



Inspection and Maintenance of Train Stops

Course 203

PARTICIPANT GUIDE

 SIGNALS TRAINING CONSORTIUM

Inspection and Maintenance of Train Stops

Participant Guide

Signals Maintenance Training Consortium

COURSE 203

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PREVIEW ONLY

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PREVIEW ONLY

How to Use the Participant Guide

Purpose of the Course

The purpose of the *Inspection and Maintenance of Train Stops* course is to assist the participant in demonstrating safety inspection and maintenance of switches, derails, and their associated components.

Approach of the Book

Each course module begins with an outline, a statement of purpose and objectives, and a list of key terms. The *outline* will discuss the main topics to be addressed in the module. A list of *key terms* identifies important terminology that will be introduced in this module. *Learning objectives* define the basic skills, knowledge, and abilities course participants should be able to demonstrate to show that they have learned the material presented in the module. A list of *key terms* identifies important terminology that will be introduced in each course module. *Review exercises* conclude each module to assist the participants in reviewing key information.

PREVIEW ONLY

Module 1

OVERVIEW AND SAFETY

Outline

- 1-1 Overview**
- 1-2 Safety**
- 1-3 Tools**
- 1-4 Testing**
- 1-5 Record Keeping**
- 1-6 Summary**

Purpose and Objectives

The purpose of this module is to provide an overview of the safety procedures to be performed during the inspection and maintenance of train stops.

Following the completion of this module, the participant should be able to complete the exercises with an accuracy of 70% or greater:

- Identify proper PPE to be used during the inspection and maintenance of train stops
- Describe Operation Control Center notification process
- Describe adverse working conditions
- Describe procedures for working in electrified territory
- Identify pinch points related to inspection and maintenance of train stops
- Identify trip, slip and fall hazards related to inspection and maintenance of train stops
- Identify and describe the standard safety tools and devices specific to the inspection and maintenance of train stops
- List tests and frequency for each tests (monthly, quarterly, etc.) as per your authority
- For each test, identify documentation that needs to be done as per location and regulating authority
- Demonstrate ability to complete proper documentation as per location and regulating authority

Key Terms

- Cycle test
- Dielectric blanket
- Fouling
- Job Safety Analysis (JSA)
- Operational Control Center (OCC)
- Out-of-Service (OOS)
- Personal Protective Equipment (PPE)
- Rail cover
- Rail Transportation Authority (RTA)
- Right of way (ROW)
- Standard Operating Procedure (SOP)
- Safety tools
- Securing the area
- Time on line

1-2 SAFETY

Prior to performing any type of train stop related tasks, signal maintainers should familiarize themselves with the scope of work to be performed. Signal maintainers should also identify all potential safety hazards that are present at the work site. Applying these approaches will ensure that work is completed timely and safely. Always follow your transportation authority's **standard operating procedures (SOPs)** when working. Additional safety measures such as daily safety job briefings and applying a **job safety analysis (JSA)** may also be incorporated. Note that utilizing **Personal Protective Equipment (PPE)** when performing work related tasks is essential to working safely.

Personal Protective Equipment (PPE)

Typical PPE (Figure 1.1) that is commonly utilized when performing work on train stops include:

- Reflective vest
- Safety code work boots
- Hard hat
- Gloves
- Safety glasses / goggles
- Portable radio



Figure 1.1 Proper PPE for Inspection and Maintenance of Train Stops

Safety Tools

While requirements for each RTA will differ, below are a few commonly used **safety tools** for the inspection and maintenance of train stops:

- Safety flags
- Beacons
- Portable radio
- Flash light
- Air horns
- Whistles

For example, the Massachusetts Bay Transit Authority (MBTA) requires signal maintainers to carry a highly visible reflective **safety bag**, also called a flag bag, when performing inspection and maintenance. This safety bag contains the safety tools (Figure 1.2) listed above as well as many of the PPE items shown in Figure 1.1.



Figure 1.2 Safety Bag with Safety Tools for Inspection and Maintenance

Module 2

TRAIN STOPS SPECIFIC PRINT READING

Outline

- 2-1 Overview
- 2-2 Train Stops and DED Specific Nomenclature
- 2-3 Train Stops and DED Specific Symbols
- 2-4 Train Stops Sequence of Operation
- 2-5 DEDs Sequence of Operation
- 2-6 Summary

Purpose and Objectives

The purpose of this module is to provide insights to interpreting typical design circuits associated with train stops and dragging equipment detectors. Typical circuit nomenclature and circuit design will be presented.

