

26 08 30 - GENERATOR TESTING PROCEDURES FORM

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Step by Step Detailed Procedure		Expected Result	Observations
1. ATS Breaker	Open ATS Breaker	Verify power off at all loads on emergency power.	
	Close ATS Breaker & put ATS Sw. to Auto	Verify all loads have power.	
2. Generator Cold Start	Open normal power breaker & immediately connect full load bank load capacity to ATS units. (This connection must be made before the generator engine is up to speed & transfer to emergency power is complete. Observe the systems performance & record the date using a Power Line Disturbance Monitor to monitor transient responses. Compare to specifications.	Time delay from power failure to engin start should be within sec.	
		Cranking time until prime mover starts and runs should be within sec.	
		Time until engine-generator is at proper voltage and frequency should be within sec.	
		Total time from power failure until ATS switch is on emergency power should be within sec.	
3. Repeat Generator Cold Start	Open normal power breaker & immediately connect full load bank load capacity to ATS units. (This connection must be made before the generator engine is up to speed & transfer to emergency power is complete. Observe the systems performance & record the date using a Power Line Disturbance Monitor to monitor transient responses. Compare to specifications.	Time delay from power failure to engin start should be within sec.	
		Cranking time until prime mover starts and runs should be within sec.	
		Time until engine-generator is at proper voltage and frequency should be within sec.	
		Total time from power failure until ATS switch is on emergency power should be within sec.	

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Step by Step Detailed Procedure	Expected Result	Observations																												
4. Phase Testing	Record voltage & amperage of each phase & frequency using analyzer, not generator gages; engine temperature, oil pressure & battery charge rate at 5 minute intervals for a period of one hour. Measure the temp. of all generator & ATS connections using a laser guided infrared temperature meter. Voltage V Frequency HZ Amperage A Coolant Temp. F Oil Pressure PSI Battery Charge Rate ATS Contacts Input Temp. F ATS Contacts Onput Temp. F ABOVE VALUES PERFORMANCE CRITERIA FOR TABLE IN SECTION 26 08 32																													
5. Return to Normal Power	Disconnect Load Bank from ATS, before transfer back to normal power. Restore Normal Power Breaker and record delay to normal power transfer using PDM. Record neutral delay time by recording V differential between EGP & UP at the time of the transfer back to normal power using PDM. Time delay to return normal power should be within _____ sec. Neutral delay time should be within _____ sec. Generator Power to Utility Power, V should be 0. Engine continues to run & cool down time should be _____ min.																													
6. Step Load Testing	After cool-down timer has expired, start the generator by opening the ATS normal input power breaker. With the emergency bus energized perform the step load test verify that volts & HZ stay within specified range during transition & HZ stability (rate of change) is acceptable using PDM.																													
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Step</th> <th>Voltage</th> <th>Frequency</th> <th>Frequency Stability</th> </tr> </thead> <tbody> <tr> <td>Specified</td> <td>V</td> <td>HZ</td> <td>Criteria</td> </tr> <tr> <td>0-25%</td> <td>V</td> <td>HZ</td> <td></td> </tr> <tr> <td>0-50%</td> <td>V</td> <td>HZ</td> <td></td> </tr> <tr> <td>0-100%</td> <td>V</td> <td>HZ</td> <td></td> </tr> <tr> <td>100-50%</td> <td>V</td> <td>HZ</td> <td></td> </tr> <tr> <td>100-25%</td> <td>V</td> <td>HZ</td> <td></td> </tr> </tbody> </table>	Step	Voltage	Frequency	Frequency Stability	Specified	V	HZ	Criteria	0-25%	V	HZ		0-50%	V	HZ		0-100%	V	HZ		100-50%	V	HZ		100-25%	V	HZ		
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Step by Step Detailed Procedure		Expected Result			Observations
7. Temperature on Load Bank	Connect full load bank to ATS Maintain power flow for 15 min and then take temperature readings with infrared meter looking for hot spots.	There should be no significant diff in temp between Phs			
		Phase 1	Phase 2	Phase 3	
		F	F	F	
		F	F	F	
8. Temperature on Utility	Transfer load to Utility source Maintain power flow fro 15 min and then take temperature readings with infrared meter looking for hot spots.	There should be no significant diff in temp between Phs			
		Phase 1	Phase 2	Phase 3	
		F	F	F	
		F	F	F	
9. ATS Test Switch	Operate the ATS test switch & verify that generator starts and emergency power sequence is initiated. Bypass the return to normal timer to accelerate the test sequence.	Generator should start and emergency power sequence initiate. Verify that total time to emergency power meets that specified (see procedure 2)			
10. Safety Interlocks ATS	Operate the ATS and controls in a deranged mannet to create an alarm condition	Alarms should be generated and emergency power remains off.			
11. Alarms ATS	Simulate all alarms, alarm contact operation and remote enunciator operation by jumping across alarms	All alarms are properly annunciated in the remote panel			

