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**SECTION 4**  
**POWER SYSTEMS**  
**ENGINEERING AND OPERATIONAL REVIEW**  
**POWER PLANTS OPERATION**

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Copies of the various charts should be duplicated so that a separate chart is dedicated to the review of each power plant. Each polarity and voltage of multiple output plants needs to be treated as a separate plant to provide space for answering items which would apply separately. Items which require that data be recorded generally provide space for those entries. NA for "not applicable" may be entered where appropriate. Sufficient copies of FORM A should be duplicated to provide a minimum of one with each chart. The repeated chart format used here best lends itself to use in a looseleaf binder.

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**NOTICE**

Not for use or disclosure outside the  
Bell System except under written agreement



## CHART 1

## COMMERCIAL AC POWER SERVICE

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STEP	PROCEDURE
1	Verify that all connected power equipment and operational support system equipment can be energized.  YES _____ NO _____
2	Verify that adequate ac lighting is provided in all power equipment and operating and maintenance areas.  YES _____ NO _____
3	Operate the emergency dc lighting by removing the ac supply fuse for the ac lights and check the adequacy of lighting in all power equipment and operational support system operating and maintenance areas. Identify all lighting deficiencies and lamps requiring replacement, then restore lighting switches to normal.  YES _____ NO _____
4	Check that ac power switchboard meters and indicating lamps, where provided, are operating properly and show the mode of operated switchgear.  YES _____ NO _____
5	Record all ac power switchboard panel meter readings on each phase. Also record the time of day the readings are taken.  TIME _____

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## CHART 2

## BATTERY PLANTS

STEP	PROCEDURE
<b>A. General</b>	
1	If the battery plant ammeters and voltmeters have not been calibrated and dated within 6 months, calibrate in accordance with Section 100-510-701 and applicable plant operational sections using a standard reference meter or digital readout meter.
2	If recalibration is required, make necessary adjustments to charging units to correct the battery plant float voltage, per office requirements.
3	Record all plant voltmeter and discharge ammeter readings. Record the time. VOLTS_____ AMPS_____ TIME_____
4	Verify that all power board fuse sizes, types and designations are in agreement with panel designations and office drawings. Do not interrupt service.
5	Check all power board fuses and switches for overheating and corrosion. Refer to Sections 026-371-501 and 026-370-701.
6	Verify that necessary spare fuses are available on spare fuse panels near the power board and that all switch-and-fuse units are properly equipped. YES_____ NO_____
7	Inspect the rear of power board equipment, bus bars, cable terminations, wiring, etc, for any physical defects, overheating due to loose connections, damaged cabling, poor housekeeping, etc, that could present a service hazard.
8	Check that all charging units are turned "on". If any units are shut down, determine the reason, correct any problems, if possible, and return operable units to service. In plants with excess capacity, charging units that had been turned "off" to conserve operating expenses should be identified and restored to the "OFF" position upon completion of tests in this section. YES_____ NO_____
9	Determine status of alarms. If any alarms are currently operated, investigate the reason and take necessary action to correct the problem.
10	Measure and record the current on the main discharge leads, during the busy hour if possible. Record the time. Refer to Sections 171-115-501 and 790-100-664 for methods that do not interrupt service. TIME_____ AMPS_____

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 CHART 2 (Contd)
 

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STEP	PROCEDURE
11	Verify that all batteries are free of visual signs of physical defects, corrosion, low electrolyte level, missing vent caps, post growth, acid leaks, etc. Refer to Section 790-100-664.  YES _____ NO _____
12	Verify that battery connections are tight.  YES _____ NO _____
13	If charging unit meters have not been calibrated and dated within 6 months, calibrate in accordance with applicable operational BSP sections.  CALIBRATION DATE _____
<b>B. Test Operation-Main Battery Plants Plant Code _____</b>	
<i>Note 1:</i> Sufficient personnel and an adequate communications link must be available for the reporting of local and remote alarms.	
<i>Note 2:</i> Do not exceed the posted battery plant voltage limits during these tests.	
<i>Note 3:</i> For those plants that are provided with the alarm surveillance and control interface option, notify the alarm surveillance and control interface central monitor prior to beginning and upon completion of any alarm check. This will assure that the circuit is functioning properly and that the alarms will be retired at the central monitor upon completion of the checks.	
14	Measure and record the ac input voltage at the rectifier terminals on two rectifiers of each plant. One rectifier should be connected to the A bus, the other to the B bus of the ac service cabinet.  VOLTS (A BUS) _____  VOLTS (B BUS) _____
15	Verify that the input connects to the proper terminals (taps) for the voltage measured as shown on the schematic drawing (SD).  YES _____ NO _____
16	If any rectifiers have a specific phase rotation requirement, verify the phase rotation.  YES _____ NO _____

