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Signals and Communication Working Group

Ac and Dc Power Supply Ground Detection Inspection, Testing and Maintenance

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

Keywords: ac and dc ground detection, ground detection, inspection, maintenance, signal

Summary: This standard is intended to help rail transit agencies ensure that special life/safety equipment is operational and reliable; incorporate safety considerations during the inspection and maintenance process; and identify inspection criteria and maintenance standards that provide a high level of passenger and personnel safety.

Foreword

The American Public Transportation Association is a standards development organization in North America. The process of developing standards is managed by the APTA Standards Program's Standards Development Oversight Council (SDOC). These activities are carried out through several standards policy and planning committees that have been established to address specific transportation modes, safety and security requirements, interoperability, and other topics.

APTA used a consensus-based process to develop this document and its continued maintenance, which is detailed in the manual for the APTA Standards Program. This document was drafted in accordance with the approval criteria and editorial policy as described. Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

This document was prepared by the Signals and Communication Working Group as directed by the Rail Standards Policy and Planning Committee.

This document represents a common viewpoint of those parties concerned with its provisions, namely transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. APTA standards are mandatory to the extent incorporated by an applicable statute or regulation. In some cases, federal and/or state regulations govern portions of a transit agency's operations. In cases where there is a conflict or contradiction between an applicable law or regulation and this document, consult with a legal adviser to determine which document takes precedence.

This document supersedes APTA RT-SC-S-020-03, which has been revised. Below is a summary of changes from the previous document version:

- Migration to the new 2025 APTA document template which standardizes and reorganizes the document's content; a document summary and foreword were added; the scope and purpose have been combined and updated to be more specific.
- Updated list of participants.
- Updated definitions, abbreviations and acronyms to be consistent with standard definitions; specifically, RTS has been replaced with rail transit system throughout the document.
- Document sections renumbered to simplify the referencing of content

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Introduction

This introduction is not part of APTA RT-SC-S-020-03, "Ac and Dc Power Supply Ground Detection Inspection, Testing and Maintenance."

APTA recommends the use of this document 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).

Scope and purpose

This document establishes standard requirements for inspecting, testing and maintaining rail transit alternating current (ac) and direct current (dc) ground detection equipment. The purpose of this standard is to verify that ground detection equipment is operating safely and as designed through periodic inspection, testing and maintenance, thereby increasing reliability and reducing the risk of hazards and failures.

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; and
- 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).

Ac and Dc Power Supply Ground Detection Inspection, Testing and Maintenance

1. Inspection, testing and maintenance requirements

1.1 Inspection, testing and maintenance frequency

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

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

- OEM-recommended intervals
- industry experience
- operating environment and conditions
- historical data
- reliability-centered maintenance program development
- failure analysis
- rail transit agency testing and experience
- regulatory requirements

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

1.2 Training

The rail transit agency and/or its 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.

1.3 Materials

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

- various dusting brushes
- rail transit agency–approved contact cleaner
- lint-free cloths
- additional materials as required by the OEM and/or transit agency

1.4 Tools

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

- multimeter*
- terminal nut wrench
- rail transit agency–approved portable radio
- rail transit agency–approved specialized ground test equipment
- standard tools carried by signal personnel
- additional tools as required by the OEM and/or rail transit agency

NOTE: Tools marked with an asterisk (*) should be calibrated in accordance with OEM and/or rail transit agency requirements.

1.5 Personal protective equipment

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

1.6 Safety

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

1.7 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 electromagnetic or electronic 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 electromagnetic or electronic device in the circuit.

Ground detection equipment inspection and maintenance procedures may be modified for each rail transit agency requirements (see “Note on alternate practices”) but shall contain steps 1 through 15 below as a minimum:

1. Notify the operations control center (OCC) and/or other authorities of the inspection, testing and maintenance activities to be performed. *No work of any type shall be performed until train movements have been protected.*
2. Inspect ground detection equipment for condition of wire tags; defective insulation; existence of heat; and loose, corroded, rusted, damaged or missing connectors and terminals.
3. Inspect ground detection equipment for any condition that may interfere with the operation of signal equipment.
4. Ensure that terminal post connections are tight.

5. Test automatic 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. When this test is performed, the ground detection indicating equipment must assume the de-energized position and/or ground-indicating status.
6. Manual ground detection devices equipped with test switches and lamps must have the switches manipulated in accordance with test procedures established by the rail transit agency to determine if the lamps are working properly. Test the positive and negative energy to determine if the power supply is isolated from ground.
7. In locations where ground detection equipment does not have test switches and/or lamps, apply a resistor in parallel with a multimeter, test lamp or test apparatus approved by the rail transit agency suitable for the power supply being tested to the positive or negative energy to ground. Test both the positive and negative energy. When this test is performed, the ground detection indicating equipment must assume the de-energized position and/or ground-indicating status.
8. Upon completion of each test, activate the reset switch to restore the ground detection equipment to normal status.
9. In locations where no automatic or manual ground detection equipment is provided for power supplies, test for the presence of grounds with an appropriate resistor in parallel with a multimeter or test apparatus approved by the rail transit agency. Test positive energy according to the method in step 10. Test negative energy according to the method in step 11.
10. Test for a positive ground by connecting one lead of the multimeter or test apparatus approved by the rail transit agency to ground. Place the other multimeter lead to the negative energy being tested. If a reading is present, it indicates a positive ground. Analog meters will not read correctly unless the proper lead is connected to the correct dc polarity.
11. Test for a negative ground by connecting one lead of the multimeter or test apparatus approved by the rail transit agency to ground. Place the other multimeter lead to the positive energy being tested. If a reading is present, it indicates a negative ground. Analog meters will not read correctly unless the proper lead is connected to the correct dc polarity.
12. When a ground condition is detected, current measurements shall be made to determine the exact level of leakage and the specific leakage path. Take immediate action to eliminate the ground(s) where current leakage exceeds the allowable limit.
13. Ensure that covers and locks are in place and secured.
14. Perform additional tests as required by the OEM and/or rail transit agency.
15. Notify the OCC and/or other authorities when inspection, testing and maintenance activities are complete.

1.8 Correction of deficiencies

Deficiencies identified during ground detection equipment inspection, testing and maintenance shall be corrected and documented in accordance with OEM and/or transit agency requirements.

1.9 Documentation

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

References

In addition to rail transit agency and OEM specifications for ground detection equipment inspection, the following should be used in conjunction with this document:

American Railway Engineering and Maintenance of Way Association, Communications and Signals Manual of Recommended Practices, 2000 Part 2.4.10 Section B: General, Item C.

Department of Transportation Federal Railroad Administration Office of Safety, Rules and Regulations Governing Railroad and Train Control Systems, Subpart A-Rules and Instructions: All Systems: 236.2 and 236.107, February 2000.

New York City Transit, Division of Signals, Policy Instruction 11.006.2, 3.5 Ground Test, 1987.

Definitions

ground: Intentional or unintentional connection of an electrical circuit to earth.

ground detector: A device used to monitor power sources for grounded conditions and to display an alarm when grounded conditions are detected. Also called *ground fault detector*.

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

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

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

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

personal protective equipment: 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.

rail transit agency: The organization or portion of an organization that operates rail transit service and related activities. Also called operating agency, *operating authority*, *transit agency*, *transit authority*, *transit system*.

terminal block: A molded nonconductive material containing one or more electrical wiring terminals. See also *terminal board*.

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

terminal post: A terminal designed to electrically connect two or more wires. Also called *binding post*.

Abbreviations and acronyms

ac alternating current
dc direct current
OCC operations control center
OEM original equipment manufacturer

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Policy & Planning Approval	Publish Date
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