved by A/E and Plant Electrical Operations and Engineering, and submitted to Commissioning Authority.
84.	Breaker trip units set and tested by Independent Testing Agency to values provided by A/E and reports approved by A/E and Plant Electrical Operations and Engineering, and submitted to Commissioning Authority.
85.	CT's located in secondary section with proper ratios and nameplates visible.
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.	A/E submitted copies of final short circuit/coordination/arc flash study to U-M and Commissioning Authority.
90.	A/E submitted final short circuit/coordination/arc flash report with fuse sizes and equipment settings to Contractor.
91.	Contractor provided fuses and adjusted equipment settings in accordance with A/E's report.
92.	A/E furnished arc flash labels and Contractor installed the arc flash labels.
93.	Commissioning Authority verified fuses and equipment settings are correct and arc flash labels are installed correctly.
94.	Electrical Contractor notified Construction Manager substation is ready for energization.
95.	Factory test reports submitted to Commissioning Authority.
96.	O & M Manual submitted and approved.
97.	Training plan submitted, training scheduled and conducted on equipment being energized.
98.	Field testing of unit substation complete.
99.	Field test reports approved by A/E and Plant Electrical Operations and Engineering, and submitted to Commissioning Authority.
100.	Proper phasing from cubicle to cubicle.
101.	Operation of transfer controls and interlocks per controls sequences of operation.
102.	Independent Testing Agency labels installed on every breaker indicating trip settings have been set.
103.	If entire substation will not be energized at this time, proper locking and signage installed to prevent unintended energization of equipment.
104.	Passed the AEC Electrical Inspection.
105.	U-M Commissioning Authority approval received.
106.	U-M Plant Electrical Operations and Engineering approval received.
107.	Construction Manager submitted a Work Control Startup Request a minimum of 7 days in advance.
108.	Construction Manager submitted a "Utilities Services Request" a minimum of 7 days in advance.
109.	Start-up notification given to Commissioning Authority 7 days in advance of scheduled start-up.
110.	Substation temporary grounds removed.
111.	Electrical Contractor's Lockout/Tagout devices removed.
112.	Control and operation of substation turned over to U-M Plant Electrical Operations and Engineering.
113.	After substation is energized, THE ROOM SHALL NOT BE USED FOR MATERIAL STORAGE OR COFFEE BREAKS. THE ROOM SHALL BE KEPT LOCKED AND SHALL NOT BE ACCESSIBLE TO UN-QUALIFIED PERSONNEL.