Following the completion of this module, the participant should be able to complete the exercises with an accuracy of 70% or greater:

- List typical train stop nomenclature
- List train stops specific relays and describe their functions
- Given a print for a specific electric train stop, describe the sequence of operation
- Given a print for a specific electro-pneumatic train stop, describe the sequence of operation
- Given a print for a specific dragging equipment detector (DED) circuit, describe the sequence of operation
- Demonstrate ability to outline the sequence of operation of an electric train stop
- Demonstrate ability to outline the sequence of operation of an electro-pneumatic train stop
- Demonstrate ability to outline the sequence of operation of a DED

Key Terms

- Activation relay
- Cab code delivery
- Central Instrument Location (CIL)
- Circuit controller
- Distant Trip Relay (DVR)
- Dragging Equipment Detector (DED)
- DED circuitry
- DED home signal control
- Home Stick Relay (HSR)
- Nomenclature
- Push button circuitry
- Relay
- Relay contacts
- Sequence of Operation
- Signal aspect
- Signal circuit
- Slot-off
- Trip recycling circuit
- Trip vane actuators
- Trip Relay (VR)
- Trip Repeater Relay (N/RVPR)

2-3 TRAIN STOP AND DED SPECIFIC SYMBOLS

An earlier 100 level course explained that railroad symbology can vary from generic electrical symbology. Additionally, there are subsets of railroad symbology that are common to railroad train stops and dragging equipment detectors (DEDs). Table 2.5 lists the generic railroad symbols that are directly applicable to inspection and maintenance of train stops and DEDs. These are generic symbols and may vary some according to location and manufacturer. Use the Notes section to add the symbol(s) used by your transit authority.

Table 2.5 Generic Signal Symbols that are Applicable to Train Stops and/or DEDs

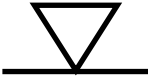

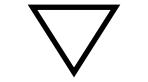

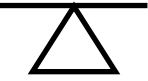




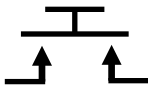
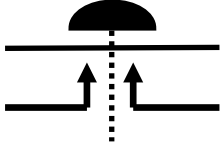
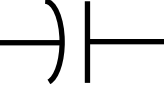
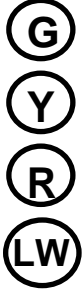


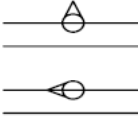


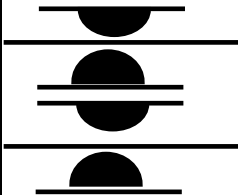
Item	Example 1	Example 2	Notes
Front Contact (making with a heel) Energized Coil Relay is up			
Front Contact (not making with a heel) De-Energized Coil Relay is			
Back Contact (making with a heel) De- Energized Coil Relay is down			
Back Contact (not making with a heel) Energized Coil Relay is up			
Relay Coil Bias Neutral (Polarity Sensitive)			
Push Button Ex. 1-DED Ex. 2-Electric Train Stop			
Capacitor (Fixed)			

Table 2.5 Generic Signal Symbols that are Applicable to Train Stops and/or DEDs (continued)

Item	Example 1	Example 2	Notes
Signal Light Letters indicate colors: Green, Yellow, Red, Lunar White			
Termination Link (aka Test Terminal)			
Automatic Trip Train Stop STOP and CLEAR			
Electro Pneumatic Train Stop Valve			
Wires Entering or Leaving Signal Station or Housing			
Dragging Equipment Detector			

Module 3

ELECTRIC TRAIN STOPS

Outline

- 3-1 Overview**
- 3-2 General Inspection and Maintenance**
- 3-3 Component Specific Inspection and Maintenance**
- 3-4 Lubrication Specifications**
- 3-5 Testing**
- 3-6 Summary**

Purpose and Objectives

The purpose of this module is to provide an overview of the inspection and maintenance of electric train stops to ensure they are operating safely and appropriately and thereby increase their reliability and reduce the risk of hazards and failures.

