



APTA STANDARDS DEVELOPMENT PROGRAM
RECOMMENDED PRACTICE

American Public Transportation Association
1666 K Street, NW, Washington, DC, 20006-1215

APTA RT-VIM-RP-013-03 Rev.2

First Published September 28, 2003

First Revision July 26, 2004

Second Revision March 31, 2012

APTA Rail Transit Standards Vehicle

Inspection and Maintenance Committee

Vehicle Communication Systems Periodic Inspection and Maintenance

Abstract: This *Recommended Practice* provides guidance for the periodic inspection and maintenance of communication systems mounted on rail transit vehicles.

Keywords: communications, heavy rail, light rail, periodic inspection and maintenance

Summary: The communications system is critical for train operation and passenger safety. This *Recommended Practice* serves as the framework for developing inspection, maintenance and test procedures to achieve safe and reliable operation of the following communication equipment typically installed in heavy and light rail vehicles: public address (PA) systems, passenger emergency intercoms, door closing warning systems, radio communications systems and vehicle-borne information signs.

Scope and purpose: This *Recommended Practice* for inspection of communication system equipment is for all transit systems that consider a properly functioning communication system as a prerequisite for revenue service. This document provides guidance to those developing a systematic and comprehensive inspection and maintenance program for communications equipment on transit vehicles. It is understood that this document may not identify all hazards that accompany the actual procedures created based upon this *Recommended Practice*.

This *Recommended Practice* 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 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 transit agencies, may be either more or less restrictive than those given in this document.

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Introduction

This introduction is not a part of APTA RT -VIM-RP -013-03, *Recommended Practice for Vehicle Communications Systems Periodic Inspections and Maintenance*.

This recommended practice for Vehicle Communications Systems Periodic Inspections and Maintenance for rail transit revenue represents a common viewpoint of those parties concerned with its provisions, namely, rail transit system/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 recommended practice describes the basic inspections and maintenance requirements for vehicle communications systems on rail transit revenue vehicles. APTA recommends the use of this standard by:

- Individuals or organizations that maintain vehicle communications systems rail transit vehicles;
- Individuals or organizations that contract with others for the maintenance of vehicle communications systems on rail transit vehicles; and
- Individuals or organizations that influence how vehicle communications systems are maintained on rail transit vehicles.

Note on 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 RTS safety program plan (or another document that is referenced in the system safety program plan).

Documentation of alternate practices shall do the following:

- 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).

Vehicle Communication Systems Periodic Inspection and Maintenance

1. Frequency of conduct

Periodic inspection and maintenance tasks on rail transit system (RTS) communication systems should be performed on a regular schedule as determined by the RTS. The frequency of any task contained within periodic inspection and maintenance 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 should be established based on a number of additional factors, including but not limited to the following:

- intervals recommended by the original equipment manufacturer (OEM)
- industry experience
- operating environment/conditions
- historic data
- performance requirements
- failure analysis
- rail transit system's testing and experience
- reliability-centered maintenance programs

2. Requirements and specific tasks

The following inspection and maintenance safety 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 RTS.

WARNING: Ensure that the vehicle is properly secured against uncontrolled movement in accordance with the RTS rules before commencing inspection and maintenance procedures.

WARNING: Remove power from vehicle communication systems equipment before attempting any repairs or replacements. Follow OEM, RTS and standard electrical safety precautions when conducting preventative maintenance to reduce the possibility of electrical shock and arc flash.

WARNING: Semiconductor components may be susceptible to electrostatic discharge 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 RTS. Consult OEM and material safety data sheet (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 vehicle communication system inspection and maintenance:

- OEM and RTS recommended lubricants.
- OEM and RTS recommended cleaning supplies.

Reference OEM maintenance manuals for additional materials.

2.2 Tools

Besides standard tools carried by the maintenance personnel, the following tools are normally required for vehicle communication system inspection and maintenance:

- multimeter
- portable test unit
- sound level meter
- tone generator

These tools require periodic calibration as specified by the RTS's practices.

2.3 Safety/personal protective equipment

Appropriate personal protective equipment, meeting minimum American National Standards Institute (ANSI) standards and as required by the RTS, shall be worn at all times in the performance of these inspection and maintenance tasks.

RTS-established safety practices, rules and procedures shall be followed at all times in the performance of these inspections and tests.

2.4 Training requirements

Rail transit systems and/or their maintenance contractors should 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 *Recommended Practice*. The training program shall include periodic, refresher training as determined by the RTS.

2.5 Inspection and maintenance

In all of the following procedures, the OEM's maintenance manuals should 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 communications system equipment.

Methodologies for the resolution of deficiencies noted while performing these procedures should 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 should be done in a comprehensive manner so as to create a useful database, which will enhance the reliability and accountability of the process.

2.5.1 System de-energized inspections

Ensure that all circuit breakers related to the operation of the communication system equipment are in the OFF position. These include, but may not be limited to, the following:

- communication control
- radio
- end route sign
- destination signs
- interior information signs
- automatic announcement system
- train-to-wayside communications (TWC) equipment
- Global Positioning System (GPS) receiver
- door motor control
- door control trainlines
- local door control
- master controller

2.5.1.1 Mechanical inspections

The following inspections should be performed on the PA amplifier, radio, cab-mounted controls, speakers, passenger emergency call stations, information signs, antennae, GPS equipment, TWC equipment and any other equipment related to the vehicle communication systems:

- Inspect housing latches for damage and security.
- Inspect housing seals for integrity.
- Inspect housing, panels and structure for corrosion.
- Inspect all mechanical mounting components, including all required fasteners and hardware.

