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Inspection and Maintenance of Track Circuits

Course 201

PARTICIPANT GUIDE



 SIGNALS TRAINING CONSORTIUM

Inspection and Maintenance of Track Circuits

Participant Guide

Signals Maintenance Training Consortium

COURSE 201

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How to Use the Participant Guide

Purpose of the Course

The purpose of the *Inspection and Maintenance of Track Circuits* course is to assist the participant in demonstrating safety inspection and maintenance of different type of track circuits used in railway transit systems.

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.

Module 1

Overview and Safety

Outline

- 1-1 Overview
- 1-2 Track Circuit Safety
- 1-3 Measuring Track Circuit Current Flow
- 1-4 Tools
- 1-5 Maintenance Schedules
- 1-6 Record Keeping
- 1-7 Summary

Purpose and Objectives:

The purpose of this module is to provide the participant with an overview to inspecting and maintaining track circuits.

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

- Use safety measures when working around track circuit
- Identify authority-specific maintenance procedures
- Record maintenance work performed
- Identify tools used in track circuit inspection and maintenance work
- Specify inspection and maintenance timetables for track circuits

Key Terms

- Best Practice
- Insulated Joint Checker
- Preventive Maintenance (PM) Sheets
- Clamp-on Amp Meter
- Insulation resistance
- Relay Tester
- Continuing Safety Education
- Jumper
- Shunt Strap
- Corrective Maintenance
- Maintenance Schedule
- Troubleshooting
- Data Sheet
- Megger
- Volt-Ohm-Meters (VOMs)
- FRA Code
- Multimeter
-
- Safety-sensitive work
- Oscilloscope
-

1-1 Overview

In the previous course, Course 101 *Overview and Introduction to Track Circuits*, the participant was introduced to track circuits and their basic components. The approach to this next level of training, Course 201 *Track Circuits Inspection and Maintenance*, is to help the participant hone essential skills for inspecting and maintaining track circuits. In doing so, this module supplements and enhances on-the-job, classroom, and other training the signal maintainer will receive from their rail transit agency.

This course was developed by a consortium of signal specialists from several rail transportation systems that, on the federal level, are governed by the Federal Railroad Administration (FRA) or the Federal Transportation Administration (FTA). Each federal agency provides the baseline for compliance in areas of safety, testing, maintenance, and record keeping pertaining to track circuits. This module uses the guidelines outlined in FRA §236 for inspection, testing, maintenance and repair as the minimum standard. Each rail transit authority may prescribe additional or more stringent guidelines. The FRA guidelines also prescribe standards to ensure that personnel working with, and affected by, safety-critical train control system related products receive appropriate training and testing.

One focus of this module is on the practice of safety for signal maintainers working around track circuits. As such, this module enhances standard safety policies of the participant's rail transportation system as well as the principles of safety covered in your orientation and in Course 100 of this series of courses, particularly the module on *Signal Maintainer Worker Safety*.

Safety extends to the proper use of tools when inspecting and maintaining track circuits. This module discusses the safe use of standard tools the signal maintainer can expect to use when working on track circuits.

Every rail transportation system adheres to strict record-keeping and timetables for inspection and maintenance. These practices ensure the safety of rail passengers, workers, and properties. This module gives a thorough overview of maintenance record keeping.

This module forms the foundation of the specifics of preventive maintenance for the other modules which cover specific maintenance steps of Direct Current (DC), Alternate Current (AC), Audio Frequency (AF) coded and electronic track circuits. Within this module track circuit worker safety, tools, and maintenance timetables are presented.

Some common acronyms are used throughout this course are:

- APTA The American Public Transportation Association
- AREMA American Railway Engineering and Maintenance-of-Way Association
- FRA Federal Railroad Administration
- FTA Federal Transportation Administration.
- OEM Original Equipment Manufacturer
- PPE Personal Protective Equipment
- RTS Rail transportation system

1-2 Track Circuit Safety

Safety is at the core of the career of a signal maintainer and it should always be a priority on every project or work order. Since 2011, accidents attributed to human factors accounted for almost 40 percent of all reported train accidents, resulting in millions of dollars in damages to the United States' railroad industry. Accidents attributed to human factors unlike any other causes except "miscellaneous", have also increased since 2010. See Table 1.

Table 1 Percentage Frequency of All Train Accidents by Cause

Cause	2009	2010	2011	2012	*2013
Human factors	34	34	37	38	37
Track & Signal defects	38	39	36	36	35
Equipment defects	14	13	12	12	11
Miscellaneous causes	14	14	16	15	16
TOTAL	100	100	100	100	100

*January to August data

Source: FRA Safety Data <http://safetydata.fra.dot.gov>

From FRA's *Compliance with Railroad Operating Rules and Corporate Culture Influences*

Employees who perform their jobs in an unsafe manner usually violate operating and safety rules. Human-factors related incidents are caused, or influenced by, unsafe work behavior and attitudes, as opposed to non-behavior related factors like inclement weather or undetected faulty track. Therefore, *nearly all human-factor incidents and injuries can be associated with one or more operating or safety rule violations.*

Every employee in railroad operations must follow a set of operating and safety rules when performing their work. Examples of these rules could be

- Railroad Rule Book
- Standard Operating Procedures (SOP)
- Operation Rules and Procedures (ORP)
- Right Of Way (ROW) Procedures



Classroom Activity Sheet 1

Write down the names of your agency's set of operating rules.

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Typically, operations and safety procedures define:

- Who can perform test
- Location where inspections will be performed
- Safety precautions/PPE
- Instructions for visual inspections
- Information to be collected
- Criteria for determining violation
- Immediate corrective action

Each rail transit authority provides its signal maintainers with **continuing safety education** which not only involves the practice of safety but also the identification and correction of unsafe conditions



Warning: Safety Precautions

Work on track circuits typically involves working when circuits are energized.
BE AWARE

Signal maintenance on the track circuit is dangerous work. This module lists some of the **best practices** for safely working around track circuits developed by experienced signal maintainers and rail transit experts. In track circuit maintenance, a best practice for safety is a well-defined method that contributes to the safety of those working on and using the rail system.

All rail signal systems require electrical energy or power for their operation and the signal maintainer is always working in **safety-sensitive** environments.

There are two forms of electrical power used in the operation of signal equipment: alternating current (AC) and direct current (DC). In many cases the electrical power is supplied in the form of alternating current and converted or rectified to direct current at the location or point of use. Both the alternating current power supply and current power supply and the rectified direct current are considered primary sources of power. Another source of power known as a secondary source is the storage battery.

Some best practices for safely working on track circuits are:

- Always wear correct PPE.
- Apply work area policies per the RTS and other jurisdictions.
- Dispatcher or operations control must be aware that you are working on a specific track circuit. Always notify operations of your working location.
- Be aware that voltages and currents of any device used in a track circuit can be hazardous.