## CHART 2 (Contd)

STEP	PROCEDURE
17	<p>If any rectifiers have internal test features such as the simulated constant current test, verify the operation and setting of all applicable adjustments per appropriate BSP operational sections.</p> <p>YES _____ NO _____</p>
18	<p>Remove ac input power to each rectifier, one at a time; observe that rectifier shuts down and other unit(s) pick up the load. Check for proper operation of local and remote alarms, if so equipped. Reapply ac power and observe that rectifier restores to normal operation, alarms are restored to normal, and, if equipped with "current walk-in," that the current gradually increases without overshoot.</p> <p>YES _____ NO _____</p>
19	<p>Turn as many rectifiers off as required to cause remaining rectifiers to operate near full load output. Verify that each rectifier current limits at the current limit requirement prescribed in the appropriate operating methods BSP. Continue this procedure until all rectifiers have been verified and adjusted to the proper current limit setting per BSP requirements.</p> <p>YES _____ NO _____</p>
20	<p>When covered in the appropriate operating methods BSP, simulate operation of the high-voltage shutdown circuit of the rectifier. Note that the rectifier shuts down, locks out, and brings in the proper alarms at both the plant and rectifier. Operate the rectifier ON-OFF switch to OFF and then to ON. Check that the rectifier returns to normal operation and that the alarms are retired. Repeat this test on all rectifiers.</p> <p>YES _____ NO _____</p>
21	<p>Check the appropriate rectifier operating methods BSP for detailed information for verifying the operation of other rectifier features and alarms. These may include remote shutdown and remote recycle, auto-boost charge, fan alarms, etc.</p> <p>YES _____ NO _____</p>
22	<p>Check the appropriate plant operating methods BSP for detailed information for verifying the operation of all power plant alarms such as HLV, FLOAT, FA, etc. Check for alarm indications at both the power plant and at any other local aisle pilot or alarm panel as required. Verify transmittal of major (MJ) and minor (MN) alarms to appropriate alarm center. If battery voltage exceeds allowable high- or low-voltage requirements, discontinue test immediately.</p> <p>YES _____ NO _____</p>

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**CHART 2 (Contd)**


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STEP	PROCEDURE
23	Manually shut down all rectifiers to place the plant on battery discharge. While doing this, observe that the proper plant alarms activate at the appropriate voltage levels at local and remote centers.

YES \_\_\_\_\_ NO \_\_\_\_\_

24	Record the battery voltage and discharge current every 5 minutes for about 35 minutes. During this time inspect battery intercell connectors for signs of overheating.
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**Note:** If battery voltage drops below minimum allowable to operate system, discontinue test immediately.

25	Restore rectifiers to service and verify that the plant returns to normal operation and that the alarms are retired.
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(a) If Auto-Sequence Start Control is provided, verify operation.

YES \_\_\_\_\_ NO \_\_\_\_\_

(b) If Auto-Sequence Control is not provided on large power plant, rectifiers shall be restored one at a time.

YES \_\_\_\_\_ NO \_\_\_\_\_

**Note:** If restoral occurs during peak ac demand period, check building engineer to avoid exceeding normal peak by limiting recharge current.

### C. Emergency Cell Plants

**Note 1:** Sufficient personnel and an adequate communications link must be available for the reporting of local and remote alarms.

**Note 2:** Do not exceed the posted battery plant voltage limits during these tests.

**Note 3:** For those plants that are provided with the alarm surveillance and control interface option, notify the alarm surveillance and control interface central monitor prior to beginning and upon completion of any alarm check. This will assure that the circuit is functioning properly and that the alarms will be retired at the central monitor upon completion of the checks.

26	Measure and record the ac input voltage at the rectifier terminals on two rectifiers of each plant. One rectifier should be connected to the A bus, the other to the B bus of the ac service cabinet.
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VOLTS (A BUS) \_\_\_\_\_

## CHART 2 (Contd)

STEP	PROCEDURE
	VOLTS (B BUS)_____
27	Verify that the input connects to the proper terminals (taps) for the voltage measured as shown on the SD.  YES_____ NO_____
28	If any rectifiers have a specific phase rotation requirement, verify the phase rotation.  YES_____ NO_____
29	If any rectifiers have internal test features such as the simulated constant current test, verify the operation and setting of all applicable adjustments per appropriate BSP operational sections.  YES_____ NO_____
30	Remove ac input power to each rectifier, one at a time; observe that rectifier shuts down and other unit(s) pick up the load. Check for proper operation of local and remote alarms, if so equipped. Reapply ac power and observe that rectifier restores to normal operation, alarms are restored to normal, and, if equipped with "current walk-in," that the current gradually increases without overshoot.  YES_____ NO_____
31	Turn as many rectifiers off as required to cause remaining rectifiers to operate near full load output. Verify that each rectifier current limits at the current limit requirement prescribed in the appropriate operating methods BSP. Continue this procedure until all rectifiers have been verified and adjusted to the proper current limit setting per BSP requirements.  YES_____ NO_____
32	When covered in the appropriate operating methods BSP, simulate operation of the high-voltage shutdown circuit of the rectifier. Note that the rectifier shuts down, locks out, and brings in the proper alarms at both the plant and rectifier. Operate the rectifier ON-OFF switch to OFF and then to ON. Check that the rectifier returns to normal operation and that the alarms are retired. Repeat this test on all rectifiers.  YES_____ NO_____
33	Check the appropriate rectifier operating methods BSP for detailed information for verifying the operation of other rectifier features and alarms. These may include remote shutdown and remote recycle, auto-boost charge, fan alarms, etc.  YES_____ NO_____

