APTA STANDARDS DEVELOPMENT PROGRAM

STANDARD

American Public Transportation Association
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Passenger Rail Equipment Safety Standards (PRESS) Inspection & Maintenance Working Group

Passenger Rail Equipment Battery System Periodic Inspection and Maintenance

Abstract: This standard describes the basic inspection functions for battery systems on passenger rail equipment.

Keywords: battery, battery maintenance, battery system, battery system maintenance, battery system periodic inspection and maintenance

Summary: This document was upgraded from a *Recommended Practice* to a standard a part of this revision because the subject matter addressed herein has been deemed safety critical. This document establishes standards for passenger rail equipment battery maintenance. Individual railroads should tailor these standards to accommodate their specific equipment and mode of operation.

Scope and purpose: This standard applies to all passenger cars. Passenger car battery systems provide continuous electrical power to specific components or subsystems of the passenger car during brief input power interruptions encountered in normal service. These batteries also serve as a stabilizing element in the DC power system and provide continuous power to critical safety systems during extended input power interruptions or during emergencies. Those systems and subsystems, if applicable, are essential in the safe operation of passenger cars. This standard is intended for use by railroads to provide procedures that could affect safety for the inspection and maintenance of batteries installed on passenger rail equipment.

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Introduction

This introduction is not part of APTA PR-IM-S-001-98, Rev. 3, "Passenger Rail Equipment Battery System Periodic Inspection and Maintenance."

This document was upgraded from a *Recommended Practice* to a standard a part of this revision because the subject matter addressed herein has been deemed safety critical.

This standard applies to all:

1. Railroads that operate intercity or commuter passenger train service on the general railroad system of transportation; and
2. Railroads that provide commuter or other short-haul rail passenger train service in a metropolitan or suburban area, including public authorities operating passenger train service.

This standard does not apply to:

1. Rapid transit operations in an urban area that are not connected to the general railroad system of transportation;
2. Tourist, scenic, historic, or excursion operations, whether on or off the general railroad system of transportation;
3. Operation of private cars, including business/office cars and circus trains; or
4. Railroads that operate only on track inside an installation that is not part of the general railroad system of transportation.

Passenger Rail Equipment Battery System Periodic Inspection and Maintenance

1. Operating authority instructions

This standard is a framework document that requires input from the operating authority. For this standard to be effective, the operating authority must do the following:

a) Obtain the OEM operating and maintenance procedures as indicated in the document.
b) Identify the information required by this standard (e.g., maintenance inspection procedures and interval between inspections).
c) Use this standard in conjunction with the OEM's master plan identifying what types of activities need to take place and how often.
d) Input the master plan into the operating authority's maintenance management system.

2. Battery system maintenance

Battery inspection, repair and maintenance procedures vary by type and construction of the battery. This standard details the maintenance procedures for both dry cell and wet cell battery systems.

CAUTION: Do not mix in the same car-set battery with cell(s)/tray(s)/crate(s)/block(s) that have different:

- battery manufacturers
- battery model types
- IEC 60623 capacities (AH)
- IEC 60623 performances (L, M, H, X)
- SOC (State of Charge)
- Manufacturing dates beyond ± 2 years (unless agreed by the battery manufacturer)

If a defect is found on any cell(s)/tray(s)/crate(s)/block(s) the entire car-set battery should be removed and replaced. Components on the battery such as nuts, washers, terminal covers, sensor assemblies (compensation and/or switch), vent caps/plugs, connectors, lugs/adapters, and cable assemblies can be replaced or added if missing without removing the entire battery.

2.1 Dry cell system

The maintenance procedure for dry cell systems consists of the following steps:

a) Ensure that batteries are fully charged in accordance with the standard maintenance procedure (SMP)/original equipment manufacturer (OEM) instructions.
b) Disconnect input power and isolate the battery from the load.
c) Inspect the condition of the battery holder for loose connection, broken or worn parts, and proper spring tension as required by the SMP.
d) Inspect the condition of the battery case for cracking and mechanical or thermal damage. Ensure that plugs or covers, if equipped, are in position and secured per the railroad SMP.
e) Inspect battery casings for damage and signs of leakage or residue in accordance with the SMP.

f) Inspect battery voltage versus rating for proper value, and check for shorted cells in accordance with SMP.
g) Reconnect input power and load.
h) Perform a capacity test as required by the SMP.
i) Inspect to ensure that battery charger output charging rates (and temperature compensator, if applicable) are in accordance with SMP.
j) Replace any components that do not meet specifications.

