# POWER PLANT

# EMERGENCY OPERATION EVALUATION

# OPERATION TEST

Contents



## 1. GENERAL

**1.01** This section covers the emergency operation test which includes:

(a) An AC commercial power failure simulation

(b) Emergency engine operation under load conditions

(c) Engine timing-relays observation

(d) A DC lighting adequacy check

(e) A discharge test for all battery plants

(f) An end cell, CEMF cell, and contactor operations check

(g) A verification of the sequencing of charging plants

(h) A testing of the maximum load of an emergency engine

**1.02** It is reissued to bring the section up-to-date.

*Note:* Marginal arrows used to denote changes are omitted.

**1.03** Sufficient personnel must be available to operate and observe:

- Switchgear equipment
- Emergency engine(s)
- Power plants
- Expected alarm conditions

**1.04** The emergency operation test may require special precautions to protect service. Do not interrupt essential services for customers or the Company.

(a) Temporarily wire equipment for special services to another power source, and/or

(b) Start the emergency engine before the test, and transfer that part of the load needed for Company operations or customer special services to the emergency engine.

**1.05** The central office chief (or equivalent) is responsible for:

(a) Preparing the Methods of Procedure (MOP) described in Section 002-502-913PT.

(b) Coordinating the activity during the test.

**1.06** At the end of the emergency operation test:

(a) Restore all plant to normal.

(b) Charge the batteries and end cells.

(c) Prepare the evaluation reports as described in Section 002-502-913PT.

**1.07** Any situation that causes a test to end before it is completed is a significant item. Enter it on the report as an unsatisfactory item and bring it to the attention of the district manager.

## 2. TEST APPARATUS AND PREPARATION

**2.01** The following equipment is usually required for the test, however, the equipment may vary in different offices:

- Data Precision Model 248 digital multimeter (or equivalent)
- Clamp-on Ammeter
- Emergency lanterns or hand lights
- Communications arrangements (from point-of-test coordination to power room and other contact points).

**2.02** To prepare for the test, be sure that:

(a) Commercial power conditions are stable, ie, no storms or other hazardous conditions exist at planned time of test.

*Note:* The standby engine alternator test should be performed by simulating a commercial power failure. Posted local emergency operating instructions should be followed and verified.

(b) All charging equipment is available and serviceable.

(c) All service protection channels are available (toll).

(d) The restoration control office is notified that no dry runs are to be scheduled during the test period (toll).

(e) Circuit requirement information for end cell, counter electromotive force (CEMF) cell and contactor operations is available for circuit requirement verification. Enter requirements data on Battery Discharge Record, Form P 2730.

**2.03** Then do the following:

(a) Prepare an MOP covering the action to be taken during the test of all power plants and involved building equipment.

(b) Review details with all personnel who will participate in the test.

(c) In addition to the normal details covered in an MOP, include the following items:

(1) Record float voltage and load (in amperes) of each plant to be tested on a separate form P 2730.

(2) A record of the normal and the peak kilowatt loads on the commercial AC supply (if KW meter is available).

(3) An assignment of personnel to cover:

- Power plants
- Switchgear
- Building equipment
- Emergency engine(s)
- Alarms

**2.04** All personnel should be at their assigned locations before the test to observe and note all plant effects.

## 3. METHOD OF PROCEDURE — AUTO-START ENGINES

**3.01** Proceed with the auto-start engine test as follows:

(a) Simulate an AC power failure condition by interrupting the commercial AC supply to the entire office, including any power failure

sensing circuits. (There should be no prior warm-up of the emergency engine for this test). Make the following observations:

(1) Engine cranking time

(2) Engine transfer time

(3) Emergency lighting turned on. Watch for safety hazards (access and egress of building and stairwells) and illumination of traffic and plant operating areas.

(4) Proper transfer of all equipment that usually transfers under emergency operating conditions

(5) Indications on the switchgear control panels (observe and record the ampere load, by phases, as a check of load balance)

***Note:*** Some offices with auto-start engine alternators provide power for essential services and telephone power load. Others are usually backup for essential or special services. See Part 4.

(b) Continue to operate office and equipment loads from the emergency engine, taking frequent readings of engine performance gauges. Log on Engine Run Log, Form E 5697.

**3.02** When the engine reaches a normal operating condition, proceed with the battery load test as follows:

(a) Turn off battery charging equipment for each plant to be tested. Each plant should be discharged for 90 minutes.

