APTA STANDARDS DEVELOPMENT PROGRAM

RAIL STANDARD

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APTA Rail Transit Standards Vehicle Inspection and Maintenance Working Group

Pantograph Current Collection Equipment Periodic Inspection and Maintenance

Abstract: This standard covers basic procedures for periodic inspection and maintenance of pantograph current collection equipment on rail transit vehicles, with emphasis on maintenance of high-voltage current collection devices.

Keywords: pantograph current collection equipment, periodic inspection and maintenance

Summary: This document establishes a standard for pantograph current collection equipment inspection and maintenance. Individual rail transit systems should tailor these standards to accommodate their specific equipment and mode of operation.

Scope and purpose: This standard is intended for use by rail transit equipment maintenance organizations. It establishes procedures for periodic inspection and maintenance of pantograph current collection equipment used on rail transit vehicles.

Participants

The American Public Transportation Association greatly appreciates the contributions of John MacEwen, who provided the primary effort in revising this *Rail Standard*.

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Introduction

This introduction is not a part of APTA RT-VIM-S-002-02 First Revision June 28, 2013 *Standard for Pantograph Current Collection Equipment Periodic Inspection and Maintenance*

This Standard for Pantograph Current Collection Equipment Periodic Inspection and Maintenance for rail transit vehicles represents a common viewpoint of those parties concerned with its provisions, namely, transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, practices or guidelines contained herein is purely voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system's operations. In those cases, the government regulations take precedence over these recommended practices. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit systems, may be either more or less restrictive than those given in this document**.**

This Standard is intended to assist RTS personnel in performing basic maintenance and inspection procedures on rail transit door systems. Since each rail transit rail cars may be different, the procedures and steps described in this document will not necessarily be applied to, nor required for, every RTS maintenance and inspection procedure.

APTA recommends the use of this standard by:

- Individuals or organizations that operate rail transit systems;
- Individuals or organizations that contract with others for the operation of rail transit systems; and
- Individuals or organizations that influence how rail transit systems are operated (including but not limited to consultants, designers and contractors).

Note on alternate practices

Individual rail transit systems may modify the practices in this standard to accommodate their specific equipment and mode of operation. APTA recognizes that some rail transit systems may have unique operating environments that make strict compliance with every provision of this standard impossible. As a result, certain rail transit systems may need to implement the standards and practices herein in ways that are more or less restrictive than this document prescribes. A rail transit system may develop alternates to APTA standards so long as the alternates are based on a safe operating history and are described and documented in the system's safety program plan (or another document that is referenced in the system safety program plan).

Documentation of alternate practices shall:

- Identify the specific APTA rail transit safety standard requirements that cannot be met.
- State why each of these requirements cannot be met.
- Describe the alternate methods used.
- Describe and substantiate how the alternate methods do not compromise safety and provide a level of safety equivalent to the practices in the APTA safety standard (operating histories or hazard analysis findings may be used to substantiate this claim).

Pantograph Current Collection Equipment Periodic Inspection and Maintenance

1. Frequency of conduct

Maintenance tasks on the pantograph current collection equipment shall be performed on a regular schedule to ensure proper operation of the equipment. The sections of this standard listed in **Table 1** provide a guide to detailed procedures for each identified maintenance task.

TABLE 1
Inspections and Maintenance Intervals

Inspections and Maintenance	Recommended Inspection Intervals (not to exceed)[1]	Section
Carbon strips	90 days	2.5(a)
Head/horns	90 days	2.5(b)
Raising and lowering	120 days	2.5(c)
Bearings	180 days	2.5(d)
Chain/cable and cam	180 days	2.5(e)
Contact force	180 days	2.5(f)
Shunts	180 days	2.5(g)
Shunt connections	180 days	2.5(h)
Insulators	180 days	2.5(i)
Roof cables	1 year	2.5(j)
Insulation test	1 year	2.5(k)
Lightning arrester	1 year	2.5(l)
Fuse	1 year	2.5(m)

1 Rail transit system transit systems may opt to use equivalent mileage instead of recommended days when determining inspection intervals.

The frequency of tasks in **Table 1** shall comply with all applicable federal, state and local regulations. Further, in the conduct of a rail transit system's periodic inspection and maintenance programs, frequencies for individual tasks may be established based on a number of additional factors, including but not limited to:

- OEM-recommended intervals;
- industry experience;
- operating environment/conditions;
- historical data;
- performance requirements;
- failure analysis;

- rail transit system's testing and experience; and
- reliability centered maintenance programs.

2. Requirements and specific tasks

WARNING: The following inspection and maintenance procedures must be carried out under overhead wire that is voltage free or in an area where no overhead wire is present. Follow proper lock-out/tag-out procedures as required by the rail transit system.

WARNING: During the lowering and raising operation, all personnel must remain clear of the pantograph to avoid being struck by the mechanism. Pay particular attention to rotating equipment and energy stored in the springs.

WARNING: Ensure the proper electrical discharge of auxiliary and propulsion capacitors. Follow proper procedures as required by the OEM and rail transit system.

WARNING: Ensure that the vehicle is secured against uncontrolled movement in accordance with the rail transit system's rules before commencing inspection and maintenance procedures.

WARNING: When detaching equipment from the pantograph assembly, ensure that all components are adequately supported to prevent uncontrolled movement.

WARNING: Use only those cleaning products and lubricants proved safe and authorized for use by the rail transit system. Consult OEM and MSDS references for suitability for each application to prevent personal injury and damage to the equipment.