## CHART 2 (Contd)

STEP	PROCEDURE
34	<p>Verify that the emergency cell switch is in good condition—gears and contacts good, clean and lubricated, etc. Make visual and mechanical inspection front and rear with covers removed.</p> <p>YES _____ NO _____</p>
35	<p>Verify that the current limiting resistors used to carry the plant load during operation of the emergency cell switch are free of evidence of cracking or other damage (discoloration is not a defect). Make sure that wires and cables are not touching the resistors.</p> <p>YES _____ NO _____</p>
36	<p>Verify that trickle chargers and emergency cell rechargers, if equipped, are operating properly. Refer to the appropriate operating methods BSPs.</p> <p>YES _____ NO _____</p>
37	<p>Verify that the EMC voltmeter relay, control circuit, and alarms are properly adjusted in accordance with the appropriate operating methods BSPs.</p> <p>YES _____ NO _____</p>
38	<p>Check the appropriate plant operating methods BSP for detailed information for verifying the operation of all power plant alarms such as HLV, FLOAT, FA, etc. Check for alarm indications at both the power plant and at any other local aisle pilot or alarm panel as required. Verify transmittal of major (MJ) and minor (MN) alarms to appropriate alarm center. If battery voltage exceeds allowable high- or low-voltage requirements, discontinue test immediately.</p> <p>YES _____ NO _____</p>
39	<p>Manually shut down all rectifiers to place the plant on battery discharge. While doing this, observe that the proper plant alarms activate at the appropriate voltage levels.</p> <p>YES _____ NO _____</p>
40	<p>Record the battery voltage and discharge current every 5 minutes for about 35 minutes. Verify that the emergency cell switch operates when the plant voltmeter approaches: (a) 22 volts for 11-cell plants, (b) 24 volts for 12-cell plants, (c) 46 volts for 23-cell plants, and (d) 125 volts for 61-cell plants. Upon completion of switch operation, immediately record the plant voltage. (It should increase to the approximate normal float voltage reading.) If the emergency cell switch again operates to connect Group 2 cells during the discharge evaluation, record the voltage at the initiation and completion of switching. During this time inspect battery intercell connectors for signs of overheating.</p> <p>VOLTS _____</p>

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**CHART 2 (Contd)**


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**STEP****PROCEDURE**

**Note:** If battery voltage drops below minimum allowable to operate system, discontinue test immediately.

- 41 Restore rectifiers to service and verify that the plant returns to normal operation and that the alarms are retired. Verify that the emergency cell switch operates when the plant voltmeter approaches: (a) 24.5 volts for 11-cell plants, (b) 26.5 volts for 12-cell plants, (c) 50.75 volts for 23-cell plants, and (d) 135 volts for 61-cell plants. If the plant is fully automatic, check the arrangements for recharging the emergency cells (1) "charge by load" or (2) emergency cell recharger. After recharge, check that trickle charger is connected. On other plants, manually recharge emergency cells per operating instructions.

(a) If Auto-Sequence Start Control is provided, verify operation.

YES \_\_\_\_\_ NO \_\_\_\_\_

(b) If Auto-Sequence Control is not provided on large power plant, rectifiers shall be restored one at a time.

YES \_\_\_\_\_ NO \_\_\_\_\_

**Note:** If restoral occurs during peak ac demand period, check building engineer to avoid exceeding normal peak by limiting recharge current.

**D. Counter EMF Plants Plant Code \_\_\_\_\_**

**Note 1:** Sufficient personnel and an adequate communications link must be available for the reporting of local and remote alarms.

**Note 2:** Do not exceed the posted battery plant voltage limits during these tests.

**Note 3:** For those plants that are provided with the alarm surveillance and control interface option, notify the alarm surveillance and control interface central monitor prior to beginning and upon completion of any alarm check. This will assure that the circuit is functioning properly and that the alarm will be retired at the central monitor upon completion of the checks.

- 42 Measure and record the ac input voltage at the rectifier terminals on two rectifiers of each plant. One rectifier should be connected to the A bus, the other to the B bus of the service cabinet.

VOLTS (A BUS) \_\_\_\_\_

VOLTS (B BUS) \_\_\_\_\_

- 43 Verify that the input connects to the proper terminals (taps) for the voltage measured as shown on the SD.

## CHART 2 (Contd)

## STEP

## PROCEDURE

YES \_\_\_\_\_ NO \_\_\_\_\_

- 44 If any rectifiers have a specific phase rotation requirement, verify the phase rotation.

YES \_\_\_\_\_ NO \_\_\_\_\_

- 45 If any rectifiers have internal test features such as the simulated constant current test, verify the operation and setting of all applicable adjustments per appropriate BSP operational sections.

YES \_\_\_\_\_ NO \_\_\_\_\_

- 46 Remove ac input power to each rectifier, one at a time; observe that rectifier shuts down and other unit(s) pick up the load. Check for proper operation of local and remote alarms, if so equipped. Reapply ac power and observe that rectifier restores to normal operation, alarms are restored to normal, and, if equipped with "current walk-in," that the current gradually increases without overshoot.

YES \_\_\_\_\_ NO \_\_\_\_\_

- 47 Turn as many rectifiers off as required to cause remaining rectifiers to operate near full load output. Verify that each rectifier current limits at the current limit requirement prescribed in the appropriate operating methods BSP. Continue this procedure until all rectifiers have been verified and adjusted to the proper current limit setting per BSP requirements.

YES \_\_\_\_\_ NO \_\_\_\_\_

- 48 When covered in the appropriate operating methods BSP, simulate operation of the high-voltage shutdown circuit of the rectifier. Note that the rectifier shuts down, locks out, and brings in the proper alarms at both the plant and rectifier. Operate the rectifier ON-OFF switch to OFF and then to ON. Check that the rectifier returns to normal operation and that the alarms are retired. Repeat this test on all rectifiers.

YES \_\_\_\_\_ NO \_\_\_\_\_

- 49 Check the appropriate rectifier operating methods BSP for detailed information for verifying the operation of other rectifier features and alarms. These may include remote shutdown and remote recycle, auto-boost charge, fan alarms, etc.

YES \_\_\_\_\_ NO \_\_\_\_\_

- 50 Measure and record the voltage across each counter EMF cell. Verify that the voltage is within specified BSP limits.

