



Grounding & Bonding for Electrical Systems Functional Performance Test

Equipment ID	«Equipment_ID»Equipment ID]
Building	{Building]
Location	[Room]

System Description

Description:

Operational Assumptions:

Initial Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 1	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 2	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		



Deferred/Seasonal Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Test Participants

Organization	Required	Optional
General Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
TAB Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Controls Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Owner's O&M Personnel	<input type="checkbox"/>	<input type="checkbox"/>

Test Equipment Required (to be provided by the Contractor)

Test Name	Equipment Description
Bolt Torque	Calibrated torque wrench
Contact Resistance	Four-probe Digital Low Resistance Ohmmeter (DLRO)
Voltage/Continuity	DVM
Fall of Potential	Fall-of-Potential Ground Resistance Tester

Functional Performance Test -- (Verify all components are ready before energizing or operating the system.)

The Commissioning Authority will make and document any changes/addition/deletions to this test procedure required by current system conditions (i.e. weather, system load, utility availability, etc.).

R = Retest (Check (✓) retest required)

C = Corrected (Check (✓) when correction verified)

Y= Checked and Passed

N = Not Passed

ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
PRE-TEST VISUAL MECHANICAL INSPECTION						
1. Verify equipment identification.	Equipment identification and plan location matches shop drawings and specifications.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Field wiring terminations match record drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
Record issues				Issue Log Item:		
				Initial	Date	
2. Confirm that system is installed per contract documents with indicated connections to each unit of electrical equipment	Connections to equipment ground buses per drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Connections to equipment enclosures/cases per drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Connections to wire mesh fence per drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Gate grounding jumper installed per drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Connections to main cold water pipes per drawings and specs.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Connections to dry type transformers per drawings and specs.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Measured diameter of bare copper conductor corresponds to diameter of specified conductors.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Conduits with grounding bushings and full-size bonding conductors.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	All busses mounted on standoff neoprene insulators.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
3. Observe condition of ground ring before backfill and/or cover applied.	No visible damage to cable.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Cable depth a minimum of 3'0".	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Ground rod configuration and depth as shown on drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
				Initial	Date	
4. Observe main ground wall mounted grounding bar.	Dimensions as specified ____ long, 4" x 1/4".	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Standoff distance 5" from wall as shown on drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Connections are welded or bolted as per the approved submittals and construction drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
5. Observe electrical closet ground buses	Buses: Copper, 1/4" x 2" x 10" minimum, length as shown on drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Buses mounted on standoff neoprene insulator - standoff distance 1" from wall as shown on drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Bus length to accommodate 100% spare.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Connections are welded or bolted as per the approved submittals and construction drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
6. Observe telecom closet ground buses	Buses: Copper, 1/4" x 2" x 8" provided by each telecom backboard.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
7. Inspect compression type and exothermically welded connections	Cables do not rotate with respect to each other or to steel column, etc. (All connections are solid).	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
8. Inspect grounding connection at service entrance	Connection point is per (not beyond service disconnect) NEC 250-23.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Neutral is solidly grounded at service disconnect, and at no point beyond.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
9. Verify equipment grounding conductor termination.	Grounding connections are made with non-reversible connections.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
10. Verify tightness of accessible bolted electrical connections with calibrated torque wrench.	Bolted torque should comply with NETA Table 100.12 unless manufacturer specified values are listed on the equipment.	<input type="checkbox"/>	<input type="checkbox"/>	Record data in Contact Integrity Table Bolt Torque	<input type="checkbox"/>	<input type="checkbox"/>
	If Contractor's Test Reports are received and used in lieu of 100% testing, perform random checks of tightness of bolted electrical connections. Randomly Test 10% of connections. If any are not tight, test 100%.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
GROUNDING ELECTRICAL INTEGRITY						
11. Perform resistance test of <u>non-accessible</u> bolted electrical system connections using a Digital Low Resistance Ohmmeter (DLRO) and non-bolted electrical system connections using a DVM.	Resistance shall be less than 500 micro-ohms.	<input type="checkbox"/>	<input type="checkbox"/>	Note: For connections that are inaccessible or unable to be verified by torque (ex: welded connections), conduct a DLRO measurement of connection resistance across connection from closest accessible point on each side. Record Data in Contact Integrity Table – DLRO/DVM	<input type="checkbox"/>	<input type="checkbox"/>
	Compare connection resistance to values of similar connections. Values should be within 10% of each other.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
12. Verify the ground system is complete (connections to building steel, water main etc.) and tested prior to performing the final "system" fall of potential.		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
13. Perform and evaluate a Fall-of-Potential test on the grounding system.	The curve should be "flat" between Y_1 and Y_2	<input type="checkbox"/>	<input type="checkbox"/>	The fall of potential test consists of plotting the ratio of $V/I-R$ as a function of probe spacing. A value of impedance is obtained at Y , Y_1 and Y_2 . This impedance is plotted as a function of distance, and	<input type="checkbox"/>	<input type="checkbox"/>
	The resistance value at distance Y is effective resistance of the electrode or system.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Results are less than or equal to 10 ohms.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
		<input type="checkbox"/>	<input type="checkbox"/>	<p>the value in ohms at which this plotted curve appears to level out is taken as the impedance value of the ground under test.</p> <p>If the curve is not flat between Y_1 and Y_2 additional impedance measurements must be taken. Position the potential probe at several additional distances between the electrode and current probe Z. Record distances and plots the impedance to obtain the flat area of the curve.</p> <p>Attach a copy of the Fall-of-Potential contractor's test report on all individual ground rods.</p> <p>Record values in Fall of Potential Table.</p>	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



Test Equipment Used:

Test Name	Manufacturer	Model Number	Serial Number	Calibration (Date)

SAMPLE



Sample
[Equipment ID]

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[Date]



Fall of Potential

Electrode ID	Distance (Y ₁)	Distance Y	Distance (Y ₂)	Distance (Z)	Resistance	AT	RH	Date

AT=Ambient Temperature

RH = Relative Humidity

SAMPLE






Final Sign-Off

Commissioning Agent	Printed Name	Initials	Date
CONTRACTOR	PRINTED NAME	INITIALS	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			
Owner's O&M Personnel			



TABLE 100.12.1
Bolt-Torque Values for Electrical Connections

US Standard Fasteners ^a
Heat-Treated Steel – Cadmium or Zinc Plated ^b

Grade	SAE 1&2	SAE 5	SAE 7	SAE 8
Head Marking				
Minimum Tensile (Strength) (lbf/in ²)	64K	105K	133K	150K
Bolt Diameter (Inches)	Torque (Pound-Feet)			
1/4	4	6	8	8
5/16	7	11	15	18
3/8	12	20	27	30
7/16	19	32	44	48
1/2	30	48	68	74
9/16	42	70	96	105
5/8	59	96	135	145
3/4	96	160	225	235
7/8	150	240	350	380
1.0	225	370	530	570

- a. Consult manufacturer for equipment supplied with metric fasteners.
- b. Table is based on national coarse thread pitch.



Low-Voltage Switchgear Functional Performance Test

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

System Description

Description:

Operational Assumptions:

Initial Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 1	Start Date	End Date	Initials
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Test Participants

Organization	Required	Optional
General Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
TAB Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Controls Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Owner's O&M Personnel	<input type="checkbox"/>	<input type="checkbox"/>

Test Instruments (To Be Provided By the Contractor)

Recommended Test Equipment (or Equivalent):

Test	Equipment Description
Bolt Torque	Calibrated torque wrench
Wiring Impedance	Low impedance ac millammeter
Sound Level	Calibrated decibel meter

System Readiness Summary Checklist

Description	Yes	No	Date
System Ready for Test	<input type="checkbox"/>	<input type="checkbox"/>	
Required Personnel Available	<input type="checkbox"/>	<input type="checkbox"/>	
Required Tools/Test Equipment/Supplies Available	<input type="checkbox"/>	<input type="checkbox"/>	
Required Safety Equipment Available	<input type="checkbox"/>	<input type="checkbox"/>	



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R = Retest (Check (✓) retest required)

Y= Checked and Passed

C = Corrected (Check (✓) when correction verified)

N = Not Passed

ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
PRE-TEST VISUAL MECHANICAL INSPECTION						
1. Safe conditions (protective gear in- place, available & procedures observed)		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
2. Verify panelboard installations	Isolation transformer installed with electrostatic shield between primary and secondary winding and connected to ground.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Completed panelboard schedules.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Appropriate anchorage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Required area clearances. 3 ft in front and 30 in wide.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	No physical damage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Breaker casing does not have cracks.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Correct alignment.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
3. Inspect panelboard doors, panels, and sections	Free of Corrosion, dents, scratches, fit.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	No missing screws.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	No open unused knockouts.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	No missing hardware.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
4. Verify panelboard configuration and nameplate data matches shop drawings, one-line diagram and specification	Volts:_____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Bus Amps: _____A.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	3ph, 4W.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Frequency: 60hZ.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Enclosure: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Transformer _____KVA.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Transformer _____V.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Transformer class _____ insulation rating.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Transformer 60Hz.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Main Breaker Max. Rating. _____ Amp.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Panelboard arrangement _____ # of circuits.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	_____ Percent Spares.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	_____ Space.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Neutral size _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	LIM installed provides continuous monitoring of impedance of each phase to ground.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	LIM combined analog and digital display.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	LIM capable of detecting all combinations of capacitive, resistive, balanced, unbalanced and hybrid faults.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	LIM contains audible alarm and alarm silence button.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	LIM contains Indication LEDs.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	LIM contains Test Button.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	LIM contains remote terminal connections.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
5. Verify panelboard equipment grounding	Solid neutral mounted in main circuit breaker compartment with main lugs, is insulated.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Neutral is bonded to ground.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Frame and enclosure connected to ground bus.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Breaker and feeder equipment grounding conductors/conduit are connected to ground bus.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
6. After testing is performed on the panelboard, verify tightness of main connections	Primary feeder cable connections properly torqued and marked.	<input type="checkbox"/>	<input type="checkbox"/>	Bolted torque should comply with NETA Table 100.12 unless manufacturer specified values are listed on the equipment. Test Name: Feeder Termination Torque Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
CAUTION: Before performing the next step, verify that all "Lock-Out / Tag-Out" safety precautions have been adhered to.						
7. Operate each circuit breaker (5) times to ensure smooth operation	Breaker opens and closes in a smooth motion without binding.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
ELECTRICAL INTEGRITY						
8. Measure sound level of isolation transformer	25dB for 5kVA or less transformer.	<input type="checkbox"/>	<input type="checkbox"/>	Test Name: Sound level Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
	30dB for 7.5 kVA transformer.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	35dB for 10 and 15kVA transformers.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	40dBfor 20 and 25kVA transformers.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
9. Perform continuity check on each branch circuit	Correct continuity is verified.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
10. Measure each isolated wiring impedance to ground	Impedance shall exceed 200,000 ohms.	<input type="checkbox"/>	<input type="checkbox"/>	Test Name: Wire Impedance Reference Equip. Table Record results as a reference for subsequent line-impedance evaluation. Record results in Data Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
LINE ISOLATION MONITOR						
11. Isolation power panel is in normal operation	Green signaling lamp is indicated on the panel.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Green signal shall be indicated at the remote monitoring station.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
12. Ground each line of the energized distribution system through a resistor 200 times the measured line voltage	Red signaling lamp is illuminated and local alarm is annunciated.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table	<input type="checkbox"/>	<input type="checkbox"/>
	Green signal shall be indicated at the remote monitoring station.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Alarm resets automatically after ground is removed.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
13. During each line grounding test press the audible alarm silence button	Local and Remote Audible alarm silences.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table	<input type="checkbox"/>	<input type="checkbox"/>
	Local and Remote Red indicating light remains illuminated.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
14. Activate test switch	Red signaling lamp is illuminated and local alarm is annunciated.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Red signal shall be indicated at the remote monitoring station.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Alarm resets automatically after release of test switch.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
FINAL INSPECTION						
15. At the conclusion of testing, inspect interior hardware and electrical terminations	All hardware in place and properly torqued.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Compartments clear of tools and hardware.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



