14. Standard for Car-Borne Cab Signal Control Systems Periodic Inspection and Maintenance

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APTA Rail Transit Standards Vehicle Inspection and Maintenance Committee

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Abstract: This standard covers basic procedures for periodic inspection and maintenance of Cab Signal Control Systems on rail transit vehicles.

Keywords: automatic train control, automatic train operation, automatic train protection, cab signal control systems, periodic inspection and maintenance
Introduction

(This introduction is not a part of APTA RT-VIM-S-014-02 Standard for Car-Borne Cab Signal Control Systems Periodic Inspection and Maintenance)

This Standard for Car-Borne Cab Signal Control Systems 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 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 this standard. 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 describes the basic inspection and maintenance requirements for cab signal control equipment on rail transit vehicles. APTA recommends the use of this standard by:

- Individuals or organizations that maintain cab signal control equipment on rail transit vehicles;
- Individuals or organizations that contract with others for the maintenance of cab signal control equipment on rail transit vehicles; and
- Individuals or organizations that influence, how cab signal control equipment is maintained on rail transit vehicles.
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Standard for Car-Borne Cab Signal Control Systems
Periodic Inspection and Maintenance

1. Overview

This document establishes a standard for cab signal control equipment inspections and maintenance. Individual rail transit systems may 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 cab signal control equipment used on rail transit vehicles.

1.2 Purpose

This standard is intended for use by rail equipment maintenance organizations. It establishes procedures for periodic inspection and maintenance of cab signal control equipment used on rail transit vehicles.

1.3 Alternate practices

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 the 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:

a) Identify the specific APTA rail transit safety standard requirements that cannot be met

b) State why each of these requirements cannot be met

c) Describe the alternate methods used

d) 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).
2. References

Original Equipment Manufacturer’s specifications for cab signal control equipment inspection and maintenance.

Rail transit system procedures for cab signal control equipment inspection and maintenance.

3. Definitions, abbreviations, and acronyms

3.1 Definitions

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

3.1.1 automatic train control: A system for automatically controlling train movement, enforcing train safety and directing train operations.

3.1.2 automatic train operation: A system that handles start-up and acceleration to running speed, maintains route speed and stops the train smoothly at proper platform position and may automatically opens the doors.

3.1.3 automatic train protection: A system for enforcing safe train operation, speed control, over-speed protection, train separation and train routing.

3.1.4 original equipment manufacturer: Enterprise that designs and builds equipment, initially.

3.2 Abbreviations and acronyms

<table>
<thead>
<tr>
<th>ANSI</th>
<th>American National Standards Institute</th>
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<tr>
<td>ATP</td>
<td>automatic train protection</td>
</tr>
<tr>
<td>ESD</td>
<td>electrostatic discharge</td>
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<tr>
<td>MSDS</td>
<td>material safety data sheet</td>
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<tr>
<td>OEM</td>
<td>original equipment manufacturer</td>
</tr>
<tr>
<td>PCB</td>
<td>printed circuit board</td>
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</tbody>
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4. Frequency of conduct

Periodic inspection and maintenance tasks on the car-borne cab signal control equipment shall be performed on a regular schedule as determined by the rail transit system. The frequency of any task contained within periodic inspection and maintenance should 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 shall 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
- Reliability Centered Maintenance Programs

5. Requirements and specific tasks

The following inspection and maintenance procedures shall be carried out when working in, under or around a vehicle that is under inspection:

**WARNING:** Follow proper lock-out/tag-out procedures as required by the rail transit system.

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

**WARNING:** Remove power from vehicle car-borne control equipment before attempting any repairs or replacements. Follow OEM, rail transit system and standard electrical safety precautions when conducting preventative maintenance to reduce the possibility of electrical shock and arc flash.

**WARNING:** Semi-conductor components may be susceptible to electrostatic discharge (ESD) damage. Follow OEM recommendations when handling printed circuit boards and components.

**WARNING:** Use only those cleaning products and lubricants proven 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.

### 5.1 Materials

The following materials are normally required for cab signal system inspection and maintenance:

- OEM and rail transit system recommended lubricants.
- OEM and rail transit system recommended cleaning supplies.
- Reference OEM maintenance manuals for additional materials.