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Step by Step Detailed Procedure	Expected Result	Observations	
15. UPS with Load Bank at 100% Bring load bank load up to 100% of rated kW (balanced load) and monitor UPS output for 2 continuous hours. Record all electrical distribution systems connection temperatures using an infrared meter.	UPS values should be within tolerances		
		Specified Actual	
	Voltage	V V	
	Frequency	HZ HZ	
	THD	< 5% %	
	Waveform Deviation	Minimal	
	There should be no significant diff in temp between Phs		
	Phase 1	Phase 2	Phase 3
	F	F	F
	F	F	F
16. UPS Step Load Test UPS shall be subjected to 3 consecutive step load tests. Monitor and record the UPS performance for Voltage Overshoot (VO), Frequency Overshoot (FO), Total Harmonic Distortion (THD) and Waveform Deviation. The generator should power load and not transfer to battery. The UPS will be monitored and waveform deformation/harmonic content. Each of the four step tests shall be performed at 1 min. intervals until 3 repetitions have been completed.	Step	VO, V	
	Specified	FO, HZ	
	0%/15sec	THD, %	
	25%/15sec	Wave	
	0%/15sec	< 5.0	Minimal
	50%/15sec		
	0%/15sec		
	100%/15sec		
	50%/15sec		
	100%/15sec		
	50%/15sec		
	125%/15sec		

(16. ups Step Load test continued on next page)

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<p>(16. ups Step Load test continued from previous page)</p> <p>UPS shall be subjected to 3 consecutive step load tests.</p> <p>Monitor and record the UPS performance for Voltage Overshoot (VO), Frequency Overshoot (FO), Total Harmonic Distortion (THD) and Waveform Deviation. The generator should power load and not transfer to battery. The UPS will be monitored and waveform deformation/harmonic content. Each of the four step tests shall be performed at 1 min. intervals until 3 repetitions have been completed.</p>	Step	VO, V	FO, HZ	THD, %	Wave	
	Specified			< 5.0	Minimal	
	0%/15sec					
	25%/15sec					
	0%/15sce					
	50%/15sec					
	0%/15sec					
	100%/15sec					
	50%/15sec					
	100%/15sec					
	50%/15sec					
	125%/15sec					
	0%/15sec					
	25%/15sec					
	0%/15sce					
	50%/15sec					
	0%/15sec					
100%/15sec						
50%/15sec						
100%/15sec						
50%/15sec						
125%/15sec						
100%/5min						
125%/5min						

