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SSIT-202 Primary Batteries - Inspecting & Testing

Purpose

Primary battery tests and inspections shall be performed to observe maximize lifespan of battery and ensure reliable power is provided for continual safe operation. Primary batteries shall be observed for degree of exhaustion by performing necessary voltage and current tests to ensure the batteries will not be exhausted in service to point of failure.

When used at grade crossing warning systems, the possibility exists that the approach line or track relay (or equivalent device that functions as a relay) may fail to restore after a train has trailed from the warning track circuits. This sets up a lockout condition wherein the approach of another train in the opposite direction will not activate the warning system until the island track is reached. As a result, an increase in the frequency of tests for primary batteries at grade crossing warnings systems is imperative.

Test Intervals

Employees shall inspect and test each primary battery frequently to ensure proper and continual operation.

Primary batteries used on crossing warning system approach circuits shall be checked at least once a month at crossings without stick release timers.

Primary batteries used on crossing warning system approach circuits shall be checked once every three (3) months at crossings with stick release timers.

Refer to *SSIT-7 Signal System Inspection and Test Intervals* for all test intervals.

Rail Safety

Employee shall ensure the site is safe for employees, the public, vehicular traffic and train operations as defined in *SSIT-8 Protecting Train Operations* prior to performing tests and inspections.

Personal Safety

The physical and chemical properties of batteries can pose a threat to personal safety if not handled properly. The following hazards are to be considered when working with batteries:

Hazard	Prevention
Explosion	• Keep sparks and open flames away from batteries. • Discharge static electricity to ground before working with batteries.
Body and Eye Irritant	• Wear proper eye protection. Have clear water for performing eye wash if acid comes into contact with eye. • Wear insulating gloves and apron when working with battery acids.
Short Circuits	• Clear work area of loose or spare conductive parts prior to work. • Keep conductive tools away from space of work. • Use insulated tools for required work.

Equipment Manuals

A copy of the battery manufacturer's manual should be on hand for reference when performing tests.

Battery Life Span and Solution

Battery service limits will be left to the discretion of the ONR S&C Supervisor. Safety must be the first consideration when determining when batteries will be removed from service. Refer to manufacturer's manual for determining correct cell solution levels and calculating remaining battery capacity.

Example Life Span

The following table is an example of a primary battery life based on load for two NIFE-SAFT ST-22-NT batteries connected in parallel to provide 4400 Ampere-Hours of service (under optimal temperature and track conditions):

Load (milliamps)	Life Span
100	1830 days (5 years)
125	1460 days (4 years)
150	1220 days (3.3 years)
175	1050 days (2.8 years)
200	915 days (2.5 years)
225	815 days (2.2 years)
250	730 days (2 years)

Visual Inspections

The following visual inspections are to be performed at each location equipped with battery banks:

Step	Procedure
1. Check Battery	→ Ensure batteries are level. → Ensure batteries are spaced properly.
2. Check Ventilation	→ Check battery housing vents are open enough to allow circulation. → Ensure vent filters are clean. → Check fan is operational (if installed). **If ventilation issue:** Restore ventilation prior to servicing batteries.
3. Check Battery Cases	→ Check case is clean, dry, and has no cracks or leaks. **If battery case showing wear:** Replace battery cell(s).
4. Check Battery Terminals	→ Check battery terminals and/or lugs are tight. → Check terminals have minimal corrosion. **If terminals showing wear:** Clean terminals. Repair and replace terminals as required.
5. Check Battery Terminal Protection	→ Check terminals are protected with protector or corrosion resistant no-oxide grease. **If metal connections exposed:** Protect with protector or grease.

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Step	Procedure
6. Check Battery Polarity	→ Check batteries' polarities align as per design (parallel or series). → Check all batteries in series have same ampere-hour capacity. **If batteries misaligned:** Contact the ONR S&C Supervisor about mismatched cell type. Change cells and terminals as required.
7. Check Wire Tags	→ Check battery lead tags match polarity and name as per design. **If wrong tag:** Replace wire tag with tag as per design.

Voltage Test

The following steps are to be performed to complete the voltage tests of the batteries:

Step	Procedure
1. Measure Voltage With Load Disconnected	• Disconnect load from the primary battery. • Connect a multimeter to the battery to obtain voltage rating with no load. → Check battery voltage is within acceptable range as per manufacturer's specifications.
2. Measure Voltage With Load Connected	• Connect load to the primary battery. • Connect a multimeter to the battery to obtain voltage rating with load connected. → Check the battery voltage is within acceptable range as per manufacturer's specifications.

Record Test Results

Record the test results for each primary battery tested:

Step	Procedure
1. Update Battery Card	• Calculate remaining AH capacity (example below). → Verify Rated AH capacity and in service date. • Add values calculated for each battery tested. • Add any notes of issues observed, or adjustments made.
2. Complete Test Form	• Record the test as completed on SSIT test form.

Battery Capacity Calculation Example

$$C_R = C - ((H \times I_n) + (H_{to} \times I_s)) \times D$$

C_R: Remaining Battery Capacity
C: Rated Battery Capacity
I_n: Normal Approach Track Circuit Current
I_s: Shunted Approach Track Circuit Current
H: Hours of Operation (per day)
H_{to}: Hours of Track Occupancy (per day)
D: Days of Battery Operation (to date)

C_R = 2400 - ((24 x 0.205) + (0.75 x 0.96)) x 365

= 2400 - (4.92 + 0.72) x 365
= 2400 - 2058.60
C_R = 341.40 AH remaining Capacity