2.1 Materials

The following materials are normally required for pantograph current collection equipment inspection and maintenance:

- approved non-conducting cleaning chemical;
- approved lubricants; and
- referenced OEM's maintenance manuals for additional materials.

2.2 Tools

The following tools are normally required for pantograph current collection equipment inspection and maintenance:

- standard tools carried by the maintenance personnel;
- force gauge (spring scale or digital);*
- 500 or 1000 VDC megohmmeter (commonly referred to as a megger);*
- multimeter;* and
- stopwatch.

NOTE: Tools marked with an asterisk require periodic calibration as specified by the rail transit system's practices.

2.3 Safety/personal protective equipment

Appropriate personal protective equipment, meeting minimum ANSI standards and as required by the rail transit system, shall be worn at all times in the performance of these inspection and maintenance tasks.

2.4 Training requirements

Rail transit systems and/or their maintenance contractors shall develop and execute training programs that provide employees with the knowledge and the skills necessary to safely and effectively perform the tasks outlined in this standard.

2.5 Inspection and maintenance

a) Visually inspect the carbon strips for thickness and condition. Replace the carbon strips if the remaining material is less than manufacturer's recommendations or rail transit system's practice. Carbon strips shall be replaced if cracks are detected.

NOTE: Carbon strips must always be replaced as a complete set. Grooving or chipping of the carbons can be corrected by grinding, provided that the damage is not too severe.

NOTE: Carbon strips can wear and deteriorate at an accelerated rate during severe weather when contact wire icing occurs. It is, therefore, recommended to inspect all vehicles immediately following such weather.

b) Check pantograph head for level and freedom of movement (rotation in relationship to pantograph arm). Check pantograph horns for damage or wear. If so equipped, check function of spring-pots and lubricate with approved lubricant.
c) Visually inspect the pantograph during raising and lowering for freedom of operation. Record the time required for movement in both directions. If required times are not met, make necessary adjustments per the OEM. In addition, check the manual raise and lower mechanism and lockdown mechanism. Make sure a manual raise handle is on board the vehicle if so equipped.
d) Inspect the bearings for freedom of movement and excessive play. Replace as required. Clean the exterior of the bearing assembly and lubricate with approved lubricants.
e) Visually inspect the chain/cable and cams for wear and freedom of movement. Replace as required. Lubricate the chain/cable with the approved lubricant.
f) Measure the contact force, using a force gauge, ascending and descending through the specified operating range. Compare the average of the two readings to that specified by the rail transit system. If necessary, make required adjustments to obtain desired contact force.
g) Visually inspect all shunts for frayed, broken, cut, burnt or otherwise defective conditions. If any of these conditions exist, replace the shunt. When replacing shunts, make sure the contact surfaces are clean and free from dirt or corrosion.

NOTE: If required by rail transit system or manufacturer's recommendation, use colloidal copper coating material between connections.

NOTE: Ensure that the shunts do not rub against each other or a frame member. Adjust shunts as required to provide clearance.

h) Visually inspect all shunts for loose connections and tighten as required.
i) Clean insulators with an approved nonconductive, carbon-dissolving solvent. Visually inspect for damage and replace if required.
j) Visually inspect all roof-mount cables for condition and tightness of connections. Make certain that cables are not lying over objects that will cause them to chafe.
k) Perform an insulation test using a megger set at 500 or 1000 VDC. Ensure that the knife switch or main breaker is in the open position. Connect the megger negative lead to the carbody ground and the positive lead to the line side of the main knife switch or circuit breaker. An insulation level sufficient

to ensure freedom from tracking, arcing, fire and other electrical hazards shall be achieved and maintained. Equipment shall meet a minimum level of 5 megohms.

l) Visually inspect the lightning arrester for cracks, damage or oil leakage. Replace if required.

m) Visually inspect ribbon/cartridge fuse for deterioration and burning, if so equipped. Using a multimeter, check the continuity of the fuses. Replace if required.

NOTE: The reason for a blown fuse should be found and corrected

2.6 Correction of deficiencies

Any deficiencies uncovered during the inspections required in Section 2.5 shall be corrected and documented in accordance with rail transit system procedures and OEM recommendations.

References

American Public Transportation Association, Recommended Practices:

- APTA PR-E-RP-004-98 "Gap and Creepage Distance" (Document was previously numbered as APTA RP-RP-E-004-98)
- APTA PR-E-RP-009-98, "Wire Used On Passenger Equipment" (Document was previously numbered as APTA RP-E-009-98)

Definitions

carbon strip: The current collector strip mounted to the top of the pantograph, which slides along the contact wire.

pantograph (pantograph current collection equipment): The current collector apparatus, typically consisting of a linked framework mounted on top of a rail transit vehicle.

Abbreviations and acronyms

ANSI	American National Standards Institute
MSDS	Material Safety Data Sheet
OEM	original equipment manufacturer
VDC	volts direct current

Summary of document changes

1. Document formatted to the new APTA standard format.
2. Sections have been renumbered and moved around.
3. Two new sections added, "*Summary of document changes* and "*Document history"*
4. Some global changes to section headings and numberings resulted when sections dealing with references and acronyms were moved to the end of the document and other cosmetic changes, such as capitalization, punctuation, spelling, grammar and general flow of text.
5. Changes and additions in the following sections:
   Abbreviations and acronyms - VDC for voltage in direct current

Document history

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