

16. APTA PR-IM-S-016-02

Standard for Pantograph Current Collection Equipment Periodic Inspection and Maintenance

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APTA Passenger Rail Equipment Safety Standards Task Force

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Abstract: This standard covers basic procedures for periodic inspection and maintenance of pantograph current collection equipment on locomotives and multiple unit (MU) cars, with emphasis on maintenance of high voltage current collection devices.

Key words: current collection equipment, pantograph, periodic inspection, maintenance

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Introduction

(This introduction is not part of APTA-PR-IM-S-016-02, Standard for Pantograph Current Collection Equipment Periodic Inspection and Maintenance)

This standard describes the basic periodic inspection and maintenance requirements for pantograph current collection equipment on locomotives/multiple unit (MU) cars. APTA recommends the use of this standard by:

- a) Individuals or organizations that maintain pantograph current collection equipment on locomotives/MU cars;
- b) Individuals or organizations that contract with others for the maintenance of pantograph current collection equipment on locomotives/ MU cars ; and
- c) Individuals or organizations that influence how pantograph current collection equipment is maintained on locomotives/ MU cars.

This standard is intended to satisfy the following objectives:

- Identify those inspection criteria and maintenance standards that provide a high level of passenger safety; and
- Incorporate safety considerations during the periodic inspection and maintenance process. Identify those inspection criteria and maintenance standards that provide a high level of workplace safety.

Participants

The American Public Transportation Association greatly appreciates the contributions of the following individual(s), who provided the primary effort in the drafting of the *Standard for Pantograph Current Collection Equipment Periodic Inspection and Maintenance*.

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APTA PR-IM-S-016-02

Standard for Pantograph Current Collection Equipment Periodic Inspection and Maintenance

1. Overview

This document establishes a standard for pantograph current collection equipment periodic inspection and maintenance. Individual railroads should tailor these standards to accommodate their specific equipment and mode of operation.

1.1 Scope

This standard includes all essential periodic inspection and maintenance requirements for pantograph current collection equipment used on locomotives/multiple unit (MU) cars.

1.2 Purpose

This standard is intended for use by rail equipment maintenance organizations. It establishes procedures for periodic inspection and maintenance of pantograph current collection equipment used on locomotives/MU cars.

2. References

This recommended practice shall be used in conjunction with the following publications. When the following standards are superseded by an approved revision the revision shall apply.

49 CFR Part 229, Railroad Locomotive Safety Standards, October 2000.

49 CFR Part 238, Passenger Equipment Safety Standards, October 2000.

APTA PR-IM-S-014-99, Standard for Modification Methodology for the Periodic Inspection and Maintenance of Passenger Coaches.

Original Equipment Manufacturer (OEM), specifications for pantograph current collection equipment inspection and maintenance.

Local operating property procedures for pantograph current collection equipment inspection and maintenance.

Railroad procedures for providing blue signal protection of workers.

3. Definitions, abbreviations, and acronyms

3.1 Definitions

For the purposes of this standard, the following terms and definitions apply.

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

3.1.2 calendar day inspection: An inspection performed each calendar day as prescribed by *49 CFR Part 229 and 238.*¹

3.1.3 periodic maintenance: The performance of selected inspection and maintenance actions on systems or sub-systems. The frequency of these actions may be set by regulatory agencies or the railroad. The frequency may be expressed as a function of time (i.e. days, weeks or months) or in mileage or cycles.

3.1.4 pantograph: (Locomotive or MU cars current collection equipment) The device that connects to the voltage supply through the catenary or contact wire to supply the power for propulsion and auxiliary systems, typically consisting of a linked framework, mounted on top of a rail vehicle.

3.2 Abbreviations and acronyms

OEM	original equipment manufacturer
CFR	Code of Federal Regulations
MU	Multiple Unit

4. Frequency of conduct

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

TABLE 1

INSPECTIONS AND MAINTENANCE	RECOMMENDED PERIODIC INSPECTION INTERVALS (Not to Exceed)	REFERENCE SECTION
Daily pantograph inspection	Daily	CFR Part 229.45
Carbon strips	Not to exceed 92 Days	5.5.a)
Head/horns	Not to exceed 92 Days	5.5.b)
Raising & lowering	Not to exceed 92 Days	5.5.c)

¹ For references in Italics, see Section 2.

