

SSIT-203 Secondary Batteries - Inspecting & Testing

Purpose

Secondary battery tests and inspections shall be performed to determine the degree of battery exhaustion. Voltage and current tests shall be performed to ensure the batteries will not be exhausted while in service to a point of failure. Batteries are tested and tracked over time spans as outlined in Time Intervals.

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 secondary batteries at grade crossing warnings systems is imperative.

Test Intervals

Employees shall inspect and test standby batteries when installed, as required, and at least once every three (3) months. 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	<ul style="list-style-type: none">• Keep sparks and open flames away from batteries.• Discharge static electricity to ground before working with batteries.
Body and Eye Irritant	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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.

Battery and Charger Technology

There are many types of batteries and chargers that may be used to accomplish the same task. The most common types of batteries are NiCAD and VRLA style batteries, and sample rated voltages have been provided for these. Different batteries have different test procedures and specified in the manufacturer's manual.

Equipment Manuals

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

Sample Rated Voltages

The following table summarizes the typical rated cell charge and discharge voltages as adjusted for temperature for NiCAD and VRLA batteries. It is advisable to consult the manufacturer's service manuals for more accurate specifications:

Battery Block Temp. (Celsius)	NiCad Battery			VRLA Battery		
	Rated Charge Voltage (AC On)	Start Discharge Voltage (AC Off 15 minutes)	End Discharge Voltage (Deep Discharge)	Rated Charge Voltage (AC On)	Start Discharge Voltage (AC Off 15 min)	End Discharge Voltage (Deep Discharge)
-10	1.56	1.38	1.07	2.42	2.26	1.88
0	1.53	1.35	1.05	2.37	2.21	1.84
10	1.50	1.33	1.03	2.32	2.17	1.81
20	1.47	1.30	1.01	2.27	2.12	1.77
25	1.46	1.29	1.00	2.25	2.10	1.75
30	1.44	1.27	0.99	2.23	2.08	1.73
35	1.41	1.25	0.97	2.18	2.03	1.69

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.

Visual Inspections

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

Step	Procedure
1. Check Battery Racks	→ Ensure racks are clean and dry. → Ensure batteries are level. → Ensure batteries are spaced properly. → Check condition of rack's bottom rubber mat and/or spill tray. If problem with rack arrangement: Reposition rack to have batteries level and equally spaced. Replace bottom as required. If sufficient battery spill: Remove excess electrolyte as instructed in manufacturer's manual.
2. Check Battery Vent Caps	→ Check vent caps are clean and sealed. If vent cap showing wear: Replace cap and/or cell(s) as required.

Continued on next page...

**ONR Signal Standards
Signal System Inspections & Tests (SSIT)**

Step	Procedure
3. 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.
4. Check Plate Deterioration (if applicable)	→ Check for cracked or broken plates. → Check bottom of battery case for excessive sediment. If plate deteriorating: Replace plate and/or cell(s) as required
5. 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.
6. 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.
7. 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.
8. Check Electrolyte Level (if applicable)	→ Check that electrolyte level is at the proper level using the following gauges: <ul style="list-style-type: none"> ○ If battery has one or no level indicator, electrolyte should cover no more than 0.75" of plates, and must be below line. ○ If battery has maximum and minimum level indicator, electrolyte must be filled between lines. If electrolyte levels low: Refer to manufacturer's instruction for verifying correct solution levels. use distilled water to top off battery liquid. Record amount of water added to battery card, initial and date.
9. 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.

Battery Readings

The following battery tests are to be performed on each secondary battery bank:

Step	Procedure
1. Log Temperature	<ul style="list-style-type: none"> • Note ambient temperature at time of testing.
2. Measure AC Power	<ul style="list-style-type: none"> • Measure and note AC voltage input to battery charger. • Measure voltage across battery bank with AC power on. • Divide voltage rating by number of cells to determine individual cell values. • Measure and note battery charging current.
3. Disconnect AC Power	<ul style="list-style-type: none"> • Disconnect AC power, put batteries under load, and wait 15 minutes before proceeding to step 5.

Continued on next page...

**ONR Signal Standards
Signal System Inspections & Tests (SSIT)**

Step	Procedure
4. Log Battery Start Voltages	<ul style="list-style-type: none"> Measure and note voltage of battery cell. Log as <u>start battery discharge voltage</u>. Divide start battery discharge by number of cells. Log value as <u>start cell discharge voltage</u>.
5. Assess Battery Start Voltages	<p>→ Check <u>start battery discharge voltage</u> is not less than .03V below manufacturer rated value.</p> <p>If battery performing out of range: Contact the ONR S&C Supervisor. Deep discharge test may be required.</p>
6. Assess Cell Start Voltages (if applicable)	<p>If the battery is a bank of individual cells:</p> <ul style="list-style-type: none"> Measure each individual cell voltage. Measured voltage should be within .03V of <u>start cell discharge voltage</u>. <p>If cells performing out of range: Contact the ONR S&C Supervisor. Battery equalizing or deep discharge test may be required.</p>
7. Reconnect AC Power	<ul style="list-style-type: none"> Turn AC power back on.
8. Update Battery Card	<ul style="list-style-type: none"> Add values observed for each bank tested for reviewing battery depletion. Add any notes of issues observed, or adjustments made.
9. Complete Test Form	<ul style="list-style-type: none"> Record the test as completed on SSIT test form.