Test Equipment Used:

Test Name	Manufacturer	Model Number	Serial Number	Calibration (Date)

Panel Data

Parameter	Data
Equipment ID:	
Manufacturer:	
Model Number:	
Serial Number:	
Mfgr. Date:	
Bus Amps:	
Volts:	
Phase/Wire/Frequency:	
Enclosure NEMA Rating:	
Short Circuit Rating:	
Isolation Transformer KVA	
Isolation Transformer Voltage	
LIM Manufacturer	



Feeder Termination Torque (Newton Meters or Foot-Pounds)

Bolt or Lug	A	B	C	N	G
Feeder Lugs					
Feeder Lugs					

Sound Level

Transformer	KVA	Sound Level (Decibel)

Wire Impedance (200,000 OHMS)

Conductor		Torque Verified		DLRO/DVM		Continuity Verified	Date
From (A)	To (B)	(A)	(B)	(A)	(B)		



Conductor	Volts	Resistor	Alarm Test				Alarm Silence			
			Local Light (On/Off)	Local Audible (On/Off)	Remote Lights (On/Off)	Alarm Resets (On/Off)	Audible		Alarm Light	
							Local (On/Off)	Remote (On/Off)	Local (On/Off)	Remote (On/Off)



Final Sign-Off

Commissioning Agent	Printed Name	Initials	Date
CONTRACTOR	PRINTED NAME	INITIALS	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			
Owner's O&M Personnel			



Low-Voltage Switchgear – Data Center Pre-Functional Checklist

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

Statement of Readiness

The above equipment and/or systems integral to them are complete and ready for functional testing, except as noted. None of the outstanding items preclude safe and reliable functional tests being performed. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

Responsible Contractor Sign Here

CONTRACTOR	PRINTED NAME	SIGNATURE	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			

This statement of readiness has been received by the Commissioning Agent on _____ and will be incorporated as part of the final commissioning report.

EQUIPMENT DATA

Switchgear Nameplate

Parameter	Data
Equipment ID	
Manufacturer	
Model	
Type	
Order Number	
Date Manufactured	
Serial Number	
Nominal kVA	



Parameter	Data
Voltage	
Phase	
Wire	
Continuous Current	
Number of Sections	
Enclosure Type	

System Readiness Checklist

Yes = Checked and Completed, N/A = Not Applicable

Inspection Checklist					
Description	Yes	N/A	Initials	Date	Comments
As-Built Drawings complete, available and on-site.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment shop drawings available.	<input type="checkbox"/>	<input type="checkbox"/>			
Operation and Maintenance manuals available.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation and startup manual available.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment warranty information completed and provided in O&M Manual.	<input type="checkbox"/>	<input type="checkbox"/>			
Verify receipt and acceptance of manufacturer's factory test reports.	<input type="checkbox"/>	<input type="checkbox"/>			
Doors to electrical room installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Locks or temporary security measures installed & operational. Room can be secured.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room clear of storage, temporary equipment, etc.	<input type="checkbox"/>	<input type="checkbox"/>			
Permanent lighting or 30 foot candle temporary lighting in service.	<input type="checkbox"/>	<input type="checkbox"/>			
Egress routes from electrical room are unobstructed.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room & equipment clean of construction debris and dust, and are dry.	<input type="checkbox"/>	<input type="checkbox"/>			
Working clearances meet NEC and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment has been installed on a level housekeeping pad.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment anchored per manufacturer's instruction.	<input type="checkbox"/>	<input type="checkbox"/>			
Warning Signs installed per shop drawings and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
All shipped-loose components installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment and switchgear grounding and bonding installed for each section.	<input type="checkbox"/>	<input type="checkbox"/>			
All grounding connections made with either exothermic process or with non-reversible compression fittings.	<input type="checkbox"/>	<input type="checkbox"/>			



Inspection Checklist					
Description	Yes	N/A	Initials	Date	Comments
Cabinet/compartment doors allow for full swing; latch open and close without binding; and no physical damage.	<input type="checkbox"/>	<input type="checkbox"/>			
Bus and units correspond to one-line diagram.	<input type="checkbox"/>	<input type="checkbox"/>			
All internal and field wiring completed and switchgear fully assembled.	<input type="checkbox"/>	<input type="checkbox"/>			
Interior low voltage switchgear bus and compartments vacuumed and wiped clean with manufacturer approved electrical cleaner.	<input type="checkbox"/>	<input type="checkbox"/>			
All bolted connections tightened to their proper torque values.	<input type="checkbox"/>	<input type="checkbox"/>			
All wiring installed properly with correct bend radius and no insulation damage.	<input type="checkbox"/>	<input type="checkbox"/>			
Testing agency has been scheduled to perform the test and the commissioning agent has been notified of the testing date.	<input type="checkbox"/>	<input type="checkbox"/>			
Test equipment requirements have been reviewed with the testing agency.	<input type="checkbox"/>	<input type="checkbox"/>			
Power available for test equipment.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation is complete and ready for verification testing.	<input type="checkbox"/>	<input type="checkbox"/>			
Training Plan approved.	<input type="checkbox"/>	<input type="checkbox"/>			
Training sessions of owner training completed / acceptance granted / training materials submitted to Commissioning Agent.	<input type="checkbox"/>	<input type="checkbox"/>			
Notes:					

Additional Comments:



Switchboards Functional Performance Test

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

System Description

Description:

Operational Assumptions:

Initial Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 1	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 2	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		



Deferred/Seasonal Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Test Participants

Organization	Required	Optional
General Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
TAB Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Controls Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Owner's O&M Personnel	<input type="checkbox"/>	<input type="checkbox"/>

Pre-Functional Performance Test Summary

Description	Yes	No	Date
System ready for test	<input type="checkbox"/>	<input type="checkbox"/>	
Required personnel available	<input type="checkbox"/>	<input type="checkbox"/>	
Required tools/test equipment/supplies available	<input type="checkbox"/>	<input type="checkbox"/>	
Required safety equipment available	<input type="checkbox"/>	<input type="checkbox"/>	

TEST INSTRUMENTS (to be provided by the Contractor)

Test Equipment Required:

Test Name	Equipment Description
Contact Resistance	Four-probe Digital Low Resistance Ohmmeter (DLRO)
Insulation Resistance	Megger-battery or line-powered (Hand-crank not acceptable)
DI Electric Withstand	High Potential Tester
Bolt Torque	Calibrated torque wrench
Relay Operation	Variable AC Voltage source
Voltage/Continuity	DVM



Functional Performance Test -- (Verify all components are ready before energizing or operating the system.)

The Commissioning Authority will make and document any changes/addition/deletions to this test procedure required by current system conditions (i.e. weather, system load, utility availability, etc.).

R = Retest (Check (✓) retest required)

Y= Checked and Passed

C = Corrected (Check (✓) when correction verified)

N = Not Passed

ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
PRE-TEST VISUAL MECHANICAL INSPECTION						
1. Safe conditions (protective gear in-place, available & procedures observed)		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
2. Inspect the exterior of the switchgear	No evidence of damage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Surfaces are clean.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	All doors, panels, and hardware present.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	All doors swing freely, latch in open and closed positions.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Feeder cable/bus routing doesn't obstruct access for operation or maintenance.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
3. Verify anchoring	Anchor bolts are provided in locations shown on manufacturer's drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
4. Verify ratings and configuration. Nameplate data match shop drawings and specifications	Volts: 480/277V.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Amps: 4000A.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	3ph, 4W.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Frequency: 60hZ.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Interrupting Rating: 65kAIC.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Enclosure: NEMA 1.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
5. Verify permanent labels are installed	Equipment labeled with name plates which are black engraved surface on white core for normal power circuits and red engraved surface on white core for emergency power circuits.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Labels include unit number, voltage, and origin of service.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
6. TVSS provided as required by drawings	Conductor length is as short as possible.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Conductor bends are minimized.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Conductors are no longer than 24 inches.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Installed on load side of main circuit breaker.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Indicator lights are functional.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	Surge event operation counter reads zero.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	TVSS is equipped with remote monitoring contacts.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
7. Inspect the control wiring for proper support, routing, protection	Control wires are supported well clear of the path of movement of breakers and auxiliary device trays.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	All wires labeled both ends.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Control wire termination connections tight and cannot be pulled from connection.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	The wire bundle at the door is supported clear of the hinge.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
8. Verify rating of all control circuit protective devices match shop drawings	Fuse and circuit breaker ratings match drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Device labels match drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
9. Verify control power transformer installation	Control power transformer installation per the schematic drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
10. Verify grounding	Connection from station ground grid to equipment ground bus. (possibly at multiple locations).	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Frames and enclosures bolted to ground buss.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Breaker and feeder equipment grounding conductor/conduit are connected to the ground buss.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Measured diameter of bare copper conductor corresponds to diameter of specified conductors.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Neutral is bonded to ground at switchgear, not transformer.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
11. Verify provision and proper operation of integral rail mounted, breaker lifting device	Remove circuit breaker using device and confirm full operation.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Confirm that lifter travels entire length of switchgear smoothly to the end of travel.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
12. Operate each circuit breaker (5) times to ensure smooth operation	Breaker opens and closes in a smooth motion without binding.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
ELECTRICAL INTEGRITY						
13. Disconnect PTs, CPTs, surge arrestors, and circuit breakers		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
14. Disconnect the main bonding jumpers at the switchgear		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
15. Perform an insulation resistance test at 1000VDC on each bus section, phase-to-phase and phase to ground with the circuit breakers connected in the closed position	Minimum insulation resistance shall be 100 Megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Insulation Resistance Data Table. Test with all circuit breakers in the closed position Test for one minute in accordance with NETA Table 100.1. Feeder conductors should not be terminated	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
16. Perform an insulation resistance test at 1000 VDC on the neutral bus section to ground	Minimum insulation resistance shall be 100 Megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Insulation Resistance Data Table Test for one minute in accordance with NETA Table 100.1.	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION		REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
17.	With the breaker in the closed position, measure the contact resistance of each phase of circuit breakers rated 400A and greater	Readings are within 50% of the average value.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Contact Resistance Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
Record issues					Issue Log Item:		
					Initial	Date	
18.	Re-connect the main bonding jumpers and verify tightness with a calibrated torque wrench		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues					Issue Log Item:		
					Initial	Date	
19.	Reconnect surge, arrestors, TVSS, CPT's, and PTs		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues					Issue Log Item:		
					Initial	Date	
20.	Reconnect CT grounds		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues					Issue Log Item:		
					Initial	Date	
21.	After testing is performed on the switchboard, verify tightness of field	Primary connections properly torqued and marked.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Feeder Termination Torque Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
		Bus-to-bus connections properly torqued and marked.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
landed feeder terminations and bus-to-bus connections	TVSS connections are properly torqued and marked.	<input type="checkbox"/>	<input type="checkbox"/>	Bolted torque should comply with NETA Table 100.12 unless manufacturer specified values are listed on the equipment. Secondary distribution feeder connections are not included in the test. Black marker marked across the head of the bolt and bus.	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
FUNCTIONAL TRIP TESTS						
22. Test the long time delay (seconds) and long time pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection.	Long delay current pick up and time delay per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Current Injection Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
23. Test the short time delay (seconds) and short time pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection	Short delay current pick up and time delay per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Current Injection Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
24. Test the instantaneous time delay (seconds) and instantaneous time pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection	Instantaneous pick up per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Current Injection Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
25. Test the ground fault time delay (seconds) and ground fault time pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection.	Ground fault pick up per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Current Injection Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
METERING						
26. Verify the nameplate matches the shop drawings	Model Number: ____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Meter supply voltage matches the AC control power supply.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
27. Verify all metering circuits	Components and wire labels match the drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Verify control power wiring to the meter.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	CT and PT locations, polarity, fusing, and wiring match the drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	CT poles shall have shorting auxiliary contacts. Screws removed from CT shorting blocks.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Confirm tightness of all (100%) CT wiring with screwdriver.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
28. Verify the correct parameters have been programmed into the meter	3ph, 4w, 1000:5 CT, 480:277V PT configuration has been entered into the meter.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	The correct PT ratio of 480:277 has been entered into the meter.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	The correct secondary L-N voltage 120V has been entered into the meter.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	The current transformer ratio 1000:5 has been correctly entered into the meter.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Phase rotation is ____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	The correct frequency 60 Hz has been entered into the meter.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Password is ____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
FINAL INSPECTION						
29. At the conclusion of testing, inspect interior hardware and electrical terminations	All hardware in place and properly torqued.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Compartments clear of tools and hardware.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