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**CHART 2 (Contd)**


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<b>STEP</b>	<b>PROCEDURE</b>
51	If the plant is equipped with separate discharge ammeters, record the current and verify that the current does not exceed the rated capacity of the countercell.  AMPS _____
52	Verify that the counter EMF cell control circuit operates at the correct voltages per the appropriate operating methods BSPs.  YES _____ NO _____
53	Check the appropriate plant operating methods BSP for detailed information for verifying the operation of all power plant alarms such as HLV, FLOAT, FA, etc. Check for alarm indications at both the power plant and at any other local aisle pilot or alarm panel as required. Verify transmittal of major (MJ) and minor (MN) alarms to appropriate alarm center. If battery voltage exceeds allowable high- or low-voltage requirements, discontinue test immediately.  YES _____ NO _____
54	Manually shut down all rectifiers to place the plant on battery discharge. While doing this, observe that the proper plant alarms activate at the appropriate voltage levels.  YES _____ NO _____
55	Record the battery voltage and discharge current every 5 minutes for about 35 minutes. Verify that the counter EMF cells are automatically shorted out by the contactor when the plant voltage approaches the operating value specified in the operating methods BSP. Immediately record the plant voltage. (It should increase to the approximate normal float voltage reading.) Some plants have two groups of counter EMF cells; if the contactor again operates to connect Group 2 cells during the discharge evaluation, record the voltage at the initiation and completion of switches. During this time, inspect battery intercell connectors for signs of overheating.  <b>Note:</b> If battery voltage drops below minimum allowable to operate system, discontinue test immediately.  VOLTS (GROUP 1) _____  VOLTS (GROUP 2) _____
56	Restore rectifiers to service and verify that the plant returns to normal operation and that the alarms are retired.  Verify that the contactor opens when the plant voltage approaches the release value specified in the applicable operating methods BSP.

CHART 2 (Contd)

STEP	PROCEDURE
	<p>(a) If Auto-Sequence Start Control is provided, verify operation.</p> <p>YES_____ NO_____</p> <p>(b) If Auto-Sequence Control is not provided on large power plant, rectifiers shall be restored one at a time.</p> <p>YES_____ NO_____</p> <p><b>Note:</b> If restoral occurs during peak ac demand period, check building engineer to avoid exceeding normal peak by limiting recharge current.</p>
	<p><b>E. Motor Generators (EMG) and Sequence Control Rectifiers</b>      Plant Code_____</p> <p><b>Note 1:</b> Sufficient personnel and an adequate communications link must be available for the reporting of local and remote alarms.</p> <p><b>Note 2:</b> Do not exceed the posted battery plant voltage limits during these tests.</p> <p><b>Note 3:</b> For those plants that are provided with the alarm surveillance and control interface option, notify the alarm surveillance and control interface central monitor prior to beginning and upon completion of any alarm check. This will assure that the circuit is functioning properly and that the alarms will be retired at the central monitor upon completion of the checks.</p>
57	Inspect all idle motor-generator sets for wear, proper lubrication, or mechanical defects (eg, commutators free of surface deformation, brush wear, commutators free of improper discoloration, etc).
58	Inspect all operating motor-generator sets for excessive heat, vibration, arcing, adjustment problems, or other unsatisfactory performance indications.
59	Turn on and turn off motor-generator sets as required to perform inspections listed in Step 57 and Step 58 for all sets.
60	<p>Measure and record the ac input voltage at the rectifier or at set terminals on two units of each plant. One unit should be connected to the A bus, the other to the B bus of the ac service cabinet.</p> <p>VOLTS (A BUS)_____</p> <p>VOLTS (B BUS)_____</p>
61	Verify that the input connects to the proper terminals (taps) for the voltage measured as shown on the SD.

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**CHART 2 (Contd)**


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STEP	PROCEDURE
	YES _____ NO _____
62	If any units have a specific phase rotation requirement, verify the phase rotation.
	YES _____ NO _____
63	If any rectifiers have internal test features such as the simulated constant current test, verify the operation and setting of all applicable adjustments per appropriate BSP operations sections.
	YES _____ NO _____
64	Verify that all motor-generator sets and/or sequence control rectifiers are properly adjusted for the proper current limit and output voltage level requirements as specified in appropriate operating methods BSPs.
	YES _____ NO _____
65	Remove ac input power to each unit one at a time, observe that it shuts down and other unit(s) pick up the load. Check for proper operation of local and remote alarms, if so equipped. Reapply ac power and observe that unit restores to normal operation, alarms are restored to normal, and, if equipped with "current walk-in," that the current gradually increases without overshoot.
	YES _____ NO _____
66	Turn as many units off as required to cause remaining units to operate near full load output. Verify that each unit current limits at the current limit requirement prescribed in the appropriate operating methods BSP. Continue this procedure until all units have been verified and adjusted to the proper current limit setting per BSP requirements.
	YES _____ NO _____
67	When covered in the appropriate operating methods BSP, simulate operation of the high-voltage shutdown circuit of the unit. Note that the unit shuts down, locks out, and brings in the proper alarms at both the plant and charging unit. Operate the unit ON-OFF switch to OFF and then to ON. Check that it returns to normal operation and that the alarms are retired. Repeat this test on all units.
	YES _____ NO _____
68	Check the appropriate charging unit operating methods BSP for detailed information for verifying the operation of other features and alarms. These may include remote shutdown and remote recycle, auto-boost charge, fan alarms, etc.
	YES _____ NO _____

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CHART 2 (Contd)

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STEP PROCEDURE

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69 Check the appropriate plant operating methods BSP for detailed information for verifying the operation of all power plant alarms such as HLV, FLOAT, FA, etc. Check for alarm indications at both the power plant and at any other local aisle pilot or alarm panel as required. Verify transmittal of major (MJ) and minor (MN) alarms to appropriate alarm center. If battery voltage exceeds allowable high- or low-voltage requirements, discontinue test immediately.

YES \_\_\_\_\_ NO \_\_\_\_\_

70 Manually shut down all charging units to place the plant on battery discharge. While doing this, observe that the proper plant alarms activate at the appropriate voltage levels at local and remote centers.

