

28. Standard for Vital Relay Testing

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Abstract: This standard provides procedures for testing rail transit vital relays.

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Introduction

(This introduction is not a part of APTA RT-SC-S-028-03, *Standard for Vital Relay 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 vital relays.

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 Vital Relay Testing

1. Overview

1.1 Scope

This document establishes standard requirements for testing rail transit vital relays.

1.2 Purpose

The purpose of this standard is to verify that vital relays are operating safely and as designed through periodic inspection and testing, thereby 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 car carried relay: A relay installed on transit cars.

2.1.2 contact: A conducting part which co-acts with another conducting part to open or close an electric circuit.

2.1.3 direct current (dc) polar relay: A relay which operates in response to a change in the direction of direct current in its controlling circuit and the armature of which may or may not remain at full stroke when its control circuit is interrupted.

2.1.4 distilled water: Water that has been purified through an evaporation/condensation process.

2.1.5 electro-mechanical code rate transmitter relay: A device which uses electrical energy to produce an oscillating action to vary periodically an electrical circuit at a definite predetermined code frequency.

2.1.6 electro-mechanical timer relay: A motor driven relay with or without an electrically operated clutch, which will not close its front contacts or open its back contacts, or both, until the expiration of a definite time interval after the relay has been energized.

2.1.7 gasket: A sealing device used to protect equipment and used to prevent gases or liquids from passing through.

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

2.1.9 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.**

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

2.1.11 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.

2.1.12 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.**

2.1.13 relay drop-away level: The level of current at which a relay armature drops to the normally de-energized state. *Syn:* **release value.**

2.1.14 relay pick-up level: The minimum current required to move a relay armature from one state to another when its coil is energized.

2.1.15 seal (tamper evident): A device used to identify tampering and/or unauthorized access to a relay's internal components.

2.1.16 seal: A device used to prevent gases or liquids from passing through.

2.1.17 sealed battery system: A network of batteries sealed to prevent the leakage of its gas or liquid contents.

2.1.18 vane relay: A type of alternating current relay in which a metal disc (vane) moves in response to current in the controlling circuit.

2.1.19 vented lead acid battery: A non-sealed storage battery consisting of electrodes.

2.1.20 vital relay: A relay, meeting certain stringent specifications, so designed that the probability of its failing to return to the prescribed state upon de-energization is so low as to be considered practically nonexistent.

2.2 Acronyms

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

3. Testing requirements

3.1 Testing frequency

The testing procedures in this standard shall be performed

- a) annually
- b) when vital relays are placed in service,
- c) when vital relays are modified, repaired, or disarranged
- d) at the frequencies recommended in Table 1 below
- e) as otherwise deemed necessary by the RTS

Table 1 – Testing frequencies

Relay types	Recommended test frequency (minimum)
Vane, dc polar, electro-mechanical timers, electro-mechanical code-rate transmitters/receivers	Every two years
Electronic/solid state timers code-rate transmitters/receivers	Every four years
Car carried vital relays	Every six years
All other vital wayside relays	Every four years

The RTS shall determine the need for additional testing frequencies for vital relays. 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 should 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 material are required for testing vital relay unless otherwise deemed necessary the by the OEM and/or RTS.

3.4 Tools

The following tools are required for testing vital relays:

- Stop watch
- Multi-meter*
- Power source*
- Relay test unit*
- RTS-approved portable radio
- Standard tools carried by maintenance personnel

* 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 and maintenance.

3.6 Safety

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

3.7 Test procedure

Vital relay testing procedures may be modified for each rail transit system's requirements (see Section 1.3) but shall contain the steps listed in Sections 3.7.1-3.7.6 as a minimum, using the approved procedures for the specific relay under test.

- 3.7.1** Notify the operations control center (OCC) and/or other authorities of the test activities to be performed.
- 3.7.2** Check the relay pick-up for proper operation in accordance with RTS procedures. Visually observe the armature and other movements and verify there are no defects or binding.
- 3.7.3** Check the relay drop-away for proper operation in accordance with RTS procedures. Visually observe the armature and other movements and verify there are no defects or binding.
- 3.7.4** Visually inspect the relay for burned, damaged, misaligned, corroded, or other contamination of the contacts.

3.7.5 Visually inspect the relay for loose, heavily discolored or broken covers, broken seals, loose or broken gaskets, foreign material, or evidence of wear and deterioration.

3.7.6 Notify the OCC and/or other authorities when inspection is complete.

3.8 Correction of deficiencies

Deficiencies identified during vital relay 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] Alstom (formerly General Railway Signal) Engineering Data Sheets.
- [B2] AREMA Manual of Recommended Practices – Communications and Signals Manual Part 2.2.12 (Recommended Functional/Operating Guidelines for Vital Software Based Interlocking Systems).
- [B3] AREMA Manual of Recommended Practices – Communications and Signals Manual Part 2.4.1 (Recommended Instructions for Inspection and Test of Signal Installations before Placing in Service).
- [B4] AREMA Manual of Recommended Practices – Communications and Signals Manual Part 2.4.10 (Recommended Instructions for Interlockings).
- [B5] Original equipment manufacturer (OEM) specifications for vital relay testing.
- [B6] Rail transit system (RTS) procedures for vital relay testing.
- [B7] Union Switch & Signal Engineering Data Sheets.