***Note:*** Do not discharge battery cells with defects or that are not fully charged.

(b) As each plant is placed on discharge, take the action listed in Table A and enter the required readings on the Battery Discharge Record, Form P 2730 (Exhibit 1).

**3.03** As soon as alarm conditions for one plant have been recorded and retired, place the next plant on discharge.

**TABLE A**

| STEP | PROCEDURE |
|---|---|
| 1 | First, place 504, 505, and 508A plants on their respective battery plants to eliminate unnecessary transfers. |
| 2 | Connect all emergency loads to the battery plants. |
| 3 | De-energize auxiliary end-cell charging units. |
| 4 | Record bus-float voltage and load current before discharge. |
| 5 | Immediately after start of discharge, observe bus voltage constantly until voltage stabilizes, and record the following:<br>• Lowest voltage reached immediately after discharge starts<br>• Recovery voltage (voltage at which the battery stabilizes)<br>• Voltage at which the end cells, CEMF cells, or contactors are operated and the lowest voltage reached after operation<br>• Office alarms (retire after observation) |

TABLE A (Cont'd)

| STEP | PROCEDURE |
|---|---|
| 6 | Continue to read and record bus voltage and load at 10-minute intervals during discharge. |
| 7 | Observe that the mechanical operation of all automatic end-cell switches meets requirements. |
| 8 | Check intercell straps and battery connections for heating. |

**3.04** Battery voltage, measured at the plant discharge bus, should not be permitted to drop below the minimum operating limits for the types of equipment served by the plant or the voltage limits given in Table B.

*Notes:*

*1.* Use the highest minimum plant discharge bus voltage (Form P 2726 calculation or Table B).

*2.* In plants equipped with CEMF or emergency cells the voltage will drop to the low limit of the control relay. After CEMF contactor or emergency cell switch operation, the voltage may drop to minimum and then recover.

*3.* There may be some exceptions in small plants for which the minimum voltage may not be valid.

TABLE B

| NOMINAL PLANT VOLTAGE | MINIMUM BUS BAR VOLTAGE |
|---|---|
| 12V | 11.2V |
| 24V | 22.0V |
| 48V | 46.0V |
| 130V | 126.0V |
| 152V | 130.0V |
| 250V | 236.0V (includes 130V plant) |

**3.05** At the completion of the discharge test, perform the following steps:

(a) Manually place each power plant on the engine alternator until the rated output is reached.

(b) Hold for 15 minutes to test breakers, wiring and engine alternator.

(c) In plants equipped with emergency cell switches or CEMF contactors, record the voltage at which the switch or contactor operates to normal position.

(d) Observe any possibility of an emergency engine overload condition with all charging equipment connected.

(e) Record the kilowatt load on the engine alternator on Form E 5697.

**3.06** Upon completion of the 15-minute maximum load test on the engine (see 3.05), do the following:

(a) Restore commercial AC supply (see 4.02). Return building lighting, building power and telephone power to commercial supply by operating transfer switches.

(b) Observe that all services have restored and are operating properly.

(c) Shut down the standby engine by using normal shut down procedures, or auto shut down if engine is so equipped.

## 4. METHOD OF PROCEDURE — MANUAL-START ENGINES 120/240V-1Ø LIGHT SERVICE AND 240V-3Ø POWER SERVICE, OR 4-WIRE 280V-3Ø SERVICE

**4.01** To prepare for the manual-start engine test, do the following (this is the same preparation required for the auto-start engine test):

(a) Prepare an MOP covering the action to be taken during the test of all power plants and involved building equipment.

(b) Review details with all personnel who will participate in the test.

(c) In addition to the normal details covered in an MOP, include the following items:

(1) A record of all float voltages and loads (in amperes) prior to starting the test.

(2) A record of the normal and the peak kilowatt loads on the commercial AC supply (if KW meter is available).

(3) An assignment of personnel to cover:

- Power plant
- Switchgear
- Building equipment
- Emergency engine(s)
- Alarms

**4.02** All personnel should be at their assigned locations before the test to observe and note all plant effects.

**4.03** Proceed with the manual-start engine test as follows:

(a) Furnish temporary power for essential services (customer-Company) known to fail on a power failure (see 1.04).

(b) Simulate an AC power failure condition by interrupting the commercial AC supply to the entire office, including any power failure sensing circuits.

***Note:*** In some cases it is advisable to deload circuit breakers or mainswitches operating near capacity to prevent arcing when the circuit is opened.

(c) Observe the following operations if the plants are automatic, or perform them if the plants are manual:

(1) Start and transfer ringing machine.