YES \_\_\_\_\_ NO \_\_\_\_\_

71 Record the battery voltage and discharge current every 5 minutes for about 35 minutes. During this time, inspect battery intercell connectors for signs of overheating.

YES \_\_\_\_\_ NO \_\_\_\_\_

**Note:** If battery voltage drops below minimum allowable to operate system, discontinue test immediately.

72 Restore charging units to service and verify that the plant returns to normal operation and that the alarms are retired.

Verify that motor-generator and/or sequence control rectifiers operate properly (ie, G0 and G1 operating modes) when under automatic control of the power plant.

(a) If Auto-Sequence Start Control is provided, verify operation.

YES \_\_\_\_\_ NO \_\_\_\_\_

(b) If Auto-Sequence Control is not provided on large power plant, units shall be restored one at a time.

YES \_\_\_\_\_ NO \_\_\_\_\_

**Note:** If restoral occurs during peak ac demand period, check building engineer to avoid exceeding normal peak by limiting recharge current.

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## CHART 3

## CONVERTER PLANTS

STEP	PROCEDURE
1	If the converter plant meters have not been calibrated and dated within 6 months, calibrate in accordance with applicable operational sections. If no plant meters are provided, use external meters. Do not interrupt circuit operation.  CALIBRATION DATE _____
2	If recalibration was required, make necessary adjustments to converters to correct the plant voltage per office requirements.  YES _____ NO _____
3	Record the plant voltage and discharge current meter readings. If required, make necessary adjustments to converters to correct the plant voltage per office requirements.  VOLTS _____ AMPS _____
4	Verify that all input and output fuse sizes and types are in agreement with the panel designations and office drawings.  YES _____ NO _____
5	If any converters have internal test features for checking alarm or protection circuits, eg, current limiting, verify the operation and setting of all applicable adjustments per BSP operational sections.  YES _____ NO _____
6	Verify that fuse alarms operate properly and that the proper signals are transmitted.  YES _____ NO _____
7	If there are two or more converters in parallel, manually shut down one converter and verify that the proper alarms are activated. Turn converter back on and observe that alarms are silenced and unit returns to normal operation. Repeat test for each converter unit.  YES _____ NO _____
8	Check the appropriate plant operating methods BSPs for detailed information for verifying the operation of all converter plant alarms.  YES _____ NO _____

**CHART 4**  
**INVERTER PLANTS**  
**(STANDBY OPERATION ONLY)**

STEP	PROCEDURE
1	<p>Verify that all input and output fuse sizes and types are in agreement with panel designations and office drawings.</p> <p>YES _____ NO _____</p>
2	<p>Check the appropriate plant operating methods BSP for detailed information for verifying the operation of all transfer and alarm circuitry.</p> <p>YES _____ NO _____</p>
3	<p>Manually transfer the plant load from commercial ac power to the dc powered source. Verify transfer and monitor lamp indications.</p> <p>YES _____ NO _____</p>
4	<p>Verify that inverter ac output voltage and frequency are within specified BSP limits. Record the voltage and frequency.</p> <p>VOLTS ØA _____ FREQ _____ Hz</p> <p>ØB _____</p> <p>ØC _____</p>
5	<p>Record the ac output current with a clamp-on ammeter (or plant meter if equipped) and watts. For three-phase inverters, check that the load is distributed on each phase per BSP requirements.</p> <p>BSP _____ AMPS _____</p> <p>WATTS _____</p>
6	<p>Manually return the plant load to commercial ac power. Verify transfer and monitor lamp indications.</p> <p>YES _____ NO _____</p>
7	<p>Simulate a commercial ac power failure by removing the ac input to the inverter plant. Verify that automatic transfer takes place within the allowable time and that the proper alarms activate and connected equipment operates satisfactorily.</p> <p>YES _____ NO _____</p>

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CHART 4 (Contd)

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STEP

PROCEDURE

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8      Restore the commercial ac input to the plant. If the plant is fully automatic, observe that automatic transfer takes place within the allowable time specified in appropriate BSP operational sections and the connected equipment operates satisfactorily. Plants not equipped for automatic restoration should be manually switched to commercial power.

YES \_\_\_\_\_ NO \_\_\_\_\_

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## CHART 5

RINGING MACHINES AND  
RINGING, TONE AND CADENCE SYSTEMS

STEP	PROCEDURE
1	Verify that fusing is in agreement with office record drawings. YES _____ NO _____
2	Verify that all voltages, tone levels and frequencies are within limits per BSP requirements. YES _____ NO _____
3	If ringing plant is equipped with dry cell batteries for superimposed ringing, trip, etc, verify that batteries are within age limits and adjusted to proper voltage. YES _____ NO _____
4	If rotary type ringing machines are provided, verify that they are properly lubricated and that cams, contacts, brushes, commutators, etc, are in good condition. YES _____ NO _____
5	Verify that ringing machines or ringing tone plants can be manually transferred, dial transferred, etc, to and from the reserve plant or machine. Check reserve ringing plant for proper operation same as regular plant. YES _____ NO _____
6	Remove power input to the regular ringing plant. Verify automatic transfer to reserve (standby) plant and that ringing fail and transfer alarms are received locally and at SCC. YES _____ NO _____
7	Restore alarms and input power to regular ringing plant. Operate the RST key and observe transfer back to regular ringing plant operation (occurs after a short time delay). YES _____ NO _____
8	For ringing plants under ESS control, make routine tests in accordance with input/output manuals and BSP requirements. Verify that correct alarms are received at the SCC. YES _____ NO _____

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**CHART 6**
**STANDBY AC PLANT  
(ENGINE-ALTERNATOR)**


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**Note:** Do not start engine until required for operational test.

