



APTA RT-SC-S-005-02, Rev. 1

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APTA Rail Transit Signal & Communications
Working Group

Route Locking Tests

Abstract: This document provides procedures for testing rail transit route locking.

Keywords: locking, route locking, signal, test, testing

Summary: This standard provides prerequisites, procedures and requirements for testing rail transit route locking. Individual rail transit systems may modify these requirements to accommodate their specific equipment and mode of operation.

Scope and purpose: This document is intended to satisfy the following objectives: to ensure that special life/safety equipment is operational and reliable; to incorporate safety considerations during the inspection and maintenance process; and to identify those inspection criteria and maintenance standards that provide a high level of passenger and personnel safety. The purpose of this standard is to verify that route locking systems are operating safely and as designed through periodic testing, thereby increasing reliability and reducing the risk of hazards and failures.

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 system'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.

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Introduction

This introduction is not part of APTA RT-SC-S-005-02, Rev. 1, “Route Locking Tests.”

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).

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).

Route Locking Tests

1. Test requirements

1.1 Test frequency

Route locking tests shall be performed based on the following intervals:

- Relay-based systems shall be tested when placed in service; after modification, repair or disarrangement; and at a regular interval not to exceed four years.
- Microprocessor-based systems being maintained under a configuration control plan conforming to APTA-RT-SC-S-035-03 shall be tested when placed in service and after modification, repair or disarrangement.
- Microprocessor-based systems being maintained without a configuration control plan conforming to APTA-RT-SC-S-035-03 shall be tested when placed in service; after modification, repair or disarrangement; and at a regular interval not to exceed four years.

1.2 Materials and data

The following materials are required for route locking tests:

- current book of plans for the location under test that includes the following details:
 - signals/routes to be tested
 - switches and their position in each route
 - diagram of route locking sections and limits
 - interlocking layout including track circuit limits and switch/signal locations
 - conflicting signals/routes
 - test data sheets or means to record test results

1.3 Tools

Test tools and apparatus shall be as required by the OEM and/or the rail transit system. Applicable tools shall be calibrated in accordance with rail transit system and/or OEM requirements.

1.4 Personal protective equipment

Personal protective equipment, as required by the rail transit system, shall be worn at all times during testing.

1.5 Safety

Rail transit system safety rules, procedures and practices shall be followed at all times during testing. No work of any type shall be performed until train movements have been protected. The normal functioning of any device shall not be interfered with, in testing or otherwise, without first taking measures to provide for the safety of train operation, which depends on the normal functioning of such device.

1.6 Test prerequisites

Prior to performing route locking tests, the test person shall ensure the following:

- A test plan is in place to ensure that all route locking is tested consistent with the intended train operation and in-service status of all devices, circuits and systems controlling or controlled by route locking.
- Track circuit (or alternate train detection method) setup and shunt test has been completed for all track circuits within the scope of this test.
- Switch relays or equations have been verified to lock the proper switches for each switch within the scope of this test.
- All track circuits within the approach have been verified to be properly represented in the approach relay logic or equation.
- Approach locking has been tested and found to operate properly.

2. Test procedure

Route locking test procedures shall be modified for each rail transit system's requirements (see "Note on alternate practices") but shall contain steps 1–9 below as a minimum. Test requirements represented here may be combined with other tests for efficiency or ease of execution. When performing this test procedure, ensure that non-vital logic does not mask the proper operation of the vital logic (if the configuration of the system prevents this, then the method of testing shall be addressed through a documented alternate practice). Where actual relays are not available to verify logic states, the test person shall use the OEM recommended microprocessor diagnostic tool to verify the internal states of vital logic equations.

1. Notify the Operations Control Center (OCC) and/or other authorities of the test activities to be performed.
2. Establish the route to be tested, and ensure that the controlling signal displays a permissive aspect and that the approach section is unoccupied.
3. Simulate occupancy of the first track circuit beyond the signal under test.
4. Verify that the signal displays a red aspect, the route request is canceled, the approach stick relay/equation is energized (after running time or quick release), and the appropriate route stick and lock relay(s)/equation(s) are de-energized. Where a two-track pickup of an approach stick is provided, it may be necessary to momentarily simulate occupancy of the second track circuit in the route to energize the approach stick relay/equation.
5. Simulate the movement of a train through the route by sequentially simulating occupancy of each track circuit within the route. Ensure that the next track circuit in the route is occupied before removing the occupancy from the previous track circuit.
6. With each change in occupancy, verify that each switch in the route is locked by observing the status of the appropriate route stick and lock relay(s)/equation(s). Where sectional release is used, verify that each section is released and that a new route cannot be established that would result in improper clearance between train movements.
7. Verify the appropriate route stick and lock relays/equations energized when the last track circuit occupancy is removed.
8. Restore the system to its original operating condition (close the opened gold nuts/test links, remove applied temporary jumpers, reset temporary time settings to documented times, etc.).
9. Notify the OCC and/or other authorities when testing is complete.

3. Correction of deficiencies

Deficiencies identified during route locking tests shall be corrected, retested and documented in accordance with OEM and/or agency requirements.

4. Documentation

Testing activities shall be documented, reviewed and filed in accordance with agency procedures.

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Related APTA standards

APTA STD-ADMIN-GL-002-22, “Definitions for Signal & Communications Terms”

APTA-RT-SC-S-035-03, Rev. 1, “Vital Processor-Based System Inspection, Testing and Configuration Control”

APTA-RT-SC-S-004-02, Rev. 1, “Approach Locking Tests”

APTA-RT-SC-S-006-02, Rev. 1, “Time Locking Tests”

References

In addition to the most recent edition of OEM specifications for testing route locking, as well as route aspect charts and/or track plans with route locking specifications for the signals under test, this document shall be used in conjunction with the following:

American Railway Engineering and Maintenance-of-Way Association (AREMA), “Communications and Signals Manual of Recommended Practices,” Part 2.4.5, Section G: Route Locking.

Federal Railroad Administration (FRA), Office of Safety, “Rules and Regulations Governing Railroad and Train Control Systems,” Section 236.379: Route Locking.

Definitions

disarrangement: Includes, but is not limited to, situations in which a relay, circuit board, termination shunt, joint bypass coupler or other electronic device is replaced with another; two or more conductors in a cable are severed; a cable or conductor in a warning system is replaced with another; or wires are removed at the same time from more than one terminal of a relay, electronic device, terminal board or other vital component of a warning system.

track circuit (or alternate train detection method): An electrical circuit that makes use of both rails to detect train occupancy of the track and, in response, to actuate signals, train control devices and grade crossing protective equipment. Also called “power frequency track circuit.”

Abbreviations and acronyms

OCC Operations Control Center
OEM original equipment manufacturer

Summary of document changes

- Document formatted to the new APTA standard format.
- Revisions made to the boilerplate sections for consistency among documents.
- Applied revisions addressing agreed-to comments from the March 10, 2016; June 8, 2016; and Oct. 4, 2016, committee meetings.

Document history

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