2.2 Wet cell system

The maintenance procedure for wet cell systems consists of the following steps:

a) Ensure that batteries are fully charged in accordance with SMP/OEM instructions.
b) Check system fault logs, if applicable.
c) Disconnect input power and isolate the battery from the load.
d) Inspect the battery box, mounting hardware and shoring/blocking for structural integrity in accordance with the SMP.
e) Inspect battery casings for damage and signs of leakage or residue in accordance with the SMP. If any cells are damaged, then replace the entire battery in accordance with the SMP.
f) Inspect and replace components that are damaged or defective with specification-compliant components as needed.
g) Wash batteries in accordance with the SMP.
h) Inspect individual battery cells for proper electrolyte levels (and replenish with distilled, demineralized, or deionized water as needed) in accordance with the SMP. Inspect intercell jumpers and all connections in accordance with the SMP.
i) If equipped, inspect that the battery filling system is operating in accordance with OEM/SMP instructions. Fill with distilled, demineralized, or deionized water as specified by the OEM/SMP.
j) Check cell voltages for proper value and watch for shorted cells in accordance with the SMP.
k) For lead-acid batteries, measure specific gravity for each cell and correct per the electrolyte temperature, as measured with an appropriate thermometer in accordance with the SMP.
l) Reconnect input power and load.
m) Perform a vehicle load test as required by the SMP.
n) Charge the battery and check the battery charger output charging rates (and temperature compensator if applicable) in accordance with SMP.

2.3 Tools/materials

The following tools and materials are required for performing battery system periodic inspection and maintenance:

- distilled/deionized water
- digital voltmeter
- bulb hydrometer
- thermometer
- insulated torque wrench*
- pressure washer
- automatic battery filler (per OEM)
- flashlight
- ammeter

NOTE: Tools marked with an asterisk (*) shall be insulated and spark-resistant for shock protection.

2.4 Safety/personal protective equipment

The following approved safety/protective equipment shall be available to personnel performing battery system periodic inspection and maintenance:

- safety glasses/splash goggles
- face shield
- rubber gloves
- rubber apron
- long-sleeved clothing
- lockout/tag-out tags

2.5 Training requirements

Personnel performing battery periodic inspection and maintenance shall receive basic training in the following areas:

- hazardous materials handling
- spill mitigation
- PPE training
- basic electricity or battery maintenance (course)

Related APTA standards

APTA PR-E-S-001-98, "Insulation Integrity"
APTA PR-E-RP-002-98, "Wiring of Passenger Equipment"
APTA PR-E-RP-007-98, "Storage Batteries and Battery Compartments"
APTA PR-E-RP-012-99, "Normal Lighting System Design for Passenger Cars"
APTA PR-E-S-013-99, Rev. 1, "Emergency Lighting System Design for Passenger Cars"
APTA PR-E-RP-015-99, "Head End Power Source Characteristics"
APTA PR-E-RP-016-99, "480 VAC Head End Power System"
APTA PR-IM-S-013-99, Rev. 1, "Passenger Car Periodic Inspection and Maintenance"
APTA PR-M-S-020-17, "Electronically Controlled Pneumatic 26C Emulation Braking System—Performance Requirements for Passenger Applications"
APTA PR-M-S-021-17, "Electronically Controlled Pneumatic Cable-Based Braking System—Performance Requirements for Passenger Applications"
APTA PR-PS-S-001-98, "Passenger Railroad Emergency Communications"
APTA PR-PS-S-002-98, Rev. 3 "Emergency Signage for Egress Access of Passenger Railroad Equipment"
APTA PR-PS-S-004-99, Rev. 2 "Low-Location Exit Path Marking"
APTA PR-PS-RP-005-00, "Fire Safety Analysis of Existing Passenger Rail Equipment"

References

Association of American Railroads, AAR RP-036, Storage Batteries, Part 1, "Recommended Method for Capacity Rating of Storage Batteries in Railroad Car Service," 1962.