Following the completion of this module, the participant should be able to complete the exercises with an accuracy of 70% or greater:

- Inspect/test and maintain contacts
- Inspect/test and maintain push button
- Inspect/test and maintain holding circuits
- Inspect/test and maintain capacitors
- Inspect/test and maintain resistors
- Inspect/test and maintain motor
- Inspect/test and maintain cribs
- Inspect/test and maintain wire connections
- Inspect/test and maintain exterior stop box housing
- Inspect/test and maintain exterior heaters
- Check for appropriate clearances when gauging trip arm in accordance with authority guidelines
- Perform a trip arm cycle test

Key Terms

- Ballast
- Clevis cotter pin
- Contact fingers and tips
- Gear case
- Gear train
- Hasp threads
- Hasp pivot pin
- Outboard bearing
- Output shaft bearing
- Pinion gear
- Return spring
- Sector gear
- Sector gear buffer
- Tool box talk

3-1 OVERVIEW

The safe and efficient operation of rail transportation systems (RTS) is greatly dependent on reliable rail signals and related devices to control train operations. As such, signal maintainers are responsible for inspecting, testing and maintaining train stops on the property of their transportation authority.

Course 103 Overview and Introduction to Train Stops provided an introduction to a variety of train stops—how they function and their basic components. This module will focus on the inspection and maintenance of electric train stops. Specifically, how to inspect, clean and adjust train stop components as well as lubricate them, when required, will be outlined. In addition, the inspection and maintenance of certain mechanical parts, including the contacts, push button, holding circuits, capacitors, resistors, motor, cribs, wire connections, exterior stop box housing, and heaters will be discussed.

It is recommended that the inspection and maintenance procedures outlined below be performed when electric train stop mechanisms are placed in service, modified, repaired, disarranged or as otherwise deemed necessary by your transportation authority. As always, follow the guidelines your transportation authority and/or OEM during inspection and maintenance procedures.

Note that this module uses the Twinco train stop (Figure 3.1) as the example for an electric train stop as it is most common amongst transportation authorities.



Figure 3.1 Twinco Train Stop ©Twinco





3-2 GENERAL INSPECTION AND MAINTENANCE

Any general inspection and maintenance begins with a job briefing or what is referred to as a **tool box talk** by some transportation authorities. Before performing any inspection and maintenance activities, your first step is to obtain proper authority for track occupancy from Operations Control Center (OCC) and /or other authorities in accordance with your RTS. Also perform a radio check to ensure it is functioning properly.

When doing any inspection and maintenance include a sensory inspection as described in Table 3.1. For train stops this includes walking on both the inside and outside of the tracks surrounding the area of the train stop components to make sure that all hardware is in place, clean and secure. One visual sign that may indicate that hardware is not secure is the presence of rust around that hardware. Tighten any loose hardware and replace any pieces that are missing. Hardware to check includes:

- Nuts and Bolts
- Plates
- Heater Terminations
- Bonding
- Ground Wires
- Stop Nut

Table 3.1 Sensory Inspection of Electric Train Stops

Sense	Example Problems
Sight 	Trash and debris, dirt, clutter, rust, worn insulation, lubricant outside the stop box, defective latches, covers, etc.
Hearing 	Motor operation (grinding noise)
Touch 	Loose components, hardware, conduit connections, etc.
Smell 	Electric burning odor; smoldering debris in the crib

Be sure to pay special attention to the condition of the trip arm. Check for items that may inhibit the smooth movement of the trip arm (Figure 3.2).

Module 4

ELECTRO-PNEUMATIC TRAIN STOPS

Outline

- 4-1 Overview
- 4-2 General Inspection and Maintenance
- 4-3 Component Specific Inspection and Maintenance
- 4-4 Testing
- 4-5 Summary

Purpose and Objectives

The purpose of this module is to provide an overview of the inspection and maintenance of electro-pneumatic train stops to ensure they are operating safely and appropriately and thereby increase their reliability and reduce the risk of hazards and failures.