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**STEP****PROCEDURE****A. General**

- 1 Verify that a sufficient number of personnel have been trained and are able to start the engine and connect the essential office load.  
YES \_\_\_\_\_ NO \_\_\_\_\_
- 2 Verify that each engine is provided with a remote emergency shutdown switch at a safe location (preferably outside the engine room).  
YES \_\_\_\_\_ NO \_\_\_\_\_
- 3 Inspect the air intake opening outside the building and verify that it is clear of obstructions and filters and screens are clean.  
YES \_\_\_\_\_ NO \_\_\_\_\_
- 4 Inspect the intake air duct of turbine installations and verify that the interior of the plenum is free from bolts, nuts, and other foreign matter which could be ingested by the engine.  
YES \_\_\_\_\_ NO \_\_\_\_\_
- 5 Test applicable engine alarms with alarm test key in accordance with the appropriate operating BSPs when the engine is not operating.  
YES \_\_\_\_\_ NO \_\_\_\_\_
- 6 Preparation for starting engine-alternator sets should include the following:
  - (a) Verify that fuel valves, oil valves, drain valves, etc, are open or closed as required.  
YES \_\_\_\_\_ NO \_\_\_\_\_
  - (b) Check fuel, oil and water levels.  
YES \_\_\_\_\_ NO \_\_\_\_\_

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**CHART 6 (Contd)**


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STEP	PROCEDURE
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(c) Verify that emergency stop and air damper (if provided) shutdown controls are in normal run position.

YES \_\_\_\_\_ NO \_\_\_\_\_

**B. Manual Start Sets**

**Note 1:** During this part of the test, sufficient personnel must be available at power plant and other locations to observe equipment operations, record alarm conditions, and take meter readings. Dedicated communications lines, independent of commercial ac for operation, should be available to remote locations and engine room.

**Note 2:** Make necessary arrangements with responsible persons of all departments involved in Operational Support Systems (OSS) and associated a/c (as listed in RL 79-10-034) to minimize the effect of transfer to standby (essential) power on minicomputers, on-line system terminals, as well as air conditioning, essential lighting, etc, as required to maintain the systems involved.

7 Measure and record engine room ambient and outside air temperature.

Room \_\_\_\_\_ °F Outdoor \_\_\_\_\_ °F

Record the time: \_\_\_\_\_ a.m. \_\_\_\_\_ p.m.

8 Record the reading on the elapsed time meter.

ELAPSED TIME \_\_\_\_\_ HRS.

9 Verify the availability of posted instructions.

YES \_\_\_\_\_ NO \_\_\_\_\_

10 Verify the adequacy of the posted instructions and make corrections and/or clarify instructions.

These engine operating instructions must include a pre-checklist of ac switchgear (authored locally) and engine-alternator settings for manual operation. The instructions must furnish step-by-step instructions on how to start, run and parallel the engine-alternator(s) (if required) prior to loading, how to load the engine (CKT BKR operation on set and on ac swbd. - essential bus only), how to verify and treat alarms, how to unload the engine-alternator (CKT BKR operation) how to stop the engine-alternator normally (DO NOT USE EMERGENCY STOP), and how to reset all controls and alarms for (standby) normal shutdown status. These instructions should be so clearly defined that a very minimum amount of prior training or experience would be required by an employee to follow the procedure.

## CHART 6 (Contd)

STEP	PROCEDURE
	<p>The engine-alternator and ac switchgear operating instructions (authored locally) should be combined in one continuous (numbered) step-by-step procedure so that each step identifies <b>where</b> the action is to be taken as shown in the following example:</p> <p style="text-align: center;"><b>EXAMPLE</b></p> <p><b>Step 1 (ENG/ALT.)</b> Place operation selector switch in MANUAL position.</p> <p><b>Step 5 (AC SWBD)</b> Operate the normal breaker to the OFF position.</p> <p>If the engine-alternator is equipped with automatic start control, the above operating instructions must also indicate proper control positions for normal automatic operation. In addition, operating instructions shall be provided for performing routine automatic test runs.</p> <p>YES _____ NO _____</p>
11	Manually start the engine-alternator(s), one at a time, for a routine test run.
12	<p>During engine cranking, measure and record the voltage at the engine start battery and at the terminals to the electric starting motor.</p> <p>VSB _____ v    VSB _____ f</p>
13	<p>Verify that the engine-alternator can be manually adjusted at no-load to operate properly in accordance with the written instructions.</p> <p>YES _____ NO _____</p>
14	<p>Test all engine alarms in accordance with the appropriate operational BSPs. Verify that the correct audible and visual indications are received and that alarms can be restored in accordance with instructions. Verify operation of the remote emergency stop feature when the engine is operating at no load. Reset and restart engine per BSP.</p> <p>YES _____ NO _____</p>
15	<p>Close the engine circuit breaker. Transfer the essential bus load to the engine proper. Allow sufficient time to verify the proper operation of all local and remote alarm functions that should occur as a result of ac power removal. Verify that rotary type ringing machines transfer, CEMF and EM cell switches operate, etc, if provided.</p> <p>YES _____ NO _____</p>
16	Verify that the essential ac loads can be manually transferred to standby engine-alternator in accordance with the written instructions.

