

# 19. Standard for Ac Power Supply Ground Detection Inspection, Testing and Maintenance

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**Abstract:** This standard provides procedures for inspecting, testing, and maintaining rail transit ac ground detection equipment.

**Keywords:** ac ground detection, ground detection, inspection, maintenance, signal

## Introduction

(This introduction is not a part of APTA RT-SC-S-019-03, *Standard for Ac Power Supply Ground Detection Inspection, Testing and Maintenance*.)

APTA rail transit safety standards represent an industry consensus on safety practices for rail transit systems to help achieve a high level of safety for passengers, employees, and the general public. This document was created by and for those parties concerned with its provisions; namely, rail transit systems (operating agencies), manufacturers, consultants, engineers, and general interest groups. This standard provides procedures for inspecting, testing, and maintaining rail transit ac ground detection equipment.

APTA recommends this standard for:

- Individuals or organizations that inspect, maintain, and/or operate rail transit systems
- Individuals or organizations that contract with others for the inspection, maintenance, and/or operation of rail transit systems
- Individuals or organizations that influence how rail transit systems are inspected, maintained, and/or operated (including but not limited to consultants, designers, and contractors)

This standard intends to meet the following objectives:

- To ensure special life/safety equipment is operational and reliable
- To help rail transit systems incorporate safety considerations during the inspection and maintenance process
- To identify inspection criteria and maintenance standards that provide a high level of passenger and personnel safety

The application of any standards, practices, or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of how a rail transit system operates. In such cases, the government regulations override any conflicting practices this document requires or recommends.

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# Standard for Ac Power Supply Ground Detection Inspection, Testing and Maintenance

## 1. Overview

### 1.1 Scope

This document establishes standard requirements for inspecting, testing, and maintaining rail transit alternating current (ac) power supply ground detection equipment and ac power supply systems not equipped with ground detection devices.

### 1.2 Purpose

The purpose of this standard is to verify that ac power supply systems are free of grounds and are operating safely and as designed through periodic inspection, testing, and maintenance, thereby increasing reliability and reducing the risk of hazards and failures.

### 1.3 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 (RTS) 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. Definitions and acronyms

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

### 2.1 Definitions

**2.1.1 alternating current (ac) ground detector:** A device used to monitor ac power supplies for grounded conditions and to display an alarm when ground conditions are detected. *Syn:* **ac ground fault detector.**

**2.1.2 hazard:** Any real or potential condition that can cause injury, death, or damage or loss of equipment or property.

**2.1.3 insulating block:** An inert, dielectric part that prohibits the passage of electrical current between two electrically active metal components.

**2.1.4 operations control center (OCC):** That facility from which train control, train dispatching, and/or train supervision takes place for the entire RTS or for specific segments of a system if there is more than one control center. *Syn:* **rail control center, rail operations center, rail service control center, train command center.**

**2.1.5 original equipment manufacturer (OEM):** The enterprise that initially designs and builds a piece of equipment.

**2.1.6 personal protective equipment (PPE):** All clothing and other work accessories designed to create a barrier against workplace hazards. Examples include safety goggles, blast shields, hard hats, hearing protectors, gloves, respirators, aprons, and work boots.

**2.1.7 rail transit system (RTS):** The organization or portion of an organization that operates rail transit service and related activities. *Syn:* **operating agency, operating authority, transit agency, transit authority, transit system.**

**2.1.8 terminal block:** A molded non-conductive block of material containing several electrical wiring terminals. *See also:* **terminal board**

**2.1.9 terminal board:** A small panel made of non-conductive materials containing one or more electrical wiring terminals. *See also:* **terminal block.**

**2.1.10 terminal post:** A terminal designed to electrically connect two or more wires. *Syn:* **binding post.**

### 2.2 Acronyms

<b>ac</b>	alternating current
<b>OCC</b>	operations control center
<b>OEM</b>	original equipment manufacturer
<b>PPE</b>	personal protective equipment
<b>RTS</b>	rail transit system

### 3. Inspection, testing, and maintenance requirements

#### 3.1 Inspection, testing, and maintenance frequency

The inspection, testing, and maintenance procedures in this standard shall be performed when ac ground detection equipment is placed in service, when it is modified, repaired, or disarranged, or as otherwise deemed necessary by RTS.

The RTS shall determine the need for additional inspection, testing, and maintenance frequencies for ac power supply ground detection equipment. A review of the following factors may be useful in making this assessment:

- OEM-recommended intervals
- Industry experience
- Operating environment/conditions
- Historical data
- Reliability-centered maintenance program development
- Failure analysis
- RTS testing and experience
- Regulatory requirements

The frequency of tasks shall comply with applicable federal, state, and local regulations.

#### 3.2 Training

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

#### 3.3 Materials

The following materials are required for inspecting, testing, and maintaining ac ground detection equipment:

- Various dusting brushes
- RTS-approved contact cleaner
- Lint-free cloths
- Additional materials as required by the OEM and/or RTS

### 3.4 Tools

The following tools are required for the inspection, testing, and maintenance of ac ground detection equipment:

- Multi-meter\*
- Terminal nut wrench
- RTS-approved portable radio
- RTS-approved specialized ground test equipment
- Standard tools carried by signal personnel
- Additional tools as required by the OEM and/or RTS

\* Calibrate in accordance with OEM and/or RTS requirements.