Following the completion of this module, the participant should be able to complete the exercises with an accuracy of 70% or greater:

- Inspect/test and maintain the following mechanical parts:
 - Contacts
 - Push button / Key release
 - Holding circuits
 - Cribs
 - Wire connections
 - Exterior stop box housing
 - Exterior heaters
 - Air line
 - Solenoid / Magnet
- Check for appropriate clearances when gauging trip arm in accordance with RTS guidelines
- Perform a trip arm cycle test

Key Terms

- Air line
- Armature
- Back finger
- Bearing strap
- Contact spring
- Front finger
- Grease fittings
- Heel
- Magnet
- Return spring
- Rocker shaft
- Tool box talk
- Universal coupling
- Z armature

Tools and Materials

As mentioned in previous train stop modules, the signal maintainers are required to have a set of RTS-approved tools to test and maintain train stops. When working on electro-pneumatic train stop mechanisms the following tools are required:

- Authority specific trip arm gauge
- Air pressure gauge (Figure 4.2)
- Ruler
- Multi-meter (calibrate according to OEM and RTS guidelines)
- Terminal nut wrench
- RTS-approved portable radio
- Other OEM recommended tools.



Figure 4.2 Air Pressure Gauge

The following materials are required for inspecting and maintaining electro-pneumatic train stop:

- grease gun
- rags
- oil can
- trash bags and ties
- scrapers
- wire brush
- paint
- cleaning and dusting brushes
- lint-free cloths
- RTS-approved degreaser, contact cleaner and other materials

Module 5

DRAGGING EQUIPMENT DETECTORS

Outline

- 5-1 Overview
- 5-2 Sensory Inspection
- 5-3 Tools
- 5-4 Component Specific Inspection and Maintenance
- 5-5 DED Trip Vane Inspection and Testing
- 5-6 DED Trip Vane Maintenance Schedule
- 5-7 Cleaning and Lubrication
- 5-8 Summary

Purpose and Objectives

The purpose of this module is to provide an overview of the inspection and preventive maintenance to be performed on dragging equipment detectors.

Following the completion of this module, the participant should be able to complete the exercises with an accuracy of 70% or greater:

- Inspect/test dragging equipment detector (DED)
- Inspect/test and maintain the following components:
 - Contacts
 - Reset push button
 - LED wayside display station
 - Wire connections
 - Grease/lubricate DED
- Check for appropriate trip vane clearances
- Tighten mounting/hold down hardware
- Perform cycle check

Key Terms

- Cab Code
- Protective circuit
- Retrofit switch assembly
- Zerk fitting
- Railroad test meter
- Switch contact assembly
- Trip vane actuator

5-1 OVERVIEW

Dragging Equipment Detectors (DEDs) are protective devices installed to restrict and/or interrupt train movement prior to entering interlockings and storage yard facilities. It is at these locations where damage to wayside equipment is highly likely to occur. As explained in *Course 103 Introduction and Overview of Train Stops*, DEDs are also known as *automatic train protection (ATP)* and *paddle draggers*. These devices detect the presence of objects under the body of a moving train which is dragging on, or near to, the track in between the rails. The height of the DED is determined by balancing the risk of not detecting an object versus the likelihood of unnecessarily stopping the train or high rail vehicle. Typically, DED trip vanes are installed at a height equal to the top of the rail. Further details on adjusting the DED height will be addressed in the section below - outlined in the general inspection and maintenance of dragging equipment detectors.

In addition to general inspection and maintenance, this module will focus on the DED trip vane (Figure 5.1) inspection and testing as well as to provide suggested frequency of periodic maintenance. Recommended tools for maintaining DEDs will also be given.



Figure 5.1 Dragging Equipment Detector (DED) Trip Vane

It is recommended that the inspection and maintenance procedures outlined below be performed in accordance with your transit authority and/or OEM guidelines. Note that this module uses the GE Dragging Equipment Detector as the example for a DED as it is used by many transportation authorities.

Figure 5.16 depicts a typical DED maintenance and testing report used on a semi-annual basis.

Typical DED Semi-annual Maintenance & Testing Report							
DED Device	Trip Vane Actuated		DED Warning Display(s) Flashing	Home Signal Slots off to Red	Cab Code Delivery Rate (no code)	DED Wayside Display/Reset Station(s) Inspected	Comments (adjustments & repairs)
	Contact Assembly Inspected	Trip Vane Restores on Center					
80L	✓	✓	✓	✓	✓	✓	N/A

FIGURE 5.16 DED SEMI-ANNUAL MAINTENANCE AND TESTING REPORT