Test Equipment Used:

Test Name	Manufacturer	Model Number	Serial Number	Calibration (Date)

Temperature: _____

Relative Humidity: _____

Insulation Resistance (1000 VDC)

Circuit Breaker (Closed)	A-B	B-C	C-A	A-G	B-G	C-G	N
1 Minute (Meg Ohms)							
Circuit Breaker (open)	A-A	B-B	C-C				
1 Minute (Meg Ohms)							

Circuit Breaker Contact Resistance

Phase	A	B	C
(Micro Ohms)			



Feeder Termination Torque (Newton Meters or Foot-Pounds)

Bolt or Lug	A	B	C	N	G
Feeder Lugs					
Feeder Lugs					

Current Injection

Function	Actual Set.	Test Setting	Test Point	Nominal Val.	A	B	C
LTD							
LDPU							
STD							
SDPU							
INSTPU							
GFD							
GFPU							



Final Sign-Off

Commissioning Agent	Printed Name	Initials	Date
CONTRACTOR	PRINTED NAME	INITIALS	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			
Owner's O&M Personnel			



TABLE 100.1

**Insulation Resistance Test Values
Electrical Apparatus and Systems**

Nominal Rating Of Equipment in Volts	Minimum Test Voltage, DC	Recommended Minimum Insulation Resistance in Megohms
250	500	25
600	1,000	100
1,000	1,000	100
2,500	1,000	500
5,000	2,500	1,000
8,000	2,500	2,000
15,000	2,500	5,000
25,000	5,000	20,000
34,500 and above	15,000	100,000

In the absence of consensus standards dealing with insulation-resistance tests, the Standards Review Council suggests the above representative values.

See Table 100.10 for temperature correction factors.




Test results are dependent on the temperature of the insulating material and the humidity of the surrounding environment at the time of the test.

Insulation-resistance test data may be used to establish a trending pattern. Deviations from the baseline information permit evaluation of the insulation.



TABLE 100.12.1
Bolt-Torque Values for Electrical Connections

US Standard Fasteners ^a
Heat-Treated Steel – Cadmium or Zinc Plated ^b

Grade	SAE 1&2	SAE 5	SAE 7	SAE 8
Head Marking				
Minimum Tensile (Strength) (lbf/in ²)	64K	105K	133K	150K
Bolt Diameter (Inches)	Torque (Pound-Feet)			
1/4	4	6	8	8
5/16	7	11	15	18
3/8	12	20	27	30
7/16	19	32	44	48
1/2	30	48	68	74
9/16	42	70	96	105
5/8	59	96	135	145
3/4	96	160	225	235
7/8	150	240	350	380
1.0	225	370	530	570

- a. Consult manufacturer for equipment supplied with metric fasteners.
b. Table is based on national coarse thread pitch.



Switchboards Pre-Functional Checklist

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

Statement of Readiness

The above equipment and/or systems integral to them are complete and ready for functional testing, except as noted. None of the outstanding items preclude safe and reliable functional tests being performed. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

Responsible Contractor Sign Here

CONTRACTOR	PRINTED NAME	SIGNATURE	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			

This statement of readiness has been received by the Commissioning Agent on _____ and will be incorporated as part of the final commissioning report.

Equipment Information

Make		Model Number			
Serial Number		NEMA Enclosure		KVA	
Volts/Phase		AMPS		KW	
Service Area					
Notes:					



System Readiness Checklist

Yes = Checked and Completed, N/A = Not Applicable

General Installation					
Description	Yes	N/A	Initials	Date	Comments
As-Built Drawings complete	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment shop drawings available	<input type="checkbox"/>	<input type="checkbox"/>			
Operation and Maintenance manuals available	<input type="checkbox"/>	<input type="checkbox"/>			
Installation and startup manual available	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment warranty information completed and provided in O&M Manual	<input type="checkbox"/>	<input type="checkbox"/>			
Verify receipt and acceptance of manufacturer's factory test reports	<input type="checkbox"/>	<input type="checkbox"/>			
Doors to electrical room installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Locks or temporary security measures installed & operational. Room can be secured.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room clear of storage, temporary equipment, etc.	<input type="checkbox"/>	<input type="checkbox"/>			
Permanent lighting or 30 foot candle temporary lighting in service.	<input type="checkbox"/>	<input type="checkbox"/>			
Egress routes from electrical room are unobstructed.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room & equipment clean of construction debris and dust, and are dry.	<input type="checkbox"/>	<input type="checkbox"/>			
Working clearances meet NEC and contract documents	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment has been installed on a level housekeeping pad.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment anchored per manufacturer's instruction	<input type="checkbox"/>	<input type="checkbox"/>			
Warning Signs installed per shop drawings and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
All shipped-loose components installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room grounding system complete.	<input type="checkbox"/>	<input type="checkbox"/>			
Ground bus(es) have been installed and terminated to ground system. Grounding electrode connection to building steel completed per design drawings.	<input type="checkbox"/>	<input type="checkbox"/>			
Temporary switchboard circuit directory completed.	<input type="checkbox"/>	<input type="checkbox"/>			
Component/subsystems are clearly and correctly identified with temporary/permanent labels (bus, section, breakers and devices)	<input type="checkbox"/>	<input type="checkbox"/>			
Transient Voltage Suppression System installed per approved shop drawings.	<input type="checkbox"/>	<input type="checkbox"/>			
Switchboard labeled with engraved laminated plastic or metal nameplates mounted with corrosion-resistant screws.	<input type="checkbox"/>	<input type="checkbox"/>			
Shipping bolts and braces removed	<input type="checkbox"/>	<input type="checkbox"/>			



General Installation					
Description	Yes	N/A	Initials	Date	Comments
Shipping splits bolted together at proper torque	<input type="checkbox"/>	<input type="checkbox"/>			
All enclosure panels and doors in place, fitted & undamaged	<input type="checkbox"/>	<input type="checkbox"/>			
All shipped-loose components installed	<input type="checkbox"/>	<input type="checkbox"/>			
Current/Potential Transformer fuses are installed and connected.	<input type="checkbox"/>	<input type="checkbox"/>			
Verify neutral connection to ground.	<input type="checkbox"/>	<input type="checkbox"/>			
All bolted electrical connections have been tightened to their proper torque values. (Note: some connections will be disconnected as part of the FPT. These connections will be field torqued to proper settings at the conclusion of the field-testing.)	<input type="checkbox"/>	<input type="checkbox"/>			
All Overcurrent protective devices have been installed at the proper ampere rating and all settings have been adjusted to match the system Coordination Study.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical testing representative has been scheduled to perform the test and the commissioning agent has been notified of the testing date.	<input type="checkbox"/>	<input type="checkbox"/>			
Test equipment requirements have been reviewed with electrical testing representative.	<input type="checkbox"/>	<input type="checkbox"/>			
Power available for test equipment.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation is complete and ready for verification testing.	<input type="checkbox"/>	<input type="checkbox"/>			
Training Plan approved	<input type="checkbox"/>	<input type="checkbox"/>			
Training sessions of owner training completed / acceptance granted / training materials submitted to Commissioning Agent	<input type="checkbox"/>	<input type="checkbox"/>			
Notes:					

Additional Comments:



Panelboards Functional Performance Test

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

System Description

Description:

Operational Assumptions:

Initial Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 1	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 2	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		



Deferred/Seasonal Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Test Equipment Required (to be provided by the Contractor)

Test Name	Equipment Description
Bolt Torque	Calibrated torque wrench
Voltage/Continuity	DVM
Insulation Resistance	Battery or line-powered (Hand-crank not acceptable).
Variable Voltage Source	3-Phase variable voltage source

Test Participants

Organization	Required	Optional
General Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
TAB Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Controls Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Owner's O&M Personnel	<input type="checkbox"/>	<input type="checkbox"/>



Functional Performance Test -- (Verify all components are ready before energizing or operating the system.)

The Commissioning Authority will make and document any changes/addition/deletions to this test procedure required by current system conditions (i.e. weather, system load, utility availability, etc.).

R = Retest (Check (✓) retest required)

Y= Checked and Passed

C = Corrected (Check (✓) when correction verified)