(2) Cut in end cells of each battery plant. Record voltage at which end cells are cut in.

(3) Turn on emergency DC lights or stumble lights. Watch for safety hazards (access and egress of building and stairwells) and illumination of traffic and plant operating areas.

(4) Transfer of vital AC circuits to emergency AC supplies.

(5) Retire alarms.

(6) Set AC switches of charging equipment to "OFF" position.

**4.04** Then start the emergency engine alternator(s):

(a) Follow local step-by-step procedures to start engine(s).

(b) Place essential AC-operated telephone equipment and building load on engine (if not covered in 4.03a).

(c) Restore lighting to the building.

***Note:*** In some locations, only the essential lights can be placed on the engine alternators.

**4.05** Proceed with the battery discharge test as follows:

(a) Prepare to discharge each battery plant for 90 minutes.

(b) As each plant is placed on discharge, take the action listed on Table C and enter the required readings on Form P 2730.

***Note:*** Do not discharge battery plants with defects or plants that are not fully charged.

(c) Continue to operate office and equipment on battery plants and the emergency engine alternator(s).

(d) Read and record engine performance gauges.

**TABLE C**

| STEP | PROCEDURE |
|---|---|
| 1 | Immediately after start of discharge, observe bus voltage constantly until it stabilizes; then record the following:<br>• Lowest voltage reached immediately after discharge starts<br>• Recovery voltage (voltage at which the battery stabilizes)<br>• Voltage at which the end cells, CEMF cells, or contactors are operated and the lowest voltage reached after operation<br>• Office alarms (retire after observation) |
| 2 | Continue to read and record bus voltage and load at 10-minute intervals during discharge. |
| 3 | Observe that the mechanical operation of all automatic end-cell switches meets requirements. |
| 4 | De-energize auxiliary end-cell charging units. |
| 5 | Check inter-cell straps and battery connections for heating. |

**4.06** Battery plants on discharge should not be permitted to drop below the minimum operating limits for the type of office they serve (see Section 002-502-914PT).

**4.07** At the completion of the discharge test, perform the following operations:

(a) Manually place each power plant on the engine alternator until the rated output is reached.

(b) Hold for 15 minutes to test breakers, wiring and engine alternator.

(c) In plants equipped with emergency cell switches or CEMF contactors, record the voltage at which the switch or contactor operates to the normal position.

(d) Watch for overloads and record KW load on engine alternator with all charging equipment connected.

(e) Remove lighting, charging equipment, and building equipment from engine alternator.

(f) Shut down engine by normal procedure.

(g) Restore all transfer switches at the AC power board to commercial power, and observe the sequencing of charging equipment for the various plants as they return to normal.

## 5. METHOD OF PROCEDURE — OFFICE WITH NO EMERGENCY ENGINE

**5.01** Before making the evaluation check, have a portable engine at the office location.

**5.02** Check the following to be sure that the engine is ready for use in case of AC power failure:

- Fuel supply
- Start battery
- Cable connections

- Phasing — each transfer switch where load can be switched from commercial voltage to emergency engine voltage

- Engine adequacy to carry load

**5.03** Refer to Part 4 for whichever subheading applies to the office under test.

## 6. SUMMARY

**6.01** Recharge all battery plants, including end cells, as soon as possible after the battery discharge test.

**6.02** Prepare a report covering the emergency operation evaluations as covered in Section 002-502-913PT.

Pacific Telephone
Nevada Bell

## Battery Discharge Record

P 2730 (11-76)
(002-502-915PT)

Observer: _____

Date: _____

Type Plant: _____

Voltage: _____

Float Voltage: _____

Load Current: _____

Minimum Voltage Allowed: _____

| Item | Time | Voltage | | Current |
|---|---|---|---|---|
| | | Battery | Load | |
| Start Time | | | | |
| End Cell or Contactor Operation Voltage (where applicable) | | | | |
| Low-Voltage | | | | |
| Recovery Voltage: | | | | |
| + 5 minutes | | | | |
| +15 minutes | | | | |
| +25 minutes | | | | |
| +35 minutes | | | | |
| +45 minutes | | | | |
| +55 minutes | | | | |
| +60 minutes | | | | |
| +65 minutes | | | | |
| +70 minutes | | | | |
| +75 minutes | | | | |
| +80 minutes | | | | |
| +85 minutes | | | | |
| +90 minutes | | | | |
| End Cell or Contactor Restoral Voltage (where applicable) | | | | |

Remarks: _____

**Exhibit 1**