### 5.2 Tools

The following tools are normally required for cab signal system inspection and maintenance:

- Standard tools carried by the maintenance personnel.
- Special tools as recommended by OEM and/or rail transit system.
- Test Fixtures (specific to OEM equipment) may include receiving and transmission loop antennas.

- Function Generator. *

- Oscilloscope. *

- Frequency Counter. *

- Digital Voltmeter. *

- Fixed Test Fixtures for PCB Calibrations.

* These tools require periodic calibration as specified by the rail transit system’s practices.

### 5.3 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.

Rail transit system established safety practices, rules and procedures must be followed at all times in the performance of these inspections and tests.

### 5.4 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.

### 5.5 Inspection and maintenance

In all of the following procedures, the OEM’s Maintenance manuals shall be referred to for such items as, torque values, voltage settings, pass/fail criteria condemning limits, clearance measurements, and specific procedure methodology. Devices must be cleaned for proper inspection. These procedures cover only the visible inspection, adjustments, and functional testing of the car-borne train control equipment. Methodologies for the resolution of deficiencies noted while performing these procedures must be tailored by the individual property in conjunction with the OEM’s recommendations. Documentation of the inspection and maintenance process as to interval, deficiencies, and resolution of those deficiencies found, shall be done in a comprehensive manner so as to create a useful database, which will enhance the reliability and accountability of the process.

#### 5.5.1 Functional safety check

A cab signal functional safety check shall be performed before releasing vehicles from any maintenance activity that could affect operation.
5.5.2 Inspection and tests performed during periodic maintenance

a) Visually inspect (if equipped) antennas, receiver coils, laminated bars, inductive loops, and pick-up coils for damage, erosion, corrosion and dirt buildup. Clean repair, calibrate, adjust and/or replace as required.

b) Check operation of all switches and pushbuttons. Clean, repair and/or replace as required.

c) Check tachometers/speed sensors for wear, loose mounting, dirt buildup, frayed wiring. Clean, repair and/or replace as required.

d) Visually inspect components for loose or missing hardware and connections. Clean, repair and/or replace as required.

e) Visually inspect wiring and cables for broken, brittle or cracked insulation. Repair and/or replace as required.

f) Visually inspect relay contacts for burns, pitting, or any other deformities. Clean, repair and/or replace as required.

NOTE: Vital relays require periodic test and calibration based on rail transit system procedures and/or OEM recommendations. Technicians who perform calibration and repairs to vital relays require specialized training.

g) Check power supply voltage(s), test coil voltage(s), wheel size setting, door no motion, door power/brake and door/step by-pass interlock(s). Make adjustments/repairs per OEM recommendations.

h) Review On-board recording equipment for recorded faults.

i) Check pick-up current, frequency for each code rate.

j) Check printed circuit boards for calibration per rail system procedures and OEM recommendations.

NOTE: Refer to rail transit system procedures and OEM recommendations for printed circuit board storage life and exchange criteria. OEM recommendations may require rail transit systems to develop system for tracking the accumulated storage time for each tested and functional printed circuit board.

k) Perform a functional (safety) check of the cab signal system before releasing vehicles from any maintenance activity that could affect operation of the cab signal system.

5.6 Correction of deficiencies

Any deficiencies uncovered during the inspections required in Section 5.5 shall be corrected and documented in accordance with rail transit system procedures and OEM recommendations.
6. Documentation/maintenance log reports

All maintenance performed on rail transit vehicle car-borne cab signal systems shall be documented. This documentation shall be noted on a unified type of form developed by the rail transit system or maintenance management information system that provides the following information and maintains complete accountability. It shall include:

- Car number.
- Date maintenance performed/completed.
- Description of problem.
- Corrective action taken.
- Operational test and inspection.
- Mileage/hours/date since last maintenance activity.
- Serial number of part installed and removed if applicable.
- Signature, identification number of technician performing the maintenance activity and date work completed.

NOTE: Computerized maintenance management information systems may not accommodate technician signatures. In the absence of a signature line, it is the responsibility of the rail transit system to ensure inspection reports can be traced back to the individual performing the inspection for accountability.