N = Not Passed

ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
PRE-TEST VISUAL MECHANICAL INSPECTION						
1. Safe conditions (protective gear in-place, available & procedures observed)		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
2. Verify panelboard installations	Completed panelboard schedules.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Appropriate anchorage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Required area clearances. 3 ft in front and 30 in wide.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	No physical damage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Breaker casing does not have cracks.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Correct alignment.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Feeder color-coding is: 480/277 V System as follows: Phase A: Brown Phase B: Orange Phase C: Yellow Neutral: Gray Ground: Green	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
3. Inspect panelboard doors, panels, and	Free of Corrosion, dents, scratches, fit.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
sections	No missing hardware.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	No missing screws.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	No open unused knockouts.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
4. Verify panelboard configuration and nameplate data matches shop drawings, one-line diagram and specification	Volts: 480/277V.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Bus Amps: ____A.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	3ph, 4W.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Frequency: 60hZ.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Enclosure: NEMA 1.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Main Breaker Max. Rating. ____ Amp.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Isolated Equipment Ground Bus if applicable.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Panelboard arrangement - # of circuits.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Neutral bus size (100%).	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Extra Gutter space as applicable.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Shunt trip as indicated.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	TVSS as indicated.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION		REQUIRED REACTION		Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
Record issues						Issue Log Item:		
						Initial	Date	
5. Verify panelboard equipment grounding	Solid neutral mounted in main circuit breaker compartment with main lugs, is insulated.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Neutral is not bonded to ground.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Frame and enclosure connected to ground bus.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Breaker and feeder equipment grounding conductors/conduit are connected to ground bus.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Record issues						Issue Log Item:		
						Initial	Date	
6. Operate each circuit breaker (5) times to ensure smooth operation	Breaker opens and closes in a smooth motion without binding.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Record issues						Issue Log Item:		
						Initial	Date	
ELECTRICAL INTEGRITY								
7. Perform an insulation resistance test at 1000VDC, phase-to-phase and phase to ground, in accordance with NETA Table 100.1	Minimum insulation resistance shall be 100 Megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Insulation Resistance Table. Perform the test on each bus section. Test for one minute in accordance with NETA Table 100.1.			<input type="checkbox"/>	<input type="checkbox"/>
	Results temperature corrected in accordance with NETA Table 100.14.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Record issues						Issue Log Item:		
						Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
8. Perform an insulation resistance test at 1000VDC on main breaker, phase-to-phase and phase to ground, connected to the bus in the CLOSED position, in accordance with NETA Table 100.1. Perform insulation resistance test (pole to pole) on main breaker with breaker in the open position	Minimum insulation resistance shall be 100 Megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Insulation Resistance Table. Perform the test on each bus section. Test for one minute in accordance with NETA Table 100.1. Test Name: Insulation Resistance Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
9. At the conclusion of testing, inspect interior hardware and electrical terminations	All hardware in place and properly torqued.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Compartments clear of tools and hardware.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
FUNCTIONAL TRIP TESTS						
10. Test the Long Time Delay (seconds) and Long Time Pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection	Long delay current pick up and time delay per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
11. Test the Short Time Delay (seconds) and Short Time Pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection	Short delay current pick up and time delay per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in the Circuit Breaker Current Injection Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
12. Test the Instantaneous Time Delay (seconds) and Instantaneous Time Pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection	Instantaneous pick up per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in the Circuit Breaker Current Injection Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
13. Test the Ground Fault Time Delay (seconds) and Ground Fault Time Pickup current (amperes) setting on device breakers rated 400A and greater, by using primary current injection.	Ground fault pick up per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in the Circuit Breaker Current Injection Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
14. After testing is performed on the panelboard, verify tightness of main connections.	Primary feeder cable connections properly torqued and marked.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in the Termination Torque Table. Bolted torque should comply with NETA Table 100.12 unless manufacturer specified values are listed on the equipment. Test Name: Bolt Torque Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



Test Equipment Used:

Test Name	Manufacturer	Model Number	Serial Number	Calibration (Date)

Data Tables

Temperature: _____

Relative Humidity: _____

Insulation Resistance (1000 VDC)

Circuit Breaker (Closed)	A-B	B-C	C-A	A-G	B-G	C-G	N
1 Minute (Meg Ohms)							
Circuit Breaker (open)	A-A	B-B	C-C				
1 Minute (Meg Ohms)							

Current Injection

Function	Actual Set.	Test Setting	Test Point	Nominal Val.	A	B	C	Trip Setting (Sec.)
LTD								
LDPU								
STD								
SDPU								
INSTPU								
GFD								



GFPU								
------	--	--	--	--	--	--	--	--

SAMPLE



Termination Torque (Newton Meters or Foot Pounds)

Bolt/Lug	A	B	C	N	G
Primary Feeder					
Feeder Lugs					

SAMPLE



Final Sign-Off

Commissioning Agent	Printed Name	Initials	Date
CONTRACTOR	PRINTED NAME	INITIALS	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			
Owner's O&M Personnel			



Table 100.1
Insulation Resistance Test Values
Electrical Apparatus and Systems

Nominal Rating of Equipment in Volts	Minimum Test Voltage, DC	Recommended Minimum Insulation Resistance in Megohms
250	500	25
600	1,000	100
1,000	1,000	100
2,500	1,000	500
5,000	2,500	1,000
8,000	2,500	2,000
15,000	2,500	5,000
25,000	5,000	20,000
34,500 and above	15,000	100,000

See Table 100.14 for temperature correction.

In the absence of consensus standards dealing with insulation-resistance tests, the Standards Review Council suggests the above representative values.




Test results are dependent on the temperature of the insulating material and the humidity of the surrounding environment at the time of the test.

Insulation-resistance test data may be used to establish a trending pattern. Deviations from the baseline information permit evaluation of the insulation.



Table 100.12

US Standard
Bolt Torques for Bus Connection
Heat-Treated Steel – Cadmium or Zinc Plated

Grade	SAE 1&2	SAE 5	SAE 7	SAE 8
Head Markings				
Minimum Tensile (P.S.I.)	64K	105K	133K	150K
Bolt Diameter in Inches	Torque (Foot Pounds)			
1/4	4.0	5.6	8.0	8.4
5/16	7.2	11.2	15.2	17.6
3/8	12.0	20.0	27.2	29.6
7/16	19.2	32.0	44.0	48.0
1/2	29.6	48.0	68.0	73.6
9/16	42.4	70.4	96.0	105.6
5/8	59.2	96.0	133.6	144.0
3/4	96.0	160.0	224.0	236.8
7/8	152.0	241.6	352.0	378.4
1.0	225.6	372.8	528.0	571.2

Reference: International Electrical Testing Association (NETA) ATS-1999, Table 100.12, page 202.

Table 100.12 (Cont.)

Bolt Torques for Bus Connections
Silicon Bronze Fasteners¹
Torque (Foot Pounds)

Bolt Diameter in Inches	Nonlubricated	Lubricated
5/16	15	10
3/8	20	14
1/2	40	25
5/8	55	40
3/4	70	60

Reference: International Electrical Testing Association (NETA) ATS-1999, Table 100.12, page 203.



Table 100.12 (Cont.)
Bolt Torques for Bus Connections
Aluminum Alloy Fasteners²
Torque (Foot Pounds)

Bolt Diameter in Inches	Nonlubricated	Lubricated
5/16	15	8.0
3/8	20	11.2
1/2	40	20.0
5/8	55	32.0
3/4	70	48.0

Reference: International Electrical Testing Association (NETA) ATS-1999, Table 100.12, page 203.

Table 100.12 (Cont.)
Bolt Torques for Bus Connections
Stainless Steel Fasteners³
Torque (Foot Pounds)

Bolt Diameter in Inches	Uncoated
5/16	14
3/8	25
1/2	45
5/8	60
3/4	90

Reference: International Electrical Testing Association (NETA) ATS-1999, Table 100.12, page 204.



Table 100.14

Insulation Resistance
Correction Factors

For Conversion of Test Temperature to 20°C

Temperature		Multiplier	
°C	°F	Apparatus Containing Immersed Oil Insulations	Apparatus Containing Solid Insulators
0	32	0.25	0.40
5	41	0.36	0.45
10	50	0.50	0.50
15	59	0.75	0.75
20	68	1.00	1.00
25	77	1.40	1.30
30	86	1.98	1.60
35	95	2.80	2.05
40	104	3.95	2.50
45	113	5.60	3.25
50	122	7.85	4.00
55	131	11.20	5.20
60	140	15.85	6.40
65	149	22.40	8.70
70	158	31.75	10.00
75	167	44.70	13.00
80	176	63.50	16.00

Reference: International Electrical Testing Association (NETA) ATS-1999, Table 100.14, page 206.



Panelboards Pre-Functional Checklist

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

Statement of Readiness

The above equipment and/or systems integral to them are complete and ready for functional testing, except as noted. None of the outstanding items preclude safe and reliable functional tests being performed. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

Responsible Contractor Sign Here

CONTRACTOR	PRINTED NAME	SIGNATURE	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			

This statement of readiness has been received by the Commissioning Agent on _____ and will be incorporated as part of the final commissioning report.

Equipment Information

Make		Model Number			
Serial Number		NEMA Enclosure		KVA	
Volts/Phase		AMPS		KW	
Service Area					
Notes:					



System Readiness Checklist

Yes = Checked and Completed, N/A = Not Applicable

General Installation					
Description	Yes	N/A	Initials	Date	Comments
As-Built Drawings complete	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment shop drawings available	<input type="checkbox"/>	<input type="checkbox"/>			
Operation and Maintenance manuals available	<input type="checkbox"/>	<input type="checkbox"/>			
Installation and startup manual available	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment warranty information completed and provided in O&M Manual	<input type="checkbox"/>	<input type="checkbox"/>			
Verify receipt and acceptance of manufacturer's factory test reports	<input type="checkbox"/>	<input type="checkbox"/>			
Verify room, enclosure, and equipment are dry and clean. Building is closed in and sealed to prevent entry of moisture due to weather conditions.	<input type="checkbox"/>	<input type="checkbox"/>			
Doors to electrical room installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Locks or temporary security measures installed and operational. Room can be secured.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room clear of storage, temporary equipment, etc.	<input type="checkbox"/>	<input type="checkbox"/>			
Permanent lighting or 30 foot candle temporary lighting in service.	<input type="checkbox"/>	<input type="checkbox"/>			
Egress routes from electrical room are unobstructed.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical equipment clean of construction debris, dust, and moisture.	<input type="checkbox"/>	<input type="checkbox"/>			
Working clearances meet NEC and contract documents	<input type="checkbox"/>	<input type="checkbox"/>			
Panelboard has been installed and anchored per manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>			
Warning Signs installed per shop drawings and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room grounding system complete.	<input type="checkbox"/>	<input type="checkbox"/>			
Ground bus(es) have been installed and terminated to ground system.	<input type="checkbox"/>	<input type="checkbox"/>			
Panelboard ratings match one-line drawing.	<input type="checkbox"/>	<input type="checkbox"/>			
Temporary panelboard circuit directory completed.	<input type="checkbox"/>	<input type="checkbox"/>			



General Installation					
Description	Yes	N/A	Initials	Date	Comments
Secondary service, feeder and branch circuit conductors per specifications: 1. 208/120 V System as follows: a. Phase A: Black b. Phase B: Red c. Phase C: Blue d. Neutral: White e. Ground: Green 2. 480/277 V System as follows: a. Phase A: Brown b. Phase B: Orange c. Phase C: Yellow d. Neutral: Gray e. Ground: Green	<input type="checkbox"/>	<input type="checkbox"/>			
Component/subsystems are clearly and correctly identified with temporary/permanent labels (bus, section, breakers and devices)	<input type="checkbox"/>	<input type="checkbox"/>			
Panelboard Transient Voltage Suppression System (TVSS) installed per construction and approved shop drawings.	<input type="checkbox"/>	<input type="checkbox"/>			
Panelboard labeled with engraved laminated plastic or metal nameplates mounted with corrosion-resistant screws.	<input type="checkbox"/>	<input type="checkbox"/>			
Panelboard short circuit rating meets construction and approved shop drawing requirements	<input type="checkbox"/>	<input type="checkbox"/>			
Panelboard provided with equipment ground bus per approved shop drawings	<input type="checkbox"/>	<input type="checkbox"/>			
Panelboard equipped with shunt trip if applicable per approved shop drawings	<input type="checkbox"/>	<input type="checkbox"/>			
Filler plates installed in unused spaces.	<input type="checkbox"/>	<input type="checkbox"/>			
Shipping bolts and braces removed	<input type="checkbox"/>	<input type="checkbox"/>			
All enclosure panels and doors in place, fitted, undamaged	<input type="checkbox"/>	<input type="checkbox"/>			
All shipped-loose components installed	<input type="checkbox"/>	<input type="checkbox"/>			
Verify neutral bus isolated from ground.	<input type="checkbox"/>	<input type="checkbox"/>			
All bolted electrical connections have been tightened to their proper torque values.	<input type="checkbox"/>	<input type="checkbox"/>			
All field connections have been tightened to their proper torque values.	<input type="checkbox"/>	<input type="checkbox"/>			
All Overcurrent protective devices have been installed at the proper ampere rating and all settings have been adjusted to match the system Coordination Study.	<input type="checkbox"/>	<input type="checkbox"/>			
Operating mechanism of each circuit breaker has been mechanically exercised.	<input type="checkbox"/>	<input type="checkbox"/>			
All vent openings are free from obstructions.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical testing representative has been scheduled to perform the test and the commissioning agent has been notified of the testing date.	<input type="checkbox"/>	<input type="checkbox"/>			



General Installation					
Description	Yes	N/A	Initials	Date	Comments
Test equipment requirements have been reviewed with electrical testing representative.	<input type="checkbox"/>	<input type="checkbox"/>			
Power available for test equipment.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation is complete and ready for verification testing.	<input type="checkbox"/>	<input type="checkbox"/>			
Training Plan approved	<input type="checkbox"/>	<input type="checkbox"/>			
Training sessions of owner training completed / acceptance granted / training materials submitted to Commissioning Agent.	<input type="checkbox"/>	<input type="checkbox"/>			
Notes:					

Additional Comments:



Engine Generators Functional Performance Test

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

System Description

Description:

Operational Assumptions:

Breaker Coordination study is available and includes the generator output breaker(s).

