6. Standard for Time Locking Testing

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

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Introduction

(This introduction is not a part of APTA RT-SC-S-006-02, *Standard for Time 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 time 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 Time Locking Testing

1. Overview

1.1 Scope

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

1.2 Purpose

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

Time locking tests verify that after a signal has been cleared and then set to stop, switches in the route governed by the signal cannot be operated and no conflicting routes can be set, until the predetermined time interval has elapsed.

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, abbreviations, and acronyms

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

2.1 Definitions

2.1.1 approach stick relay: A vital interlocking relay used in an approach locking circuit.

2.1.2 clear signal: A signal displaying a permissive aspect.

2.1.3 conflicting route: Two or more routes opposing, converging, intersecting, over which train movements can not be made simultaneously without the possibility of collision.

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

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

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

2.1.7 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.

2.1.8 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**.**

2.1.9 interlocking control panel: A panel displaying a line diagram of the trackage in and near a particular interlocking or group of interlockings, and equipped with various pushbuttons, electric switches, indicator lights and audible alarms to allow control and monitoring of that section of trackage.

2.1.10 interlocking machine: An assemblage of manually operated devices for the control of signals, switches or other units, and including mechanical or circuit locking or both to establish proper sequence of movements.

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

2.1.12 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.

2.1.13 non-vital logic: Software used in Interlocking Microprocessors that replaces the NX relay logic and used to perform non-vital functions.

2.1.14 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.

2.1.15 operations control center (OCC): A location or locations designed, equipped, and staffed for the purposes of monitoring and controlling RTS activities from a central location or locations. *Syn:* **rail control center, rail operations center, rail service control center**.

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 time locking: Either mechanical or electrical locking that prevents an established route from being changed until expiration of a predetermined time interval. Time locking is initiated when a signal is set to stop by a means other than normal train operation. Time locking differs from approach locking, as time locking is not conditional, and is in effect regardless if the approach track circuit is occupied or not.

2.2 Abbreviations and acronyms

ASR	approach stick relay
LED	light emitting diode
NX	entrance/exit
OCC	operations control center
OEM	original equipment manufacturer

PPE personal protective equipment
RTS rail transit system

3. Test requirements

3.1 Test frequency

Testing tasks for time locking shall be performed when an interlocking is placed in service, when time locking components are modified, repaired, or disarranged, or as otherwise deemed necessary by the RTS.

The RTS should develop test frequencies for time locking based on a number of additional factors, including but not limited to:

- 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 time locking unless otherwise specified by the OEM and/or RTS.

3.4 Tools

The following tools are required for testing time locking:

- Stopwatch

- Multi-meter*
- RTS-approved portable radio
- Standard tools carried by maintenance 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

Time locking testing procedures may be modified for each rail transit system's requirements (see Section 1.3) but shall contain the steps listed in 3.7.1-3.7.8 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 Establish a route and set the home signal to stop.

3.7.3 Verify that the affected timing device is functioning properly, affected lock relay is de-energized and/or the equivalent function is restrictive. At microprocessor interlockings with no external timing devices, monitor the processor LED governing the timing function on the route being tested, the interlocking control panel lights, or the lock out indication normally received at OCC and/or control towers.

3.7.4 Attempt to operate a switch contained in the route or align a conflicting route while the timer is running.

3.7.5 Verify that no conflicting routes can be aligned, the associated lock relay remains de-energized and/or the equivalent function remains restrictive during the time interval.

3.7.6 At conventional interlocking machines or control panels, operate the lever to the indicating position and attempt to restore lever to normal position while time release is operating. Lever should only release after the predetermined time interval has elapsed. The setting for a mechanical timer at a conventional interlocking is dependent on the specification of the interlocking.

3.7.7 Attempt to cancel the route while the timing device is running at relay interlockings. The route should not cancel, the ASR relay should remain de-energized, and/or equivalent function remains restrictive until the predetermined time interval has elapsed.

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

3.8 Correction of deficiencies

Deficiencies identified during time 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

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[B3] New York City Transit, Division of Signal Policy Instruction, Standard Test Instruction 11.006.2, Section 3.11, Time Locking, 1987.

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

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