Replace or repair all missing or defective components. Tighten or replace loose hardware as required in accordance with OEM recommendations.

2.5.1.2 Electrical inspections

The following inspections should also be performed on the equipment listed in the previous section:

- Check wiring for chafed or cut insulation. Repair or replace as required.
- Check wires for loose crimps or worn or corroded lugs. Repair or replace as required.
- Check wires for loose terminals, and tighten as required.
- Check wires for heat fatigue. Repair or replace as required.
- Check connectors for damage, and ensure that there are no damaged or misaligned contacts. Repair or replace as required.
- Check relay contacts for burns, pitting or any other deformities. Clean, repair or replace as required.
- Check fuses for burned, separated or otherwise damaged elements, and replace as required.

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

2.5.2 System-energized functional tests

Ensure that all circuit breakers related to the operation of the communication system equipment are in the ON position. These include, but may not be limited to, the following:

- communication control
- radio
- end route sign
- destination signs
- interior information signs
- automatic announcement system
- TWC equipment
- GPS receiver
- door motor control
- door control trainlines
- local door control
- master controller
- operator's screen display (TOD)

NOTE: For all functions that operate across communications trainlines, the test procedures should include verification of proper operation in all cars of the train.

2.5.2.1 PA announcement system

Perform an operational (functional) check of the PA Announcement System.

- a) Verify that the public address circuit is working properly by making an announcement while pressing the push-to-talk button on the operator's console. If the vehicle's communication system is intended to announce a chime when the push-to-talk button is depressed, then verify that this occurs. Activate the internal tone generator, place an external tone generator near the microphone, or speak clearly into the microphone. All interior speakers must clearly reproduce the input sound.
- b) If the vehicle is equipped with exterior speakers, then repeat the steps above to test the operation of the exterior speakers. If it is possible to make exterior and interior speakers broadcast the same announcement, then this function must also be tested.
- c) If the vehicle is equipped with an automatic announcement system, then verify that it is in proper working order and that it produces clear and accurate test messages.

2.5.2.2 Passenger emergency intercom

Perform an operational (functional) check of the passenger emergency intercom system.

- a) Ensure that all passenger intercom stations are capable of placing a call to the operator and establishing clear two-way communications.
- b) If multiple passenger intercom stations are intended to be capable of establishing communication with the operator's cab, then test this functionality.
- c) Verify that the operator can properly discontinue communication with each passenger intercom station.

2.5.2.3 Door closing warning signal

If so equipped, perform an operational (functional) check of the audible and visual indication of side door closings. This may consist of a simple chime or tone, while other systems may broadcast a prerecorded verbal announcement. This passenger warning system should be inspected, tested and maintained.

- a) Begin by opening all passenger doors.
- b) Upon commanding the doors on each side of the vehicle to close, verify that the audio and visual indications are working properly to alert passengers that the side doors of the vehicle are about to close.
- c) If required by the RTS maintenance procedures, verify that the audible signal volume is correctly set in accordance with the specified criteria.

2.5.2.4 Radio communications system

Perform an operational (functional) check of the radio communications system.

- a) Test to ensure that radio communication can be established between the operator's cab and Central Control.
- b) Confirm that the volume control in the cab properly controls the sound from minimum to maximum.
- c) If it is possible to broadcast the received radio signal directly through to the passenger area, then test this function.
- d) If the vehicle is equipped with a silent alarm, then test this feature in accordance with the RTS's procedures.

2.5.2.5 Information signs

If so equipped, perform an operational (functional) check of the passenger information sign system. System components may include side destination signs, interior information signs, electronic strip maps (route maps), end route signs, and sign control.

- a) Verify that all information signs are functioning properly. Enter a test pattern to verify proper operation of all elements of the display.
- b) Enter updated sign information, and verify that the signs display the proper message.
- c) Inspect the general condition of all signs and control apparatus. Repair or replace any defective components.
- d) If the system is capable of displaying a "send help" signal via the silent alarm, then test this feature in accordance with the RTS's procedures.

2.6 Correction of deficiencies

Any deficiencies uncovered during the inspections required in Section 2.5.1 and 2.5.2 should be corrected and documented in accordance with RTS procedures and OEM recommendations.

3. References

The following references should be used in conjunction with this *Recommended Practice*:

- original equipment manufacturers' specifications for communication system equipment inspection and maintenance
- rail transit system procedures for communication system equipment inspection and maintenance

4. Definitions

original equipment manufacturer (OEM): The enterprise that designs and builds equipment, initially.

5. Abbreviations and acronyms

| | |
|------|---------------------------------------|
| ANSI | American National Standards Institute |
| GPS | Global Positioning System |
| OEM | original equipment manufacturer |
| MSDS | material safety data sheets |
| PA | public address |
| RTS | rail transit system |
| TOD | train operator display |
| TWC | train-to-wayside communications |