Initial Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 1	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 2	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		



Deferred/Seasonal Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Test Participants

Organization	Required	Optional
General Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
TAB Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Controls Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Owner's O&M Personnel	<input type="checkbox"/>	<input type="checkbox"/>

Test Equipment Required (to be provided by the Contractor)

Test Name	Equipment Description
Voltage/Continuity	DVM
Bolted Connection or Contact Resistance	Four-probe Digital Low Resistance Ohmmeter (DLRO)
Insulation Resistance	Battery or line-powered (Hand-crank not acceptable).
Primary Current Injection	Current Injection Test Device rated for 2X the ground fault pickup setting of the breaker
2 and 4 Hour Load Bank Test	Resistive load bank with capacity equal to or greater than rated load. Rated at 2% accuracy for voltage, current and KW.
Phase Rotation	Verify proper phasing
Volt. & Freq. Regulation	Computer to record voltage and frequency from the output of the generator control panel.
Decibel	Measure sound pressure
Back Pressure	Manometer with a scale of greater than 40" water
Bolt Torque	Calibrated torque wrench



System Readiness Summary Checklist

Description	Yes	No	Date
System Ready for Test	<input type="checkbox"/>	<input type="checkbox"/>	
Required Personnel Available	<input type="checkbox"/>	<input type="checkbox"/>	
Required Tools/Test Equipment/Supplies Available	<input type="checkbox"/>	<input type="checkbox"/>	
Required Safety Equipment Available	<input type="checkbox"/>	<input type="checkbox"/>	

Functional Performance Test -- (Verify all components are ready before energizing or operating the system.)

The Commissioning Authority will make and document any changes/addition/deletions to this test procedure required by current system conditions (i.e. weather, system load, utility availability, etc.).

R = Retest (Check (✓) retest required)

Y= Checked and Passed

C = Corrected (Check (✓) when correction verified)

N = Not Passed

ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
PRE-TEST VISUAL MECHANICAL INSPECTION						
1. Safe conditions (protective gear in-place, available & procedures observed)		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
2. Verify that the Engine, Generator, Battery, and Battery Charger nameplate data matches shop drawings and construction documents.	kW: _____.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in data table.	<input type="checkbox"/>	<input type="checkbox"/>
	Rating: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Freq.: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Phase/Wire: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Power Factor: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Voltage Output: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
3. Verify generator circuit breaker settings.	Circuit breaker size and phase: _____.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
	Ground fault protection is disabled.	<input type="checkbox"/>	<input type="checkbox"/>	Ground fault indication and alarm is recommended	<input type="checkbox"/>	<input type="checkbox"/>
	Circuit breaker is set per the coordination study.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
4. Inspect physical and mechanical condition.	No visible damage to generator or enclosure.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Engine generator exterior is clean and dry.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Generator control panel interior is clean and dry.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Generator control panel mounted at an accessible height.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Vibration isolation is installed at engine and at radiator.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	All external connections are made with flexible connections.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Verify remote monitoring wiring is connected and labeled.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Verify control wiring is connected and labeled.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Feeder cable/bus routing doesn't obstruct access for operation or maintenance.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Control wiring harness(es) does not rub against vibrating or moving parts.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
5. Verify anchoring	Anchor bolts are provided in locations shown on manufacturer's drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
6. Verify equipment grounding	Verify ground rod is installed with connection to engine generator frame.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Generator neutral bonded to ground with conductor sized per NEC 250-20.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Measured diameter of bare copper conductor corresponds to diameter of specified conductors.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Ground strap from engine to frame.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Ground strap from generator enclosure to frame.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Ground bus provided in termination cabinet with properly terminated ground conductors.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
7. Verify lube oil levels are within manufacturer's recommended limits	Lube oil level is filled to proper level.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
8. Verify fuel system installation and integrity	Day tank is full of fuel (90% for diesel).	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Fuel level in day tank matches fuel gauge.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Remote fueling station is installed and operating properly.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	There are not clearance issues with the remote fueling station.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	All alarms are operating properly from remote fueling station to Building Automation System (BAS).	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Fuel system is free of leaks.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Flexible fuel lines are installed at engine.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
9. Verify cooling system installation and integrity	Coolant level is filled to proper level.	<input type="checkbox"/>	<input type="checkbox"/>	Record radiator name plate date in data table.	<input type="checkbox"/>	<input type="checkbox"/>
	Verify coolant system freeze protection level.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Cooling system is free from leaks.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Flexible coolant lines are installed between engine and radiator.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
10. Verify exhaust system installation and integrity	Exhaust system, silencer and flexible connector installed and supported.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust system expansion is not transferred to engine components such as turbocharger.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Silencer is equipped with condensate drain plug and turn valve.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust system is equipped with rain cap.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust system is properly insulated within building.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust system has at least 9" clearance from combustible materials.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
ELECTRICAL INTEGRITY						
11. Verify operation of coolant line heater.	Verify that valves to the water jacket heater are open.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Record supply voltages and amperage with	<input type="checkbox"/>	<input type="checkbox"/>
	Verify thermostats switch at their setpoint temperatures (110°F).	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	Verify pump runs continuously independent of heater operation.	<input type="checkbox"/>	<input type="checkbox"/>	heaters and pump in operation. Calculate heater and pump wattage based on line voltage and current. Verify wattage calculated is same as shop drawing data. Manufacturer's Specifications: Heater: Watts _____ Volts _____ Phase _____ Pump: Watts _____ Volts _____ Phase _____	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
12. Verify operation of battery and starting system.	Loss of Power Alarm is operable.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Record cell voltages for all cells with terminals available, total battery charging voltage and charging current. Manufacturer's	<input type="checkbox"/>	<input type="checkbox"/>
	Low Battery Volt Alarms at: 18.6V-25.7V.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	High Battery Volt Alarms at: 26.9V-36.3V.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Power On led in on.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	Battery Heater Pad: 120VAC input.	<input type="checkbox"/>	<input type="checkbox"/>	Specifications: Nom. Batt. Voltage: _____ Rec. Float Charge Voltage: _____ Float Voltage: _____ Equalize Voltage: _____ Max over float Ampere Taper (Max to Min): _____ Nominal Output Voltage: _____ Input Voltage: _____ Ambient Temp: -40°F to 122°F	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
13. Verify operation of generator space heaters	Space heaters operate when generator is not running and not operating while generator is running.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Record supply voltages and amperage with heater in operation. Calculate heater wattage based on line voltage and current. Verify wattage calculated is same as shop drawing data. Manufacturer's Specifications: Heater: Watts _____ Volts _____ Phase _____	<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
Record issues				Issue Log Item:		
				Initial	Date	
14. Perform an insulation resistance test at 1000 VDC on generator windings.	Minimum insulation resistance value is 100 Megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Take reading at 1 minute. Take reading at 10 minutes. Record ambient temperature and relative humidity. Test Name: Insulation Resistance. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
15. With the breaker in the closed position, measure the contact resistance of each phase of the primary circuit.	Readings are within 50% of the lowest value.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test Name: Contact Resistance Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
16. Perform an insulation resistance test on the Generator Circuit Breaker at 1000VDC, phase-to-phase and phase to ground, connected to the bus in the closed position, in accordance with NETA Table 100.1.	Minimum insulation resistance shall be 100 Megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test for one minute in accordance with NETA Table 100.1. Test Name: Insulation Resistance Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
17. Test the Long Time Delay (LTD) (seconds) and Long Time Pickup current (LDPU) (amperes) setting of the breaker, by using primary current injection.	Long delay current pick up and time delay per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
18. Test the Short Time Delay (STD) (seconds) and Short Time Pickup current (SDPU) (amperes) setting of the breaker, by using primary current injection.	Short delay current pick up and time delay per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
19. Test the Instantaneous Time Delay (ITD) (seconds) and Instantaneous Time Pickup current (INSTPU) (amperes) setting of the breaker, by using primary current injection.	Instantaneous pick up per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION		REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
20.	Test the Ground Fault Delay (GFD) (seconds) and Ground Fault Pickup current (GFPU) (amperes) setting of the breaker, by using primary current injection.	Instantaneous pick up per coordination study.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test Name: Primary Current Inject. Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues					Issue Log Item:		
					Initial	Date	
ALARMS AND CONTROL PANEL TEST							
21.	Verify control wiring between generator and ATS are correctly terminated.	Terminations match shop drawings.	<input type="checkbox"/>	<input type="checkbox"/>	Note: this step applies to field land terminations only	<input type="checkbox"/>	<input type="checkbox"/>
Record issues					Issue Log Item:		
					Initial	Date	
22.	Record all setpoints at Engine Generator Control Panel.		<input type="checkbox"/>	<input type="checkbox"/>	Manufacturer's checklist can be attached to this form in lieu of recording	<input type="checkbox"/>	<input type="checkbox"/>
Record issues					Issue Log Item:		
					Initial	Date	
23.	Verify all warning/pre-alarms per manufacturer's instructions and verify operation and local annunciation at Engine Generator Control Panel.	Overcrank.	<input type="checkbox"/>	<input type="checkbox"/>	1-13 NFPA 110 Spec Section 16231	<input type="checkbox"/>	<input type="checkbox"/>
		Low Water Temp.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		High Water Temp.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Low Oil Pressure.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Overspeed.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Low Coolant Level.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	EPS Supplying Load.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Control switch not in Auto.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	High Battery Voltage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Low Battery Voltage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Battery Charger AC Failure.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Lamp Test.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Contacts for local and remote common alarm.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
24. Verify all shutdown conditions per manufacturer's instructions and verify operation and local annunciation at Engine Generator Control Panel.	Overcrank.	<input type="checkbox"/>	<input type="checkbox"/>	1-5 NFPA 110 Spec Section 16231	<input type="checkbox"/>	<input type="checkbox"/>
	High Water Temp.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Low Oil Pressure.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Overspeed.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Low Coolant Level.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
25. Verify remote audible annunciation of all status, warning/pre-alarm, and shutdown conditions per manufacturer's instructions.	Overcrank.	<input type="checkbox"/>	<input type="checkbox"/>	1-9 NFPA 110 Spec Section 16231	<input type="checkbox"/>	<input type="checkbox"/>
	Low Water Temp.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	High Water Temp.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Low Oil Pressure.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Overspeed.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Low Coolant Level.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Control switch not in Auto.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	Contacts for local and remote common alarm.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Audible alarm silencing switch.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
26. Verify installation of remote E-Stop	Located outside of generator room door.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Near each exit/entrance to genset room.					
	Located locally on the genset package.					
	Cover not damaged, scratched, or broken.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
27. Verify remote annunciation of engine conditions at building automation system	Annunciator panel lights & alarms function by initiating test switch.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
28. With generator in a "cold start" condition, conduct a load performance test, by initiating a NORMAL failure and transfer of ATS's for time specified in the remarks column.	Engine starts and runs.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
	Air intake louvers open fully.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust damper opens fully.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Fuel is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>	Load generator for a maximum of 2 hrs using available building load and/or a load bank	<input type="checkbox"/>	<input type="checkbox"/>
	Coolant is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Lube oil is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
				During test, verify exhaust, coolant, and fuel system is functioning	<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	Exhaust system expansion is not transferred to engine system components.	<input type="checkbox"/>	<input type="checkbox"/>	properly. Test Name: 2 Hour Load Bank Test Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust system is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
29. Restore normal sources to ATS's (or turn off load bank) and transfer ALL load off of generator and allow to cool down for 5 minutes	Generator runs in cool down mode for 5 min.	<input type="checkbox"/>	<input type="checkbox"/>	Test Name: 2 Hour Load Bank Test Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
30. Disconnect emergency feeders to ATS and connect load bank directly to load side of generator		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
31. With a load bank connected to the load side terminals of the generator,	Engine starts and runs.	<input type="checkbox"/>	<input type="checkbox"/>	Test Name: 4 Hour Load Bank Test Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
	Air intake louvers open fully.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust damper opens fully.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
start generator at local control panel with engine control switch	Fuel is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Coolant is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Lube oil is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust system expansion is not transferred to engine system components.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Exhaust system is not leaking.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
32. Conduct a load performance test utilizing a load bank to achieve 100% rated load of generator for time specified in the remarks column.		<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Load generator at 50% for 15 min. Load generator at 75% for 15 min. Load generator at 100% for 3.5 hrs During test, verify exhaust, coolant, and fuel system is functioning properly. Test Name: 4 Hour Load Bank Test Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
33. In conjunction with load performance test, verify voltage regulation by recording RMS voltage while increasing load on generator.	Voltage regulation is $\pm 1\%$.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table Record voltage at no load. Record voltage at 50% load. Record voltage at 75% load. Record voltage at 100% load. Calculate voltage regulation percentage. Test Name: Volt. & Freq. Regulation Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
34. In conjunction with load performance test, verify frequency regulation by recording frequency while increasing load on generator.	Frequency regulation is $\pm 1\%$	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table Record frequency at no load. Record frequency at 50% load. Record frequency at 75% load. Record frequency at 100% load. Calculate voltage regulation percentage. Test Name: Volt. & Freq. Regulation Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
35. During load performance test, verify engine operation is within normal operating limits.		<input type="checkbox"/>	<input type="checkbox"/>	Manufacturer's Specifications: RPM @ 60Hz: 1800 RPM Coolant Amb. Temp: 190°F	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
36. During load performance test, verify correct phase rotation.	Phase rotation at generator matches NORMAL power source.	<input type="checkbox"/>	<input type="checkbox"/>	A(U), B(V), C(W) Test Name: Phase Rotation Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
37. During step 3, while generator is running at 100% load, measure sound level.	Measured sound pressure level in rooms directly adjoining the generator room, as well as above and below, if applicable.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test Name: Sound Level Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
38. While generator is running at 100% load, conduct Exhaust-System Back Pressure Test	Maximum backpressure at full-rated load is within manufacturer's written maximum allowable limits of 6.7 kPa or 26.9" H2O for the engine.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Connect test instrumentation to exhaust line close to engine exhaust manifold. Test Name: Back Pressure Test Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
39. Decrease load to 0% and allow the generator to cool down for 5 minutes	Generator cools down.	<input type="checkbox"/>	<input type="checkbox"/>	Test Name: 4 Hour Load Bank Test	<input type="checkbox"/>	<input type="checkbox"/>
	No leaks from any system are found.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION		REQUIRED REACTION		Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
Record issues						Issue Log Item:		
						Initial	Date	
40. After the cool down, once the prime mover has reached rated voltage and frequency, transfer full rated load onto the engine generator in a single block.	Engine continues to run without shutdown or overspeed trip and recovers to steady state voltage and frequency ranges within 5 seconds.	<input type="checkbox"/>	<input type="checkbox"/>	Test Name: Block Load Test		<input type="checkbox"/>	<input type="checkbox"/>	
Record issues						Issue Log Item:		
						Initial	Date	
41. Decrease load to 0% and shutdown generator with local E-Stop.	Generator shuts down.	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	
	Remote annunciator alarms with E-Stop.	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	
Record issues						Issue Log Item:		
						Initial	Date	
42. Disconnect fuel solenoid and simulate start to engine.	Engine cycle cranks a minimum of three 15-second cranking cycles with 15 seconds between cycles.	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	
	At completion of third cycle engine stops cranking and "overcrank" shutdown alarm is annunciated locally and remotely.	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	
Record issues						Issue Log Item:		
						Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
FINAL INSPECTION						
43. After testing is performed on the generator, verify tightness of field landed feeder terminations.	Primary feeder cable connections properly torqued and marked.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Bolted torque should comply with NETA Table 100.12 unless manufacturer specified values are listed on the equipment. Secondary distribution feeder connections are not included in the test. Test Name: Bolt Torque Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
44. Refill fuel tanks and verify 90% fuel levels	Fuel level indicator verifies 90% fuel level in day tank.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Fuel level indicator verifies 90% fuel level in storage tank.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