### 3.5 Personal protective equipment

Personal protective equipment, as required by the RTS, shall be worn at all times during inspection, testing, and maintenance.

### 3.6 Safety

RTS safety rules, procedures, and practices shall be followed at all times during inspection, testing, and maintenance.

### 3.7 Inspection, testing, and maintenance procedures

Of circuits that affect safe train operations, only the following may contain a ground or combination of grounds that permit a current flow equal to or greater than 75% of the release value of any relay or other electromagnetic device in the circuit:

- Circuits that include a track rail
- The common wires of single-wire, single break, signal control circuits using a grounded common
- Ac power distribution circuits that are grounded in the interest of safety



All other circuits that affect the safety of train operation, shall be kept free of any ground or combination of grounds that permit a current flow equal to or greater than 75% of the release value of any relay or other electromagnetic device in the circuit.

Ac power supply ground detection inspection, testing, and maintenance procedures may be modified for each rail transit system's requirements (see Section 1.3) but shall contain the steps listed in Sections 3.7.1 - 3.7.21 as a minimum.

- 3.7.1** Notify the operations control center (OCC) and/or other authorities of the inspection, testing, and maintenance activities to be performed.
- 3.7.2** Inspect ac ground detection equipment for condition of wire tags, defective insulation, heat, and loose, corroded, rusted, damaged, or missing connectors and terminals.
- 3.7.3** Inspect ac ground detection equipment junction boxes and other enclosures for condition of identification plates and markers, rust, corrosion, damage, cracks, breaks, defective latches, locks, hinges, covers, weather seals, gaskets, loose, deteriorated, or damaged conduit connections, and missing or loose components and hardware. Holes and unused entrances not used for ventilation shall be sealed.
- 3.7.4** Inspect polyvinyl chloride (PVC), fiberglass, rubber and other cable conduit material for damage, cracks, breaks, loose conduit connections, missing or loose components, and hardware.
- 3.7.5** Inspect junction boxes and enclosures for the presence and condition of stored circuit drawings, terminal list, and instructions.
- 3.7.6** Inspect ac ground detection equipment for an accumulation of debris underneath the equipment. Remove and bag debris.
- 3.7.7** Inspect wayside drains where applicable, for blockage or ineffective drainage.
- 3.7.8** Inspect ac ground detection equipment for damage caused by standing water, water leaks, or retention.
- 3.7.9** Inspect ac ground detection equipment for any condition that may interfere with the operation of signal equipment.
- 3.7.10** Ensure terminal post connections are tight.
- 3.7.11** Test automatic ac ground detection equipment for proper operation by actuation of test switches, which will ground the positive or negative energy. Test both the positive and negative energy. (For the purposes of this paragraph the positive and negative energy are defined as arbitrarily based on the fact that when one side of the energy is positive, the other side is negative.) When this test is performed, the ac ground detection indicating equipment must assume the de-energized position and/or ground indicating status.

- 3.7.12** Manual ac ground detection devices equipped with test switches and lamps must have the switches manipulated in accordance with test procedures established by the RTS to determine if the lamps are working properly. Test both sides of the energy to determine if the power supply is isolated from ground.
- 3.7.13** In locations where ac ground detection equipment does not have test switches and/or lamps, apply a resistor in parallel with a multi-meter, test lamp, or test apparatus approved by the RTS suitable for the power supply being tested to each side of the energy to ground. Test both sides of the energy. When this test is performed, the ac ground detection indicating equipment must assume the de-energized position and/or ground indicating status.
- 3.7.14** Upon completion of each test, activate the reset switch to restore the ac ground detection equipment to normal status.
- 3.7.15** In locations where no automatic or manual ground detection equipment is provided for ac power supplies, test for the presence of grounds with an appropriate resistor in parallel with a multi-meter or test apparatus approved by the RTS. Test positive energy according to method in step 3.7.15. Test negative energy according to method in step 3.7.16.
- 3.7.16** Test for a positive ground by connecting one lead of the multi-meter or test apparatus approved by the RTS to ground. Place the other meter lead to the negative side of the energy being tested. If a reading is present, it indicates a positive ground.
- 3.7.17** Test for a negative ground by connecting one lead of the multi-meter or test apparatus approved by the RTS to ground. Place the other meter lead to the positive side of the energy being tested. If a reading is present, it indicates a negative ground.
- 3.7.18** When a ground condition is detected, take immediate action to eliminate the ground.
- 3.7.19** Ensure that covers and locks are in place and secured.
- 3.7.20** Perform additional tests as required by the OEM and/or RTS.
- 3.7.21** Notify the OCC and/or other authorities when inspection, testing, and maintenance activities are complete.

### **3.8 Correction of deficiencies**

Deficiencies identified during ac ground detection equipment inspection and maintenance shall be corrected and documented in accordance with OEM and/or RTS requirements.

### **3.9 Documentation**

Inspection, testing, and maintenance activities shall be documented, reviewed, and filed in accordance with RTS procedures.

## Annex A

(informative)

### Bibliography

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