INSPECTIONS AND MAINTENANCE	RECOMMENDED PERIODIC INSPECTION INTERVALS (Not to Exceed)	REFERENCE SECTION
Bearings	Not to exceed 92 Days	5.5.d)
Chain/cable & cam	Not to exceed 92 Days	5.5.e)
Contact force	Not to exceed 92 Days	5.5.f)
Shunts	Not to exceed 92 Days	5.5.g)
Shunt connections	Not to exceed 92 Days	5.5.h)
Insulators	Not to exceed 92 Days	5.5.i)
Fuse/circuit breaker	Not to exceed 92 Days	5.5.j)
Safety signage	Not to exceed 92 Days	5.5 k)
Pantograph poles	Not to exceed 92 Days	5.5 l)
Latch-down mechanisms	Not to exceed 92 Days	5.5 m)
Auxiliary pumping systems	Not to exceed 92 Days	5.5 n)
Fiber-optic systems	Not to exceed 92 Days	5.5 o)
Lightning arrester	Not to exceed 92 Days	5.5.p)
Roof cables	Not to exceed 92 Days	5.5.q)
Operating cylinders, springs, hoses, and air foils (if equipped)	Not to exceed 92 days	5.5 r)
Insulation test	1 Year not to exceed 3 years	5.5.s)
Pantograph changeout	1 Year not to exceed 3 years	5.5 t)

The frequency of tasks in Table 1 shall comply with all applicable federal, state, and local regulations. As part of a railroads periodic inspection and maintenance program, 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
- Railroad's testing and experience
- Reliability centered maintenance programs

5. Requirements and specific tasks

WARNING: SAFETY HAZARD

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 and Blue Signal Protection of Workers procedures as required by the railroads and in accordance with federal regulations.

WARNING: SAFETY HAZARD

During the lowering and raising operation, all personnel must remain clear of the pantograph to avoid being struck by the mechanism.

WARNING: SAFETY HAZARD

Ensure the vehicle is secured against uncontrolled movement in accordance with local railroad rules before commencing inspection and maintenance procedures.

WARNING: SAFETY HAZARD

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

5.1 Materials

- Approved non-conducting cleaning chemical
- Approved lubricants
- Additional materials as required by OEM

5.2 Tools

- Force gauge (spring scale or digital)
- 1000 Vdc Megohm-meter (commonly referred to as a megger)*
- Multi-meter*

- Stop watch*
- Standard tools carried by the maintenance personnel

*Tools shall be calibrated in accordance with OEM and railroad's procedures.

5.3 Safety/personal protective equipment

Personal protective equipment, as required by the railroad, shall be worn at all times in the performance of these inspection and maintenance tasks.

5.4 Training requirements

Railroads and/or their maintenance contractors shall develop and execute training programs, consistent with the requirements of *49 CFR Section 238.109²* that provide employees with the knowledge and the skills necessary to safely and effectively perform the tasks outlined in this standard.

5.5 Inspection and maintenance procedures

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

NOTE: Carbon strips can be replaced as a complete set or grooving or chipping may be corrected by matching or grinding, providing proper safety precautions are taken.

NOTE: Carbon strips can wear and deteriorate at an accelerated rate, particularly during freezing conditions. It is recommended that all carbon strips be inspected immediately following the completion of each run during such conditions.

- b) Check pantograph head for freedom of movement (rotation and/or vertical movement in relationship to pantograph arm). Check pantograph horns for damage or wear.
- 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 OEM recommendations. In addition, check the manual raise and lower mechanism and lock-down 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.

² For references in Italics, see Section 2.

- f) Measure the contact force, using a force gauge or weights, ascending and descending through the specified operating range. Compare the average of the two readings to that specified by the railroad. If necessary, make required adjustments to obtain the 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 railroad or OEM recommendations, 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 non-conductive grease-dissolving solvent. Visually inspect for damage and replace if required.
- j) Visually inspect ribbon/cartridge fuse and/or circuit breakers for deterioration and burning, if so equipped. Functional testing of all grounding switches, current transformers, vacuum breakers, etc. should be done at this time, utilizing the safety precautions already established. Using a multimeter check the continuity of the fuses. Replace if required.
- k) Visually inspect all safety-related signage. Replace/clean if missing/obscured.
- l) Pantograph poles should be checked for cracks and delamination. Check for broken end horns or other damage.
- m) Inspect and test latch-down mechanisms for effective locking devices.
- n) Check auxiliary pumping devices (if applicable) for ease of operation. Inspect for leaks.
- o) If so equipped, clean and service fiber-optic system in accordance with OEM instructions.
- p) Visually inspect the lightning arrester for cracks, damage, or oil leakage. Clean with an approved non-conductive grease dissolving solvent. Replace if required.
- q) 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.
- r) Inspect condition of all operating cylinders, springs, hoses, and air foils (if so equipped). Replace as necessary.

- s) Perform an insulation test using a megger set at 1000 Vdc. Ensure that the knife switch or main breaker is in the open position. Connect the megger negative lead to car body 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 five (5) megohms.

- t) Follow OEM recommendations for pantograph changeout. Check roof insulators for cracks and chips. Replace as necessary. Clean with approved cleaning agent.

**Annex A
(informative)**

B.1 Bibliography

[B1] APTA PR-E-RP-004-98 Recommended Practice For Gap and Creepage Distance.

[B2] APTA PR-E-RP-009-98 Recommended Practice for Wire used on Passenger Equipment.