NAMEPLATE DATA

Engine Nameplate (May be found in multiple nameplate locations)

Parameter	Data
Equipment ID	
Manufacturer	
Serial Number	
Model Number	
Date Manufactured	
Horsepower	
kW	

Generator Nameplate

Parameter	Data
Manufacturer	
Serial Number	
Model Number	
Date Manufactured	
Volts	
Amps	
KVA	
Frequency	
RPM	
KW	
PF	
Insulation Class:	



Battery Nameplate

Parameter	Data
Manufacturer	
Serial Number	
Model Number	
Quantity	
Volts	
Cold Cranking Amps	

Battery Charger Nameplate

Parameter	Data
Manufacturer	
Serial Number	
Model Number	
Input Amps	
Input Volts	
Output Amps	
Output Volts	

Circuit Breaker Name Plate Data

Parameter	Data
Manufacturer:	
Type/Model:	
Serial Number:	
Frame Size/Rating	
Interrupting Rating	
Voltage Rating	



Radiator Nameplate

Parameter	Data
Manufacturer	
Serial Number	
Model Number	
Date Manufactured	

Coolant Pump(s) & Heater(s)

Designation	Volts	Amps	Watts

Battery System

Cell Volts	Charging Volts	Charging Amps

Space Heater(s)

Designation	Voltage	Amperage	Wattage



Test Equipment Used:

Test Name	Manufacturer	Model Number	Serial Number	Calibration(Date)

Insulation Resistance (1000 VDC)

Generator Windings	A-B	B-C	C-A	A-G	B-G	C-G
1 Minute (Meg Ohms)						
10 Minutes (Meg Ohms)						
Circuit Breaker						
1 Minute (Meg Ohms)						

Circuit Breaker Contact Resistance

Phase	A	B	C
(Micro Ohms)			



Current Injection

Function	Actual Set.	Test Setting	Test Point	Nominal Val.	A	B	C
LTD							
LDPU							
STD							
SDPU							
INSTPU							
GFD							
GFPU							

2 Hour Load Bank Test

Crank Time Until Prime Mover Start and Runs	
Time Required for Prime Mover to Come Up to Operating Speed	
Voltage Overshoot	
Frequency Overshoot	
Time Required to Achieve Steady State Operation	

Time	Load	RPM	Freq.	Amps	Volts	kW	Oil Press	Oil Temp	Exhaust Temp	Cool. Temp	Fuel Level	Batt. Chrg Rate
0 min	100%											
5 min	100%											
10 min	100%											
15 min	100%											
30 min	100%											
45 min	100%											
1 hour	100%											
1 hour 15 min	100%											
1 hour 30 min	100%											
1 hour 45 min	100%											
2 hour	100%											



4 Hour Load Bank Test

Time		Load	RPM	Freq.	Amps	Volts	kW	Oil Press	Oil Temp	Exhaust Temp	Cool. Temp	Fuel Level	Batt. Chrg Rate
0 min		50%											
5 min		50%											
10 min		50%											
15 min		75%											
30 min		75%											
45 min		100%											
1 hour		100%											
1 hour 15 min		100%											
1 hour 30 min		100%											
1 hour 45 min		100%											
2 hour		100%											
2 hour 15 min		100%											
2 hour 30 min		100%											
2 hour 45 min		100%											
3 hour		100%											
3 hour 15 min		100%											
3 hour 30 min		100%											
3 hour 45 min		100%											
4 hour		100%											

Voltage & Frequency Regulation

Function	50% Load	75% Load	100% Load
Voltage (V)			
Frequency (hz)			



Phase Rotation – (Circle Phase Rotation)

Normal Power	A B C	A C B
Emergency Power	A B C	A C B

Sound Level

Location	Decibel (DB)

Back Pressure Test

System Exhaust Pressure	Location

Block Load Test

Recovery Time: _____

Bolt Torque (Newton Meters or Foot Pounds)

Bolt/Lug	A	B	C	N	G
Normal					
Emergency Lugs					



Final Sign-Off

Commissioning Agent	Printed Name	Initials	Date
CONTRACTOR	PRINTED NAME	INITIALS	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			
Owner's O&M Personnel			



Engine Generators Pre-Functional Checklist

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

Statement of Readiness

The above equipment and/or systems integral to them are complete and ready for functional testing, except as noted. None of the outstanding items preclude safe and reliable functional tests being performed. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

Responsible Contractor Sign Here

CONTRACTOR	PRINTED NAME	SIGNATURE	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			

This statement of readiness has been received by the Commissioning Agent on _____ and will be incorporated as part of the final commissioning report.