## CHART 6 (Contd)

STEP	PROCEDURE
	YES _____ NO _____
17	Verify that engine room air intake louvers, exhaust fans, and remote radiator equipment (if provided), all operate properly.
	YES _____ NO _____
18	Verify that sump pumps and compressor dehydrator are connected to the essential ac bus and operate properly.
	YES _____ NO _____
19	Verify that all ac operated equipment assigned to the essential ac bus return to normal operation, battery plant voltages return to normal float values.
	YES _____ NO _____
20	Record all data requested on "Engine Run Log" and note any discrepancies.
21	For diesel engine installations, determine if the total load (essential plus any nonessential load that can be connected) is <b>greater than 30 percent</b> of the rated capacity of the set. Record actual load.
	LOAD _____ kW
	<b>Note:</b> In determining that 30 percent load is available, do not count air conditioning compressors as they usually will not be available in the winter.
22	If the total diesel engine load is 30 percent or greater or if it is a turbine, continue to run for the time required to observe meters, gauges, alarms, etc, and verify that the engine runs free of serious oil, fuel, water and exhaust leaks and that temperature, pressure, speed, voltage, etc, remain within requirements. Record results in Engine Run Log.
	YES _____ NO _____
23	When all the above tests have been completed, verify that the load can be transferred back to the commercial ac supply and the engine can be shut down in accordance with the written instructions.
	YES _____ NO _____
24	Measure and record the ambient temperature in the engine room. Record the time and the reading on the elapsed time meter on the engine set(s).
	ROOM _____ °F

## CHART 6 (Contd)

STEP

PROCEDURE

ELAPSED TIME \_\_\_\_\_ HRS

TIME \_\_\_\_\_

**C. Automatic Start Sets**

**Note 1:** During this part of the test, sufficient personnel must be available at power plant and other locations to observe equipment operation, record alarm conditions, and take meter readings. Dedicated communications lines, independent of commercial ac for operation, should be available to remote locations and engine room.

**Note 2:** Make necessary arrangements with responsible persons of all departments involved in Operational Support Systems (OSS) and associated a/c (as listed in RL 79-10-034) to minimize the effect of transfer to standby (essential) power on minicomputers, on-line system terminals, as well as air conditioning, essential lighting, etc, as required to maintain the systems involved.

- 25 Measure and record engine room ambient and outside air temperature.

Room \_\_\_\_\_ °F Outdoor \_\_\_\_\_ °F

Record the time: \_\_\_\_\_ a.m. \_\_\_\_\_ p.m.

- 26 Record the reading on the elapsed time meter.

ELAPSED TIME \_\_\_\_\_ HRS

- 27 Verify the availability of posted instructions.

YES \_\_\_\_\_ NO \_\_\_\_\_

- 28 Verify the adequacy of the posted instructions and make corrections and/or clarify instructions.

These engine operating instructions must include a pre-checklist of ac switchgear (authored locally) and engine-alternator settings for manual operation. The instructions must furnish step-by-step instructions on how to start, run and parallel the engine-alternator(s) (if required) prior to loading, how to load the engine (CKT BKR operation) on set and on ac swbd. - essential bus only), how to verify and treat alarms, how to unload the engine-alternator (CKT BKR operation) how to stop the engine-alternator normally (DO NOT USE EMERGENCY STOP), and how to reset all controls and alarms for (standby) normal shutdown status. These instructions should be so clearly defined that a very minimum amount of prior training or experience would be required by an employee to follow the procedure.

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**CHART 6 (Contd)**


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**STEP****PROCEDURE**

The engine-alternator and ac switchgear operating instructions (authored locally) should be combined in one continuous (numbered) step-by-step procedure so that each step identifies **where** the action is to be taken as shown in the following example:

**EXAMPLE**

**Step 1** (ENG/ALT.) Place operation selector switch in MANUAL position.

**Step 5** (AC SWBD) Operate the normal breaker to the OFF position.

If the engine-alternator is equipped with automatic start control, the above operating instructions must also indicate proper control positions for normal automatic operation. In addition, operating instructions shall be provided for performing routine automatic test runs.

YES \_\_\_\_\_ NO \_\_\_\_\_

29 Operate the standby engine-alternator in the simulated power failure mode. If it fails to start or shuts down due to a trouble condition, an alarm indication should be received. Before attempting to restart the engine, make sure that the trouble condition has been cleared, the alarm restored, and that all controls have been restored to the normal standby position. Record cause and correction. Restart engine.

30 Verify the proper operation of the engine-alternator and associated equipment using the written instructions for both local and remote operation, as equipped.

YES \_\_\_\_\_ NO \_\_\_\_\_

31 Verify that engine room air intake louvers, exhaust fans, and remote radiator equipment (if provided) all operate properly.

YES \_\_\_\_\_ NO \_\_\_\_\_

32 Verify that sump pumps and compressor dehydrator are connected to the essential ac bus and operate properly.

YES \_\_\_\_\_ NO \_\_\_\_\_

33 Verify that all ac operated equipment assigned to the essential ac bus return to normal operation, battery plant voltages return to normal float values.

YES \_\_\_\_\_ NO \_\_\_\_\_

34 Record all engine-alternator data requested on "Engine Run Log" and note any discrepancies.

YES \_\_\_\_\_ NO \_\_\_\_\_

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**CHART 6 (Contd)**

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<b>STEP</b>	<b>PROCEDURE</b>
35	Measure and record the ambient temperature in the engine room. Record the time and the reading on the elapsed time meter on the engine set(s).  ROOM _____ °F  ELAPSED TIME _____ HRS  TIME _____

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## CHART 7

## POWER FAILURE SIMULATION

**Note:** This test should be made annually in all buildings equipped with an engine-alternator to assure satisfactory performance of the entire building in the event of a commercial power failure.

