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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.	*(see table below)*	

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
12. ATS Digital Readouts	Check calibration of ATS digital readouts of frequency, current and volts against a calibrated instrument.	ATS should be within tolerances			
			Specified	Actual	
		Voltage	V	V	
		Ampereage	A	A	
		Frequency	HZ	HZ	
13. UPS with Load Bank Off	Connect the UPS to a load bank and leave the load bank off. Operate the UPS for 1/2 hour without load while monitoring UPS output with Power Line Disturbance Monitor and Load Profiler. Take a waveform and load profiler snapshot. Observe the varations in voltage, frequency, total harmonic distortion (THD), and the wave form deviation.	UPS values should be within tolereances			
			Specified	Actual	
		Voltage	V	V	
		Frequency	HZ	HZ	
		THD	< 5%	%	
		Waveform Deviation	Minimal		
14. UPS with Load Bank at 50%	Bring the UPS to its 50% kW rating (balanced load) in 25% increments. Operate the UPS for 1 hour and monitor UPS output	UPS values should be within tolereances			
			Specified	Actual	
		Voltage	V	V	
		Frequency	HZ	HZ	
		THD	< 5%	%	
		Waveform Deviation	Minimal		

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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.	UPS values should be within tolereances					
			Specified		Actual		
		Voltage	V		V		
		Frequency	HZ		HZ		
		THD	< 5%		%		
		Waveform Deviation	Minimal				
	Record all electrical distribution systems connection temperatures using an infrared meter.	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 repitions have been completed.	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					
	(16. ups Step Load test continued on next page)	50%/15sec 125%/15sec					

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Step by Step Detailed Procedure		Expected Result					Observations
(16. ups Step Load test continued from previous page)		Step	VO, V	FO, HZ	THD, %	Wave	
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 repitions have been completed.	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	Actural	
		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	Actural	
		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 Deviation	Minimal		
		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 Distributior	Generator values should be within following tolerances. Specified Actural Load < 100% % UPS loads should properly operate off the generator and not transfer to battery.	
	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.	All emergency lights ON. All emergency receptacles powered. Fire Alarm system powered. Specialty systems powered. HVAC & Controls powered.	

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Step by Step Detailed Procedure		Expected Result	Observations
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:	