Equipment Information

Make		Model Number			
Serial Number		NEMA Enclosure		KVA	
Volts/Phase		AMPS		KW	
Service Area					
Notes:					



System Readiness Checklist

Yes = Checked and Completed, N/A = Not Applicable

General Installation					
Description	Yes	N/A	Initials	Date	Comments
As-Built drawings complete.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment shop drawings available.	<input type="checkbox"/>	<input type="checkbox"/>			
Operation and Maintenance manuals available.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation and startup manual available.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment warranty information completed and provided in O&M Manual.	<input type="checkbox"/>	<input type="checkbox"/>			
Verify receipt and acceptance of manufacturer's factory test reports.	<input type="checkbox"/>	<input type="checkbox"/>			
Doors to generator room installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Locks or temporary security measures installed & operational. Room can be secured.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator room clear of storage, temporary equipment, etc.	<input type="checkbox"/>	<input type="checkbox"/>			
Permanent lighting or 30 foot candle temporary lighting in service.	<input type="checkbox"/>	<input type="checkbox"/>			
Egress routes from generator room are unobstructed.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator room & equipment clean of construction debris and dust, and are dry.	<input type="checkbox"/>	<input type="checkbox"/>			
Working clearances meet NEC and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment has been installed on a level housekeeping pad.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment anchored per manufacturer's instruction.	<input type="checkbox"/>	<input type="checkbox"/>			
Warning signs installed per shop drawings and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
All shipped-loose components installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room grounding system complete.	<input type="checkbox"/>	<input type="checkbox"/>			
Ground bus (ses) have been installed and terminated to ground grid system.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator neutral bus is not solidly grounded by factory-installed bonding jumper as specified for a four-pole system.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator frame and enclosure bonded to ground.	<input type="checkbox"/>	<input type="checkbox"/>			
All wiring installed properly with correct bend radius and no insulation damage.	<input type="checkbox"/>	<input type="checkbox"/>			
All power conductors have been braced/tied per manufacturer's installation instructions.	<input type="checkbox"/>	<input type="checkbox"/>			
All piping, electrical, and control connections between skid-mounted devices and non-skid-mounted devices made with flexible connections (pipe, conduit, etc.).	<input type="checkbox"/>	<input type="checkbox"/>			
All bolted electrical connections have been tightened to their proper torque values.	<input type="checkbox"/>	<input type="checkbox"/>			



General Installation					
Description	Yes	N/A	Initials	Date	Comments
Manufacturer's field service personnel have completed preliminary checkout and startup.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine lube oil system is fully operational and free of leaks.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine coolant system is fully operational and free of leaks.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine fuel supply system is fully operational and free of leaks.	<input type="checkbox"/>	<input type="checkbox"/>			
Fuel supply system tank is full and ready for operation.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine exhaust is fully operational and free of leaks.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine exhaust has rain cap installed at exterior outlet.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine exhaust has condensate drain installed at silencer.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine exhaust has expansion fitting installed in exhaust piping to account for expansion.	<input type="checkbox"/>	<input type="checkbox"/>			
Engine exhaust system, silencer and pipe, are fully insulated.	<input type="checkbox"/>	<input type="checkbox"/>			
Intake air and discharge air dampers functional.	<input type="checkbox"/>	<input type="checkbox"/>			
Batteries are fully charged and in service.	<input type="checkbox"/>	<input type="checkbox"/>			
Battery charger electrically connected to power source and control wiring connections to generator control panel completed.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator remote annunciation panel is remotely installed, electrically connected and fully operational.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator remote E-stop is remotely installed, electrically connected and fully operational.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator control wiring to switchgear installed, electrically connected, and operational with control wiring installed in separate conduit per manufacturer's recommendations.	<input type="checkbox"/>	<input type="checkbox"/>			
Generator control wiring to building management control panel is installed, electrically connected and fully operational.	<input type="checkbox"/>	<input type="checkbox"/>			
All contacts, devices, etc. for interface with SCADA-system are installed, functional and wired to terminal strips for connection of field wiring.	<input type="checkbox"/>	<input type="checkbox"/>			
Remote annunciator panel is installed, electrically connected and operational.	<input type="checkbox"/>	<input type="checkbox"/>			
All circuit breaker protecting devices have been set and recorded per the protective device coordination study.	<input type="checkbox"/>	<input type="checkbox"/>			
Metering current transformer ratio and accuracy class matches drawings/specs.	<input type="checkbox"/>	<input type="checkbox"/>			
Metering potential transformer ratio and accuracy class matches drawings/specs.	<input type="checkbox"/>	<input type="checkbox"/>			
Metering wiring phase and polarity matches meter	<input type="checkbox"/>	<input type="checkbox"/>			



General Installation					
Description	Yes	N/A	Initials	Date	Comments
instruction manual wiring diagrams.					
Utility power is available and connected for system operation.	<input type="checkbox"/>	<input type="checkbox"/>			
All sensors have been installed and calibrated according to manufacturing and design specification.	<input type="checkbox"/>	<input type="checkbox"/>			
All status and alarm indicators are installed and functioning properly.	<input type="checkbox"/>	<input type="checkbox"/>			
All field and interconnecting wiring is completed and labeled at each end with visible and readable tags. (Printed markings on the conductors are NOT acceptable.).	<input type="checkbox"/>	<input type="checkbox"/>			
Field landed control wiring terminations are made using ring connectors NOT fork connectors.	<input type="checkbox"/>	<input type="checkbox"/>			
All manufacturing factory and field start-up tests attached to this SRC.	<input type="checkbox"/>	<input type="checkbox"/>			
Testing agency has been scheduled to perform the test and the commissioning agent has been notified of the testing date.	<input type="checkbox"/>	<input type="checkbox"/>			
Test equipment requirements have been reviewed with the testing agency.	<input type="checkbox"/>	<input type="checkbox"/>			
Power available for test equipment.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation is complete and ready for verification testing.	<input type="checkbox"/>	<input type="checkbox"/>			
Training plan approved.	<input type="checkbox"/>	<input type="checkbox"/>			
Training sessions of owner training completed / acceptance granted / training materials submitted to Commissioning Agent.	<input type="checkbox"/>	<input type="checkbox"/>			
All specified tools, equipment & spare parts are on site.	<input type="checkbox"/>	<input type="checkbox"/>			
Notes:					

Additional Comments:



Automatic Transfer Switches Functional Performance Test

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

System Description

Description:

Operational Assumptions:

Initial Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 1	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Re-Test 2	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		



Deferred/Seasonal Test	Start Date	End Date	Initials
Results (Check one) <input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> Partial Test w/Corrective Actions <input type="checkbox"/> Complete Test w/Corrective Actions <input type="checkbox"/> Other	Explanation:		

Test Participants

Organization	Required	Optional
General Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Contractor	<input type="checkbox"/>	<input type="checkbox"/>
TAB Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Controls Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Owner's O&M Personnel	<input type="checkbox"/>	<input type="checkbox"/>

Test Equipment Required (to be provided by the Contractor)

Test Name	Equipment Description
Bolt Torque	Calibrated torque wrench
Bolted Connection or Contact Resistance	Four-probe Digital Low Resistance Ohmmeter (DLRO)
Voltage/Continuity	DVM
Insulation Resistance	Battery or line-powered (Hand-crank not acceptable).
Relay Operation	Variable AC Voltage source

System Readiness Summary Checklist

Description	Yes	No	Date
System Ready for Test	<input type="checkbox"/>	<input type="checkbox"/>	
Required Personnel Available	<input type="checkbox"/>	<input type="checkbox"/>	
Required Tools/Test Equipment/Supplies Available	<input type="checkbox"/>	<input type="checkbox"/>	
Required Safety Equipment Available	<input type="checkbox"/>	<input type="checkbox"/>	



Functional Performance Test -- (Verify all components are ready before energizing or operating the system.)

The Commissioning Authority will make and document any changes/addition/deletions to this test procedure required by current system conditions (i.e. weather, system load, utility availability, etc.).

R = Retest (Check (✓) retest required)

Y= Checked and Passed

C = Corrected (Check (✓) when correction verified)

N = Not Passed

ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
PRE-TEST VISUAL MECHANICAL INSPECTION						
1. Safe conditions (protective gear in-place, available & procedures observed)		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
2. Confirm that NORMAL and EMERGENCY sources match final design drawings.	Normal: MDS.	<input type="checkbox"/>	<input type="checkbox"/>	Source: Normal: _____	<input type="checkbox"/>	<input type="checkbox"/>
	Emergency: EDP.	<input type="checkbox"/>	<input type="checkbox"/>	Emergency: _____	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
3. Verify equipment nameplate data matches one-line drawings, specifications, and/or shop drawings and record date on attached table.	Volts: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Amps: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	4 pole, 4W.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Frequency: 60hZ.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Interrupting Rating: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Enclosure: _____.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
4. Verify permanent labels for transfer switch is installed.	Melamine plastic laminate, minimum 1/16" thick.	<input type="checkbox"/>	<input type="checkbox"/>	Spec Section 16075	<input type="checkbox"/>	<input type="checkbox"/>
	Black letters on white face.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Secured with self tapping, stainless-steel (SS) screws or SS machine screws with nuts and flat and lock washers.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
5. Verify accessibility for maintenance.	Door opens freely and swings fully open.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	3'-6" minimum clearance in front of switch.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Cables do not block access to indicators or adjustable components.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Cables do not block access to manual transfer switch operator.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
6. Inspect physical and mechanical conditions.	No visible signs of damage.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	No visible dirt, metal chips or contamination.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Appropriate source indicating lights are illuminated.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
Record issues				Issue Log Item:		
				Initial	Date	
7. Verify anchoring.	Anchor bolts are provided in locations shown on manufacturer's drawings.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
8. Verify the barriers and arc chutes are properly installed around contacts.	Barriers partially surround ATS contacts and are insulated.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Arc chutes are installed around the contacts.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
9. Verify ATS is properly grounded.	Enclosure bonded to ground bus.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Incoming (normal and emergency) and outgoing (load) feeder grounding conductors bonded to ground bus.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Neutral bus/pole isolated from ground.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
10. Confirm that components of control system including terminal block, wiring, and Ni-Cad batteries are complete.		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
				Initial	Date	
11. Perform manual transfer operation with both NORMAL and EMERGENCY sources de-energized. Use detachable manual operator to transfer from NORMAL to EMERGENCY and back.	Switch should transfer smoothly and with full contact travel speed.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Mechanical interlocking should prevent simultaneous closure of NORMAL and EMERGENCY sources.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
12. Perform manual bypass operation to each source.	Switch should transfer smoothly and with full contact travel speed.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
ELECTRICAL INTEGRITY						
13. Measure contact resistance on all poles in both closed positions.	Readings are within 50% of the average value, including the neutral pole.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table.	<input type="checkbox"/>	<input type="checkbox"/>
				Spec Section 16415		
Record issues				Issue Log Item:		
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
14. Perform an insulation resistance test at 1000VDC on each bus section, phase-to-phase and phase to ground.	Minimum insulation resistance shall be 100 megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test for one minute in accordance with NETA Table 100.1. Isolate ALL control wiring and electronic devices prior to testing. Test across open contacts for both NORMAL and EMERGENCY sources. Test phase-to-ground with all other phases grounded for both NORMAL and EMERGENCY sources. Spec Section 16415 Test Name: Insulation Resistance, Reference Equipment Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
15. Perform insulation resistance test at 1000 VDC to verify Automatic Transfer Switch is isolated from load when bypassed.	Insulation resistance shall equal or exceed 100 Megohms.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Test for one minute in accordance with NETA Table 100.1. Isolate ALL control wiring and electronic devices prior to testing Test Name: Insulation Resistance, Reference Equipment Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
				Initial	Date	
16. Verify the operation of four-line LCD display and character keyboard.	All data displays operate.	<input type="checkbox"/>	<input type="checkbox"/>	Record Password: _____	<input type="checkbox"/>	<input type="checkbox"/>
	All program parameters accessible.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
17. Verify "In Phase Monitoring" setting.	In phase monitoring is enabled.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
18. Verify all voltage, frequency, and time delay settings.	Use ATS microprocessor control system.	<input type="checkbox"/>	<input type="checkbox"/>	Record values in the "Actual Setpoint" column in the ATS Parameters and Setpoints table Spec Section 16415	<input type="checkbox"/>	<input type="checkbox"/>
	Device pick-up (PU) and drop-out (DO).	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
19. Verify all applicable local and remote annunciation by the monitoring system for various operating conditions.	Operating Conditions: NORMAL power available	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	EMERGENCY power avail.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	ATS in NORMAL position.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	ATS in EMERGENCY position.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	LED indicating lights are operating.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>



