10. Standard for Traffic Locking Testing

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Abstract: This standard provides procedures for testing rail transit traffic locking.

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Introduction

(This introduction is not a part of APTA RT-SC-S-010-02, *Standard for Traffic Locking Testing*.)

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 testing rail transit traffic locking.

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 Traffic Locking Testing

1. Overview

1.1 Scope

This document establishes standard requirements for the testing rail transit traffic locking at conventional and NX type interlockings where traffic locking is used. Not all rail transit systems use traffic locking.

1.2 Purpose

The purpose of this standard is to verify that traffic locking circuitry and equipment are operating safely and as designed through periodic testing, thereby increasing reliability and reducing the risk of hazards and failures.

Traffic locking tests verify that traffic locking will prevent traffic from changing direction on a section of track in between interlockings while that section is occupied or while a signal displays an aspect to proceed into that section.

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 aspect: The visual appearance of a flag, lantern or the lens of a wayside signal, as viewed from the direction of an approaching train or a cab signal as viewed by an observer in the cab. An aspect conveys an indication.

2.1.2 block: A continuous section of track of defined limits, the use of which by rolling stock is governed by an ATC or wayside signals or both. A block may contain one or more track circuits.

2.1.3 block occupancy: The presence of a train in a track circuit or block or the resultant state achieved by shunting the rails of the track circuit.

2.1.4 clear signal: A signal displaying a permissive aspect.

2.1.5 conventional interlocking: An interlocking that uses a manual system of controls to align switches and clear signals to establish routes.

2.1.6 electric locking: The application of one or more electric locks or equivalent circuits, by which interlocked devices are secured against operation under certain conditions.

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

2.1.8 home signal: A controlled signal located at the entrance to one or more interlocked routes or blocks to govern trains entering or using those routes or blocks.

2.1.9 interlocking: An arrangement of signals and signal appliances so interconnected that functions must succeed each other in proper sequence, permitting train movements over controlled routes only if safe conditions exist.

2.1.10 lever: A hand operated switch for rapidly opening and closing a circuit.

2.1.11 locking: The electrical or mechanical establishment of a condition for a switch, interlocked route, speed limit or automatic function which cannot be altered except by a prescribed and inviolate sequence of unlocking actions.

2.1.12 non-vital logic: Software used in interlocking microprocessors that replaces the NX relay logic and used to perform non-vital functions.

2.1.13 NX interlocking: An Interlocking that uses a non-vital system of controls that automatically aligns switches and clears signals to establish interlocked routes by entrance and exit selection. The basic NX involves four non-vital logic circuits; Route Initiation, Storage, Completion and Check.

2.1.14 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**.

2.1.15 opposing route: Either of two routes that require opposite direction of running on the same interlocking block.

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

2.1.17 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.

2.1.18 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.**

2.1.19 route: The course, way or direction to be traveled from one controlled signal to another.

2.1.20 signal: An appliance that conveys information governing train movement.

2.1.21 switch: A track structure of movable running rails (points) with necessary fastening to provide a means for routing trains from one track to another.

2.1.22 timing device: A timing relay or mechanical timer whose contacts become open and/or closed upon completion of a definite (usually adjustable) time interval (up to several minutes) after the timing relay has been energized or mechanical timer set.

2.1.23 traffic: The prescribed direction of train operation in a section of track between Interlockings or between consecutive signals. The direction of traffic for a section of track is locked and cannot be changed when a block in that section is occupied or a signal is cleared for a route into that section.

2.1.24 traffic locking: Traffic locking is electric locking which prevents the manipulation of levers or other devices for changing the direction of traffic on a section of track in between interlockings while that section is occupied or while a signal displays an aspect to proceed into that section.

2.2 Acronyms

OCC	operations control center
OEM	original equipment manufacturer
PPE	personal protective equipment
RTS	rail transit system

3. Test requirements

3.1 Test frequency

The testing procedures in this standard shall be performed when an interlocking is placed in service, when traffic locking components are modified, repaired, or disarranged, or as otherwise deemed necessary by the RTS.

The RTS shall determine the need for additional test frequencies for traffic locking. 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

No consumable materials are required for testing traffic locking unless otherwise specified by the OEM and/or RTS.

3.4 Tools

The following tools are required for testing traffic locking:

- Multi-meter*
- RTS-approved portable radio
- 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 testing.

3.6 Safety

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

3.7 Test procedure

Traffic locking testing procedures may be modified for each rail transit system's requirements (see Section 1.3) but shall contain the steps listed in 3.7.1-3.7.11 as a minimum. When performing this test procedure, ensure that non-vital logic does not mask the proper operation of the vital logic.

3.7.1 Notify the operations control center (OCC) and/or other authorities of the test activities to be performed.

3.7.2 Set the direction of traffic to be tested by establishing a route.

3.7.3 Verify that the affected traffic relay is de-energized or equivalent processor function is restrictive.

3.7.4 Attempt to change the direction of traffic by aligning opposing routes at the exiting interlocking when the traffic is locked.

3.7.5 Ensure the direction of traffic cannot be changed, by verifying that signals for opposing routes do not clear and the signal for the route established in Section 4.7.4, at the entrance interlocking, remains clear.

3.7.6 Cancel the attempted opposing routes exiting interlocking.

3.7.7 Cancel the route previously established.

3.7.8 Verify traffic remains locked by de-energizing each track circuit within the traffic control limits and verify that the associated traffic relay remains de-energized or the equivalent processor function remains restrictive (direction of traffic cannot be changed). Simulation or actual block occupancy should be used to verify traffic locking for all blocks contained in the traffic control limit.

3.7.9 Verify traffic remains locked until the test is complete.

3.7.10 Notify the OCC and/or other authorities when testing is complete.

3.8 Correction of deficiencies

Deficiencies identified during traffic locking testing shall be corrected and documented in accordance with OEM and/or RTS requirements.

3.9 Documentation

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

Annex A

(Informative)

Bibliography

[B1] American Railway Engineering and Maintenance of Way Association, Communications and Signals Manual of Recommended Practices, 1996 Part 2.4.5 Section H: Traffic Locking.

[B2] Rules and Regulations Governing Railroad and Train Control Systems, Department of Transportation Federal Railroad Administration Office of Safety, Latest Revision February 14, 2000. Section: Inspection and Tests 236.381: Traffic Locking.

[B3] New York City Transit, Division of Signal Policy Instruction, Standard Test Instruction 11.006.2, Section 3.14, Traffic Locking, 1987.

[B4] Original equipment manufacturer (OEM) specifications for traffic locking testing.

[B5] Rail transit system (RTS) procedures for traffic locking testing.