Deutsches Institut fur Normung, DIN 40771, BS 6260, Cells with Pocket Plates and Cells with Steel or Plastic Container.

International Electrotechnical Commission, IEC 60623, Ed. 4.0, "Secondary cells and batteries containing alkaline or other non-acid electrolytes – Vented nickel-cadmium prismatic rechargeable single cells," September 2001.

International Electrotechnical Commission, IEC 60077-1, Ed. 1.0, "Railway applications – Electric equipment for rolling stock – Part 1: General service conditions and general rules," October 1999.

IEEE, STD 450-1987, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations," 1987.

International Organization for Standardization, ISO-9001, "Quality management systems – Requirements," 2008.

Normes Françaises Ferroviaires, NFF 64-018 and NFF 16-101, Railway Rolling Stock Accumulators (Batteries) Nickel—Cadmium Secondary Single Cells.

SAFT NIFE, Procedure for Testing Batteries.

International Union of Railways, UIC 854R, Technical Specification for "Starting Batteries" (Alkaline or Lead Acid).

This standard also shall be used in conjunction with the following publications:

- applicable federal, state, and local regulations
- OEM instructions
- standard maintenance procedure (see Definitions)

Definitions

dry cell battery: Voltage-generating cells having an electrolyte in the form of moist paste or gel. Also known as sealed lead acid batteries, gel-cells, or valve-regulated lead acid (VRLA) batteries.

electrolyte: Typically, sulfuric acid (H_2SO_4) for lead acid batteries or a solution of potassium hydroxide (KOH) for Nickel Cadmium (NiCd) batteries, and distilled water.

original equipment manufacturer (OEM) instructions: The technical documentation produced by the organization that built or manufactured a specific piece of passenger rail equipment describing maintenance procedures and frequencies for that piece of equipment.

periodic maintenance: The performance of selected inspection and maintenance actions on systems or sub-systems. Regulatory agencies or the operating authority may set the frequency of these actions. The frequency may be expressed as a function of time (e.g., days, weeks, or months) or of utilization (mileage, cycles, etc.). The scope of these inspection and maintenance actions must be in full compliance with all applicable federal, state, and local regulations.

standard maintenance procedure (SMP): The internal railroad document giving specific instruction on how to perform maintenance on a specific system or compound.

wet cell battery: Voltage-generating cells having a liquid electrolyte.

Abbreviations and acronyms

AAR	Association of American Railroads
Ah	Amp-hours
H	High rate of discharge
L	Low rate of discharge
M	Medium rate of discharge
NATSA	North American Transportation Services Association
OEM	original equipment manufacturer
PPE	personal protective equipment V
PRESS	Passenger Rail Equipment Safety Standards
SMP	standard maintenance procedure
VRLA	valve-regulated lead acid
X	Very high rate of discharge

Summary of document changes

- Document formatted to the new APTA standard format.
- Sections have been moved and renumbered.
- Scope and Summary moved to the front page.
- Sections of definitions, abbreviations and acronyms moved to the rear of the document.

- Three new sections added: “Related APTA Standards,” “Summary of document changes” and “Document history.”
- Some global changes to section headings and numberings resulted when sections dealing with references and acronyms were moved to the end of the document, along with other cosmetic changes, such as capitalization, punctuation, spelling, grammar, and general flow of text.
- Added new Section 1, “Operating authority instructions.”
- Added new Section 2.2(b) regarding fault logs.
- Removed Section 2.2(g) and Section 2.2(i) due to redundancy with Sections 2.2(b) and 1.2(k), respectively.
- Added new Section 2.2(i) regarding battery filler.
- Upgraded to standard from recommended practice.
- Section 2.2 rearranged the sequencing of steps to be performed and deleted unnecessary and/or inapplicable steps.
- Revised the definitions of “dry cell battery” and “wet cell battery.”
- Added PPE and VRLA to “Abbreviations and acronyms.”

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Policy & Planning Approval	Publish Date
First published	Jan. 22, 1999	—	—	March 17, 1999	March 17,1999
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