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Step by Step Detailed Procedure		Expected Result		Observations	
17. Grounding	Verify connections & grounding is in compliance with NEC, especially grounding & bonding of UPS & generator.	Wiring & grounding are in compliance with NEC.			
18. UPS with Load Bank at 100%	With the UPA loaded as stated in the previous test, the UPS INTERNAL manual maintenance bypass switch will be manually operated 2 consecutive times transferring the load between UPS power, alternate power, and back to UPS power. Switching shall occur in 2 minute intervals. Verify that specified voltage dynamic regulation is met during switching.	UPS values should be within the following .			
		Specified	Actual		
		Voltage			
		Frequency			
		THD			
		Waveform Deviation			
19. UPS with Load Bank at 100%	With the UPA loaded as stated in the previous test, the UPS EXTERNAL manual maintenance bypass switch will be manually operated 2 consecutive times transferring the load between UPS power, alternate power, and back to UPS power. Switching shall occur in 2 minute intervals. Verify that specified voltage dynamic regulation is met during switching.	UPS values should be within the following .			
		Specified	Actual		
		Voltage			
		Frequency			
		THD			
		Waveform Deviation			

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Step by Step Detailed Procedure	Expected Result	Observations
20. Safety Interlocks UPS	Operate the UPS & controls in a deranged manner to create alarm condition. Alarms should be generated and emergency power will remain off.	
21. Alarms UPS	Simulate all alarms, alarm contact operation and remote enunciation operation by jumping across alarms. All alarms are properly annunciated at the remote panel.	
22. UPS Digital Readouts	Check calibration of UPS digital readouts of frequency, current and volts against a calibrated instrument. UPS should be within tolerances	
	Specified	Actual
	Voltage V	V
	Ampereage A	A
	Frequency HZ	HZ
23. UPS with Load Bank at 100%	With the UPS loaded at 100%, UPS input power will be interrupted to simulate a power failure. The UPS output will be monitored & recorded for RMS values, waveform deformation/harmonic content. The roll-off of battery potential shall be monitored, recorded and compared to the battery run time spec. All accessible battery terminations will be checked for temperature variations with a infrared meter. UPS values should be within these tollerances.	
	Specified	Actual
	RMS V	V
	Battery A/sec	A/sec
	THD < 5%	
	Waveform Minimal	
	Deviation	
UPS shutdown at low battery string volts V	V	

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Step by Step Detailed Procedure	Expected Result	Observations								
24. Preparation Integrated Building Test	Reconnect power to the UPS and with 100% output load on the UPS system and full battery recharged current (waite aprox. 5 minutes to allow batteries to charge to support load during loss of power).									
25. Emergency Power Including UPS	Test the function of all loads on emergency power including UPS loads. Open the circuit breaker serving the ATS to simulate a power failure on the feeder serving the ATS & Backup Power Distributor Verify that proper power is delivered to each device listed in the emergency panel schedules and that equipment directly wired function properly. Record generator output with the Powerline Disturbance Monitor and a Load Profiler.	Generator values should be within following tolerances. <table style="width:100%; border:none;"> <tr> <td style="width:40%;"></td> <td style="width:20%; text-align:center;">Specified</td> <td style="width:20%; text-align:center;">Actural</td> <td style="width:20%;"></td> </tr> <tr> <td>Load</td> <td style="text-align:center;">< 100%</td> <td></td> <td style="text-align:right;">%</td> </tr> </table> UPS loads should properly operate off the generator and not transfer to battery. All emergency lights ON. All emergency receptacles powered. Fire Alarm system powered. Specialty systems powered. HVAC & Controls powered.		Specified	Actural		Load	< 100%		%
	Specified	Actural								
Load	< 100%		%							

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26. Emergency Power Specialty System Test Initiate a building smoke detector. Initiate a security system alarm. Initiate a HVAC alarm. Check telecom system. Test elevator recall. Monitor UPS charging system	Fire alarm Security system should work properly HVAC monitoring system should work properly. Telecom system works properly. Elevator works properly. UPS charging properly. SYSTEM THAT HAVE OFF SITE MONITORING VERIFY THAT CORRECT SIGNALS ARE SENT AND RECEIVED.	
27 Emergency Power Including UPS Monitored Alarms Verify the following functions by causing the alarm, recording the time and having the monitoring company fax a copy of the alarm condition. Simulate an electrical failure or malfunction Simulate a UPS switch detection. Simulate a HVAC condition alarm.	Electrical failure alarm. Response Time: Power switched alarm. Response Time: HVAC alarm. Response Time:	