STEP	PROCEDURE
<b>A. General</b>	
1	Review the results of the Engineering and Operational Reviews that have been completed and clear up all defects that would affect service during the Power Failure Simulation Test.
2	<p>This test should be performed only after the following conditions have been verified.</p> <p>(a) The stationary or portable engine-alternator is operable and of adequate size to support the essential load.</p> <p>YES _____ NO _____</p> <p>(b) Previous tests and local supervisory judgment indicates that the essential power equipment will function satisfactorily during the Power Failure Simulation Test.</p> <p>YES _____ NO _____</p> <p>(c) A local Method of Procedure (MOP) has been prepared covering the action to be taken during the test and all other necessary arrangements have been made.</p> <p>YES _____ NO _____</p>
<b>B. Method of Procedure—Automatic Plants</b>	
3	Simulate a commercial ac power failure condition by interrupting the commercial ac supply to the entire office, including any power failure sensing circuits. Verify that engine load does not exceed the rating of the connected engine-alternators.
4	<p>Record and observe the following:</p> <p>(a) Adequacy of emergency lighting</p> <p>YES _____ NO _____</p> <p>(b) Power failure alarms</p> <p>YES _____ NO _____</p>

## CHART 7 (Contd)

STEP

PROCEDURE

(c) Engine cranking time

TIME \_\_\_\_\_ SECS.

(d) Engine transfer time to take over the load

TIME \_\_\_\_\_ SECS.

(e) If the end-cell switch(es) operated

YES \_\_\_\_\_ NO \_\_\_\_\_

(f) Proper transfer of all equipment which transfers under emergency operating conditions

YES \_\_\_\_\_ NO \_\_\_\_\_

(g) Alarms retired

YES \_\_\_\_\_ NO \_\_\_\_\_

(h) Verify transfer of standby inverter plants (eg, 504B or 523A power plants)

YES \_\_\_\_\_ NO \_\_\_\_\_

5 Continue to operate office and equipment loads from the engine-alternator, taking readings of engine-alternator meters and gauges at start and at 15-minute intervals. Enter this information in the engine log (refer to the appropriate BSP for engines). Check the engine-alternator for overload. Record the kilowatt load with all charging plants and other equipment connected in engine log.

YES \_\_\_\_\_ NO \_\_\_\_\_

6 Verify proper operation of all equipment assigned to the essential ac bus.

YES \_\_\_\_\_ NO \_\_\_\_\_

7 Equipment loads should be left on the standby ac power for a minimum of 3 hours.

YES \_\_\_\_\_ NO \_\_\_\_\_

**Caution:** Never operate the engine-alternators, other than gas turbine driven types, manually or automatically, at less than 30 percent of full load for any longer than absolutely necessary. If the minimum available load is less than 30 percent of the alternator full-load rating, supplement the load with an artificial load to bring the total load up to at least 30 percent, but not to exceed full load. See Section 171-123-101 for information on artificial loads.

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**CHART 7 (Contd)**


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STEP	PROCEDURE
8	Observe that necessary operational support systems equipment (such as lighting, air handling, etc.) is adequate and operates properly.  YES _____ NO _____
9	Restore commercial ac supply to the office. Verify that the load on the essential bus transfers automatically to commercial power. Engine should shut down automatically.  YES _____ NO _____
<p><b>Caution: Do not stop the engine(s) using the emergency stop pushbutton. Refer to the appropriate BSP for the operating procedures for the engine-alternator(s).</b></p>	
10	Observe the sequencing of charging equipment for the various power plants as they return to normal.
<p><b>C. Method of Procedure—Manual or Semi-Automatic Plants (Stationary or Portable)</b></p>	
Proceed with the manually operated engine-alternators as follows:	
<p style="padding-left: 40px;">There should be no prior warmup of the emergency engine-alternator for this test.</p>	
11	Simulate an ac power failure condition by interrupting the commercial ac supply to the entire office, including any power failure sensing circuit. Record and observe the following: <ul style="list-style-type: none"> <li>(a) Adequacy of dc lighting YES _____ NO _____</li> <li>(b) Power failure alarms YES _____ NO _____</li> <li>(c) If end cell switches operated YES _____ NO _____</li> <li>(d) Alarms retired YES _____ NO _____</li> </ul>
12	Start the standby engine-alternator(s). Follow local step-by-step procedures in accordance with the appropriate BSP for the engine-alternator(s).  YES _____ NO _____

## CHART 7 (Contd)

STEP	PROCEDURE
13	<p>Transfer all office and equipment loads designated to be operated from standby power to the engine-alternator(s) as prescribed in local practices.</p> <p>YES _____ NO _____</p>
14	<p>Continue to operate office and equipment loads from the engine-alternator, taking readings of engine-alternator meters and gauges at start and at 15-minute intervals. Enter this information in the engine log (refer to the appropriate BSP for engines). Check the engine-alternator for overload. Record the kilowatt load with all charging plants and other equipment connected in engine log.</p> <p>YES _____ NO _____</p>
15	<p>Verify proper operation of all equipment assigned to the essential ac bus.</p> <p>YES _____ NO _____</p>
16	<p>Equipment Loads: Equipment loads should be left on the standby ac power for a minimum of 3 hours.</p> <p>YES _____ NO _____</p>
<p><b>Caution: Never operate the engine-alternators, other than gas turbine driven types, manually or automatically, at less than 30 percent of full load for any longer than absolutely necessary. If the minimum available load is less than 30 percent of the alternator full-load rating, supplement the load with an artificial load to bring the total load up to at least 30 percent, but not to exceed full load. See Section 171-123-101 for information on artificial loads.</b></p>	
17	<p>Observe that necessary operational support systems equipment (such as lighting, air handling, etc,) is adequate and operates properly.</p> <p>YES _____ NO _____</p>
18	<p>Restore the commercial ac supply to the office. Transfer all loads on the essential bus back to commercial power. Verify that the engine can be shut down manually.</p> <p>YES _____ NO _____</p>

**Caution: Do not stop the engine(s) using the emergency stop pushbutton. Refer to the appropriate BSP for the operating procedures for the engine-alternator(s).**

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**CHART 7 (Contd)**

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<b>STEP</b>	<b>PROCEDURE</b>
19	Prepare a report covering the emergency operating evaluation and test as covered in "report."

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