ACTION		REQUIRED REACTION		Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
Record issues						Issue Log Item:		
						Initial	Date	
20. Verify proper phase rotation	Emergency source matches utility source.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Record issues						Issue Log Item:		
						Initial	Date	
TRANSFER OPERATION TESTS								
21. Disconnect NORMAL power source to transfer switch.	Time delay on engine start equals setpoint.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Spec Section 16231			<input type="checkbox"/>	<input type="checkbox"/>
	Start signal sent to engine generator.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Transfer time delay equals setpoint.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Time delay in neutral equals setpoint.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	ATS transfers to Emergency source position.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Total time to connect to Emergency source is no more than 10-seconds.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Record issues						Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
						Initial	Date	
22. Restore Normal power source to Automatic Transfer Switch to verify setpoints.	Re-transfer time delay equals setpoint.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Spec Section 16231			<input type="checkbox"/>	<input type="checkbox"/>
	ATS transfers to Normal source position.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Time delay in neutral equal setpoint.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
	Engine cool down time delay equals setpoint.	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
	Engine shuts off after cool down delay times out.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
23. Repeat steps #21 and #22, except manually disconnect. EMERGENCY source, to simulate failure of the engine, after restoration of NORMAL power and before the re-transfer delay has expired.	Switch should re-transfer to Normal without delay on engine shutdown.	<input type="checkbox"/>	<input type="checkbox"/>	Spec Section 16231	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
24. Verify operation of ATS TEST switch.	Simulates failure of normal source.	<input type="checkbox"/>	<input type="checkbox"/>	Spec Section 16231	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
BYPASS AND ISOLATION SWITCH OPERATION						
25. Verify Automatic Transfer Switch manual bypass and isolation switch operation with NORMAL source energized and load on ATS.	ATS mechanism is de-energized and power passes through the bypass/isolation switch path.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	



ACTION	REQUIRED REACTION	Y (✓)	N (✓)	COMMENTS	R (✓)	C (✓)
26. Restore the Automatic Transfer Switch to its automatic mode by manually reversing the bypass and isolation switch operation.	ATS mechanism is energized and the bypass/isolation switch path is de-energized.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:	<input type="checkbox"/>	<input type="checkbox"/>
				Initial	Date	
FINAL INSPECTION						
27. After testing is performed on the ATS, verify tightness of field landed feeder terminations (NORMAL, EMERGENCY, and LOAD feeders).	Feeder cable connections properly torqued and marked.	<input type="checkbox"/>	<input type="checkbox"/>	Record results in Data Table. Bolted torque should comply with NETA Table 100.12 unless manufacturer specified values are listed on the equipment. Test Name: Bolt Torque Reference Equip. Table	<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	
28. Prior to energization, inspect interior hardware.	All hardware in place and properly torqued.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	Compartments clear of tools and hardware.	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Record issues				Issue Log Item:		
				Initial	Date	



Test Equipment Used:

Test Name	Manufacturer	Model Number	Serial Number	Calibration(Date)

ATS NAMEPLATE DATA

Parameter	Data
Equipment ID	
Manufacturer	
Model	
Serial No.	
Catalog No	
Mfg. Date	
Current Rating	
Voltage Rating	
Poles:	
Closing & Withstand Amps	
NEMA Enclosure	

Contact Resistance

Contacts	A	B	C	N
Normal				
Emergency				



Insulation Resistance

Phase to Phase	A – B	B - C	C – A
Normal			
Emergency			
Phase to Ground	A - G	B - G	C – G
Normal			
Emergency			
To Load (ATS in Bypass)	A – LOAD	B – LOAD	C - LOAD
Normal			
Emergency			

PARAMETERS AND SETPOINTS

Voltage

Parameter	Actual Setpoint	Specification Setpoint	Range	Factory Default
Normal Over-Voltage Dropout				
Normal Over -Voltage Pickup				
Emergency Over-Voltage Dropout				
Emergency Over -Voltage Pickup				
Normal Under-Voltage Dropout				
Normal Under-Voltage Pickup				
Emergency Under-Voltage Dropout				
Emergency Under-Voltage Pickup				

Frequency

Parameter	Actual Setpoint	Specification Setpoint	Range	Factory Default
Normal Over-Frequency Dropout				
Normal Over -Frequency Pickup				
Emergency Over-Frequency Dropout				
Emergency Over -Frequency Pickup				
Normal Under-Frequency Dropout				
Normal Under-Frequency Pickup				



Parameter	Actual Setpoint	Specification Setpoint	Range	Factory Default
Emergency Under-Frequency Dropout				
Emergency Under-Frequency Pickup				

Time Delay

Parameter	Actual Setpoint	Specification Setpoint	Range	Factory Default
Neutral Position Time Delay				
Normal Failure Time Delay (Gen Start)				
Emergency Failure Time Delay				
Transfer to Emergency Time Delay				
Return to Normal Time Delay				
Engine Cool Down				

Note: The "Actual Setpoint" column in the above table should be filled in during step 0

Feeder Termination Torque (Newton Meters or Foot-Pounds)

TORQUE FEEDERS	A	B	C	N	G
NORMAL					
EMERGENCY					
LOAD					



Final Sign-Off

Commissioning Agent	Printed Name	Initials	Date
CONTRACTOR	PRINTED NAME	INITIALS	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			
Owner's O&M Personnel			



Automatic Transfer Switches Pre-Functional Checklist

Equipment ID	[Equipment ID]
Building	[Building]
Location	[Room]

Statement of Readiness

The above equipment and/or systems integral to them are complete and ready for functional testing, except as noted. None of the outstanding items preclude safe and reliable functional tests being performed. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

Responsible Contractor Sign Here

CONTRACTOR	PRINTED NAME	SIGNATURE	DATE
General Contractor (GC)			
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
TAB Contractor (TAB)			
Controls Contractor (CC)			

This statement of readiness has been received by the Commissioning Agent on _____ and will be incorporated as part of the final commissioning report.

EQUIPMENT DATA

Static Switch Nameplate

Parameter	Data
Equipment ID	
Manufacturer	
Model	
Catalog Number	
Date Manufactured	



Static Switch Source #1 Isolation Circuit Breaker (CB1) Nameplate

Parameter	Data
Manufacturer/Model	
Frame Amps	
Volts	
GFI Module	
SC Rating	
Current Rating	

Static Switch Source #2 Isolation Circuit Breaker (CB2) Nameplate

Parameter	Data
Manufacturer/Model	
Frame Amps	
Volts	
GFI Module	
SC Rating	
Current Rating	

Static Switch Output Isolation Circuit Breaker (CB3) Nameplate

Parameter	Data
Manufacturer/Model	
Frame Amps	
Volts	
GFI Module	
SC Rating	
Current Rating	



Static Switch Bypass to Source #1 Circuit Breaker (CB4) Nameplate

Parameter	Data
Manufacturer/Model	
Frame Amps	
Volts	
GFI Module	
SC Rating	
Current Rating	

Static Switch Bypass to Source #2 Circuit Breaker (CB5) Nameplate

Parameter	Data
Manufacturer/Model	
Frame Amps	
Volts	
GFI Module	
SC Rating	
Current Rating	

System Readiness Checklist

Yes = Checked and Completed, N/A = Not Applicable

Inspection Checklist					
Description	Yes	N/A	Initials	Date	Comments
As-Built Drawings complete, available and on-site.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment shop drawings available.	<input type="checkbox"/>	<input type="checkbox"/>			
Operation and Maintenance manuals available.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation and startup manual available.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment warranty information completed and provided in O&M Manual.	<input type="checkbox"/>	<input type="checkbox"/>			
Verify receipt and acceptance of manufacturer's factory test reports.	<input type="checkbox"/>	<input type="checkbox"/>			
Doors to electrical room installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Locks or temporary security measures installed & operational. Room can be secured.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room clear of storage, temporary equipment, etc.	<input type="checkbox"/>	<input type="checkbox"/>			
Permanent lighting or 30 foot candle temporary lighting in service.	<input type="checkbox"/>	<input type="checkbox"/>			



Inspection Checklist					
Description	Yes	N/A	Initials	Date	Comments
Egress routes from electrical room are unobstructed.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room & equipment clean of construction debris and dust, and are dry.	<input type="checkbox"/>	<input type="checkbox"/>			
Working clearances meet NEC and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment has been installed on a level housekeeping pad or properly attached to the structure or wall.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment anchored per manufacturer's instruction.	<input type="checkbox"/>	<input type="checkbox"/>			
Warning Signs installed per shop drawings and contract documents.	<input type="checkbox"/>	<input type="checkbox"/>			
All shipped-loose components installed.	<input type="checkbox"/>	<input type="checkbox"/>			
Electrical room grounding system complete.	<input type="checkbox"/>	<input type="checkbox"/>			
Grounding electrode conductor has been attached to the building ground ring.	<input type="checkbox"/>	<input type="checkbox"/>			
Shipping bolts and braces removed.	<input type="checkbox"/>	<input type="checkbox"/>			
ATS doors allow for full swing; latch open and close without binding; and no physical damage.	<input type="checkbox"/>	<input type="checkbox"/>			
All field and interconnecting wiring is completed and labeled at each end with visible and readable tags. (Printed markings on the conductors are NOT acceptable.).	<input type="checkbox"/>	<input type="checkbox"/>			
All bolted connections tightened to their proper torque values.	<input type="checkbox"/>	<input type="checkbox"/>			
All wiring installed properly with correct bend radius and no insulation damage.	<input type="checkbox"/>	<input type="checkbox"/>			
All contacts, devices, etc. for interface with SCADA system are installed, functional and wired to terminal strips for connection of field wiring.	<input type="checkbox"/>	<input type="checkbox"/>			
Verify Normal and Emergency line side phase rotation.	<input type="checkbox"/>	<input type="checkbox"/>			
Verify that NORMAL and EMERGENCY sources are available.	<input type="checkbox"/>	<input type="checkbox"/>			
ATS settings have been adjusted per the Engineer/specifications.	<input type="checkbox"/>	<input type="checkbox"/>			
Equipment layout and schematic wiring diagrams available and on-site.	<input type="checkbox"/>	<input type="checkbox"/>			
System sequence of operation available and on-site.	<input type="checkbox"/>	<input type="checkbox"/>			
Remote STS summary alarm wiring complete and tested.	<input type="checkbox"/>	<input type="checkbox"/>			
Logic and control connections are routed away from power runs for noise prevention.	<input type="checkbox"/>	<input type="checkbox"/>			
Modbus TCP/IP network interface connection made and operational.	<input type="checkbox"/>	<input type="checkbox"/>			
Machine room space air conditioning working and available for use.	<input type="checkbox"/>	<input type="checkbox"/>			
Factory-supplied critical spare parts inventory delivered and available on-site.	<input type="checkbox"/>	<input type="checkbox"/>			



Inspection Checklist					
Description	Yes	N/A	Initials	Date	Comments
Factory test and startup documentation provided with copies attached to this SRC.	<input type="checkbox"/>	<input type="checkbox"/>			
Testing agency has been scheduled to perform the test and the commissioning agent has been notified of the testing date.	<input type="checkbox"/>	<input type="checkbox"/>			
Test equipment requirements have been reviewed with the testing agency.	<input type="checkbox"/>	<input type="checkbox"/>			
Power available for test equipment.	<input type="checkbox"/>	<input type="checkbox"/>			
Installation is complete and ready for verification testing.	<input type="checkbox"/>	<input type="checkbox"/>			
Training Plan approved.	<input type="checkbox"/>	<input type="checkbox"/>			
Training sessions of owner training completed / acceptance granted / training materials submitted to Commissioning Agent.	<input type="checkbox"/>	<input type="checkbox"/>			
Notes:					

Additional Comments: