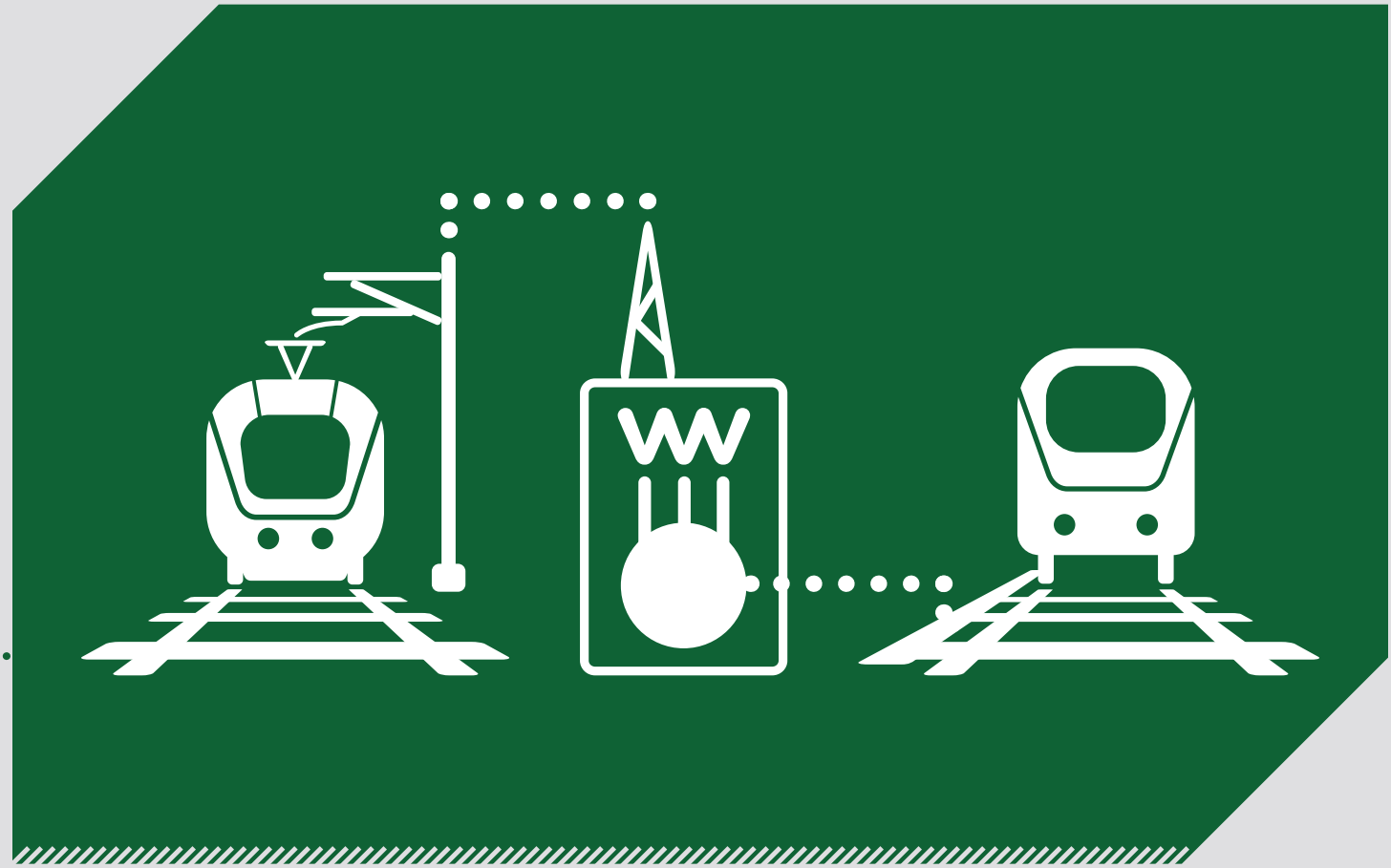

Traction Power Course Catalog

TRACTION POWER TRAINING CONSORTIUM

Contents

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Please note: All images contained within this document were contributed by members of the National Traction Power Training Consortium unless otherwise noted.

Overview

Launched in early 2020, the National Traction Power Training Consortium (Traction Power Consortium or Consortium) is a four-year project that is developing ready-to-use training materials for upskilling new and experienced traction power technicians working in transit jobs.

The Consortium is a group of public transportation agencies that are members of the American Public Transportation Association (APTA). Within these agencies, traction power systems are also referred to as rail or train electrification systems. Each participating agency assigns two subject matter experts (SMEs) to advise instruction designers, provide content, and help shape the Consortium courses. As of June 2022, the ten agencies working with the International Transportation Learning Center on the Traction Power Consortium are listed in Figure 1.

Figure 1 National Traction Power Training Consortium Member Locations

AGENCY	UNION	LOCATION
BART	SEIU 1021	Oakland, CA
Bi-State Development MetroLink	IBEW 2 IBEW 399	St. Louis, MO
CATS		Charlotte, NC
DART	ATU 1338	Dallas, TX
GCRTA	ATU 268	Cleveland, OH
Metro Transit	ATU 1005	Minneapolis, MN
NFTA	ATU 1342	Buffalo, NY
SacRT	IBEW 1245	Sacramento, CA
SEPTA	TWU 234	Philadelphia, PA
Tacoma Link Sound Transit		Tacoma, WA
VTA	ATU 2665	Santa Clara, CA

The focus of the Traction Power Consortium is to develop courses on topics such as power distribution, substations, overhead systems, and third rail systems. For each topic, courses are created at three levels:

100 Level Introduction and Overview

200 Level Inspection and Maintenance

300 Level Troubleshooting, Adjustment, and Repair

Figure 2 shows the training courses by topic areas and course level.

Figure 2 National Traction Power Training Consortium Course Sequence

Topic Areas	Course No.	100 LEVEL Introduction and Overview	Course No.	200 LEVEL Inspection and Maintenance	Course No.	300 LEVEL Troubleshooting, Adjustment and Repair
Overview	100	Overview, General Safety, and Regulations of Traction Power Systems	200	Prep for Insp and Maint of Traction Power Systems	300	Principles of Troubleshooting Traction Power Systems
Power Distribution	101	Introduction to Traction Power Distribution	201	Insp and Maint of Power Distribution	301	Troub, Adjust & Repair of Power Distribution
Substations	102	Introduction to Substations	202	Insp and Maint of Substations	302	Troub, Adjust & Repair of Substations
Overhead Systems	103	Introduction to Overhead Systems	203	Insp and Maint of Overhead Systems	303	Troub, Adjust & Repair of Overhead Systems
Third Rail	104	Introduction to Third Rail Systems	204	Insp and Maint of Third Rail Systems	304	Troub, Adjust & Repair of Third Rail Systems
Control Systems	105	Overview to Control Systems				
Rigging	106	Overview to Rigging and Lifting with Vertical and Horizontal Loads	206	Rigging and Lifting Operations		

For each course, deliverables include:

- Participant guides
- Instructor guides
- PowerPoints with instructor notes
- Pre- and post-course assessments
- Module quizzes
- Instructional videos
- Hands-on learning activities

Member agencies have the advantage of implementing completed courses immediately while working with subject matter experts across the country to develop new material. The participatory process (including running pilot courses on new material) accelerates the learning process for frontline technicians.

Updated 08-21-2023

100 Level Courses

Course TP100: *Overview, General Safety, and Regulations of Traction Power Systems*

This half-day course presents an overview of safety and regulations for working around traction power systems. The class focuses on the history of traction power systems as well as the major safety concerns, standard practices, regulatory authorities, and tools used in working on traction power systems.

This course is organized into four modules. Within each module there may be several learning application activities and demonstrations. Before starting the module instruction, participants are expected to complete a pre-course assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a post-course assessment as well as a course evaluation.

Module 1: History and Overview of Traction Power Systems

A brief overview to the history of traction power systems (aka rail electrification systems), provides a summary of the basics needed for an understanding of traction power functions, and an overview of the guidelines for training traction power maintainers.

Module length	25 minutes
Number of slides	13
Videos included?	Yes
Quiz?	No

Learning Objectives

Following the completion of this module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- Recall the history and functions of traction power leading up to the 21st century.
- Identify basic functions and features of each mode of traction power system.
- Recall basic health and safety features of working with traction power systems.

Module 2: Major Safety Concerns and Standards Practices

Outcome: This Module presents an introduction to the major safety concerns and standards that public transportation agencies are always looking to reduce and prevent. High voltage safety and arc flash safety are covered, but optional dependent on the local training procedures. This module also covers common practices that can reduce occupational hazards and identifies necessary PPE.

Module length	90 minutes
Number of slides	28
Videos included?	No
Quiz?	No

Learning Objectives

Following the completion of this module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- Identify the major safety concerns for traction power systems and their respective avoidance/prevention methods.
- Identify High Voltage safety basics and prevention techniques.
- Identify Arc Flash hazards, safety and prevention methods.
- Identify burn avoidance and prevention methods.
- Recall the steps for emergency response and preparedness for traction power hazards.
- Recall the standard safety practices and methods for reducing hazardous conditions such as LOTO, removing power and zero energy states, and handling electrical equipment.
- Identify proper general personal protective equipment [PPE] for use in a traction power system.

Module 3: Regulatory Authority

Outcome: Introduces what regulatory authority is and the major federal organizations that oversee and regulation public transportation health and safety standards. Part of this module also introduces several important publications by a few agencies that are important to traction power maintenance work.

Module length	24 minutes
Number of slides	13
Videos included?	No
Quiz?	Yes

Learning Objectives

- Identify the function of a regulatory agency.
- Recall the major federal and state level regulatory authorities.
- Recall the major codes and standards for general regulation of traction power systems.

Module 4: Tools of the Trade

Outcome: presents new maintainers with common tools that are used in traction power maintenance.

Module length	26 minutes
Number of slides	16
Videos included?	Yes
Quiz?	No

Learning Objectives

- Identify the functions and use of a DC Voltmeter
- Identify the functions and use of a Digital Voltmeter
- Identify the functions and use of a hot stick
- Identify the functions and use of grounding cables
- Identify the functions and use of Hi-Pot testing and a digital low resistance ohmmeter.

Course TP101: *Introduction to Traction Power Distribution*

This one-day course gives an overview of power as it is generated and distributed to the transit agency and eventually the rail car. This course is one in the series of Consortium courses on traction power.

Participants engage in a series of activities and course content is supplemented with examples to support participants' successful application to their work.

This course consists of seven modules. Within each module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation.

Module 1: Overview to Power Distribution

Outcome: This module gives an overview of power as it is generated and distributed to the transit agency and eventually the rail car.

Module length	TBD
Number of slides	33
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe the history of power distribution.
- Explain the purpose and methods of power distribution in transit.
- Differentiate between power distribution used in transit systems.
- Identify operating voltages.

Module 2: Power Distribution Systems

Outcome: This module gives an overview of the principles of operation of power conversion and distribution for traction power use.

Module length	TBD
Number of slides	25
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe the components used for power distribution of overhead systems.
- Describe the components used for power distribution of overhead contact systems.
- Describe the components used for power distribution of third rail systems.

Module 3: Cables and Feeders

Outcome: This module gives an overview the cables and feeders used for the distribution of power between the substation and rail vehicles.

Module length	TBD
Number of slides	59
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe feeders.
- Describe AC feed and related components.
- Describe DC positive feed and related components.
- Describe DC negative return and related components.
- Describe Ariel cable components.
- Describe underground cable components.

Module 4: Bonds

Outcome: This module gives an overview of the bonds used for the distribution of power between the substation and rail vehicles.

Module length	TBD
Number of slides	19
Videos included?	No
Quiz?	Yes

Learning Objectives

- Differentiate between types of bonds.
- Describe methods of bond attachment.
- Explain the effect of improper bonding.

- Describe impedance bonds.
- Explain traction power as it relates to the track circuit.

Module 5: Switches

Outcome: This module gives an overview of the principles of switches used for the distribution of power between the substation and rail vehicles.

Module length	TBD
Number of slides	22
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe wayside disconnect switches.
- Describe the fuse disconnect switch.

Describe switch mounting.

Module 6: Sectionalizing

Outcome: This module gives an overview of the principles of sectionalizing used for the distribution of power between the substation and rail vehicles.

Module length	TBD
Number of slides	20
Videos included?	No
Quiz?	Yes

Learning Objectives

- Explain the purpose and process of sectionalizing.
- Explain how schematics and line prints relate to power distribution and can be utilized for sectionalizing.
- Describe insulators.

Module 7: Duct Bank and Manhole Systems

Outcome: This module gives an overview of the principles of duct bank and manhole used for the distribution of power between the substation and rail vehicles.

Module length	TBD
Number of slides	27
Videos included?	No
Quiz?	Yes

Learning Objectives

- Explain duct bank and manhole systems.
- Explain confined space procedures and hazards.

Course TP102: *Introduction and Overview to Substations*

Course 102, Introduction to Traction Power Substations, provides participants with an overview to the principles of the traction power substations as they prepare to work on overhead and third rail traction power systems for a public transportation agency. This course is one in the series of 18 consortium courses on traction power.

Module 1: Introduction and Overview

Outcome: This module presents an overview of the principles of operation of a traction power substation system and describes its major components.

Module length	2.5 hours
Number of slides	24
Videos included?	No
Quiz?	Yes

Learning Objectives

- Review safety principles for working in a traction power substation.
- Describe the functions of a traction power substation
- Explain operating voltage variations within a substation.
- Identify types of substations within the traction electrification system.

Module 2: Elements of a Traction Power Substation

Outcome: This module helps the participant define the fundamental elements of a traction power substation in preparation for inspection and maintenance work.

Module length	2.1 hours
Number of slides	27
Videos included?	Yes
Quiz?	Yes

Learning Objectives

- Describe characteristics of incoming utility power.
- Describe principles of conditioning energy for traction power.
- Identify core equipment of a substation
- Explain fundamentals of a substation electrical drawing.

Module 3: AC Switchgear

Outcome: This module helps the participant define the fundamental elements of the AC switchgear system in a traction power substation.

Module length	1.1 hour
Number of slides	19
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe AC switchgear ratings used for in traction electric systems.
- List major components of the AC switchgear.
- Describe functions of the AC switchgear components.
- Explain the concepts of earthing and grounding.

Module 4: DC Switchgear

Outcome: This module helps the participant define the fundamental elements of a DC switchgear system in a traction power substation. Following the completion of this module

Module length	2.7 hours
Number of slides	28
Videos included?	Yes
Quiz?	Yes

Learning Objectives

- List major components of the DC switchgear system.
- Describe functions of DC switchgear components
- Describe principles of conditioning energy for traction power.

Module 5: Ancillary and Battery Equipment

Outcome: This module helps the participant become familiar with the various ancillary equipment inside a traction power substation in preparation for inspection and maintenance work.

Module length	1.6 hours
Number of slides	T27
Videos included?	Yes
Quiz?	No

Learning Objectives

- List ancillary equipment associated with traction substations.
- Describe the battery system in a substation.

Course TP103: *Introduction and Overview to Overhead Systems*

This half-day course is an overview of overhead line electrification systems that will help prepare individuals for work on traction power systems. The course reviews major components overhead systems and discusses the principles of operation of major components.

This course consists of three modules. Within each module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation.

Module 1: Overview to Overhead Catenary Electrification Systems

Outcome: This module describes overhead catenary electrification (OCS) systems, their classifications, wiring types, and major components.

Module length	30 minutes
Number of slides	19
Videos included?	Yes
Quiz?	No

Learning Objectives

- Recall what an overhead catenary system is
- Differentiate between simple and complex wire setups
- Differentiate between auto-tensioned and fixed-tension systems
- Define Rigid Overhead Conductor Systems

Module 2: OCS System Infrastructure

Outcome: This module lists the major components of the overhead line electrification systems.

Module length	55 minutes
Number of slides	27
Videos included?	Yes
Quiz?	Yes

Learning Objectives

- Recall the primary function of each OCS component.

Module 3: Principles of Operation

Outcome: This module reviews the principles of Ohm's Law and demonstrates how it is relevant to traction power work. This module also reviews standard tools and equipment that technicians will use for inspection and maintenance.

Module length	45 minutes
Number of slides	22
Videos included?	Yes
Quiz?	No

Learning Objectives

- Explain the difference between energized and de-energized
- Explain how voltage standards apply to the OLE system
- Explain how tensioning setups function in an OLE system
- Explain how sectionalization operates in an overhead system

Course TP104: *Introduction and Overview to Third Rail Systems*

This course offers participants an introductory overview to third rail systems, including the makeup of third rail and critical safety procedures and tools, the theory and operations that are involved with third rail systems, and primary components and bond types that make up third rail systems.

This course consists of three modules. Within each module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation.

Module 1: Safety Surrounding Third Rail

Outcome: This module describes and gives an overview of the third rail system and safety, looking at how it functions, examining the components and bonds that make up a third rail system and how to isolate a section of third rail.

Module length	TBD
Number of slides	34
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe the function of a third rail system and negative return process
- Describe procedures for de-energization (or sectionalization) of third rail for emergency shut down situations
- Identify PPE and safety tools necessary for maintaining third rail systems
- Explain how sectionalization operates in an overhead system
- Recall the isolation process/features of a third rail system

Module 2: Theory & Operation of Third Rail

Outcome: This module offers insight into the theory and processes that make a third rail system operates.

Module length	TBD
Number of slides	27
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe the process of power distribution throughout a third rail system
- Recall the procedure(s) for power isolation of a third rail system and its components
- Define electrolysis and galvanic corrosion
- Identify sources of power for third rail heaters/snow melters

Module 3: Third Rail Components & Infrastructure

Outcome: This module examines the primary components, bond types and bond attachments that make up a third rail system

Module length	TBD
Number of slides	56
Videos included?	No
Quiz?	No

Learning Objectives

- Identify the major components of third rail systems
- Recall the purpose of major components for a third rail system
- Identify and describe the purpose of different bond types for third rail systems
- Identify and describe the purpose of different bond attachments for third rail systems

Course TP150: *Traction Power Control Systems*

This1-day course presents inspection and maintenance preparations and practices for traction power distribution systems. The class focuses on inspection and maintenance of traction power distribution. Participants engage in a series of activities that help them practice and prepare completing inspection, maintenance and testing as traction power maintainers. Content is supplemented with examples to support participants' successful application of the course content to their work.

This course consists of 3 modules. Within the Module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation

Module 1: Overview of Traction Power Control Systems

Outcome: This Module presents an introduction to traction power control systems.

Module length	120 minutes
Number of slides	46

- Identify the governing oversight for traction power control systems
- Explain safety related to traction power control systems

Module 2: The Traction Power System Control

Outcome: This Module presents an overview to local and remote controls for traction power systems.

Module length	120 minutes
Number of slides	45
Videos included?	Yes
Quiz?	Yes

Learning Objectives

- Explain how traction power maintainers can access data and control the traction power system
- Compare local control to remote control

Module 3: Traction Power Control Components

Outcome: This Module introduces resources for troubleshooting traction power systems.

Module length	210 minutes
Number of slides	83
Videos included?	No
Quiz?	Yes

Learning Objectives

- Explain protective relays and control devices in terms of their function and relation to the traction power system
- Identify protective relays and control devices in one-line prints

Course TP106: *Overview to Rigging and Lifting with Vertical and Horizontal Loads*

This course is under development. Completion expected by December 2024.

Module 1: Principles of Rigging

Module 2: Working Safely

Module 3: Vertical and Horizontal Loads

Module 4: Tools and Equipment

Module 5: Communication

200 Level Courses

Course TP200: *Preparing for Inspection and Maintenance of Traction Power Systems*

This half-day course examines the areas of traction power inspection and maintenance in which the participant is expected to work and how to approach that work. Included in this course is discussion on how agencies log and record various inspection and maintenance tasks; explains the common components participants would expect to see when working and maintaining traction power systems including the substation, overhead systems, and third rail systems. This course also highlights standard tools and equipment traction power maintainers use in their work.

Module 1: Overview to Inspection and Maintenance

Outcome: This module reviews health and safety practices when working around traction power systems, examines the requirements of inspection and maintenance, and discusses the importance of updating and keeping accurate records of work. This module also offers the participant a short overview of major components in the traction power substation, overhead systems and third rail systems.

Module length	60 minutes
Number of slides	19
Videos included?	Yes
Quiz?	No

Learning Objectives

- Outline the process of inspection and maintenance for traction power systems
- Recognize common varieties of maintenance schedule or inspection sheets
- Identify agency prerequisites for traction power inspection and maintenance

Module 2: Approaches to Inspection and Maintenance

Outcome: This module helps the participant identify major components for traction power inspection and maintenance and offers tips and approaches for new maintainers to consider while working in substations and on overhead line and third rail systems.

Module length	136 minutes
Number of slides	45
Video?	Yes
Quiz?	Yes

Learning Objectives

- Identify the components of traction power systems within the substation, overhead and third rail systems.
- Describe the functions of each testing type for inspection and maintenance and when to use them.
- Describe common tasks to complete and checks to look for when inspecting and maintaining traction power systems.

Module 3: Tools and Equipment for Inspection and Maintenance

Outcome: This module reviews the Ohm's Law and helps the course participant understand its relevance to inspection and maintenance work. This module also lists common types of tools and equipment that traction power maintainers often use in their work.

Module length	40 minutes
Number of slides	20
Videos included?	No
Quiz?	No

Learning Objectives

- Recall Ohm's Law
- Identify and explain the functions of the tools and equipment needed for inspection and maintenance
- Examine requirements for tool and equipment checks and certification

Course TP201: Inspection and Maintenance of Traction Power Distribution Systems

This course is a one-day course that provides participants with a guide to inspecting, maintaining, and testing traction power systems as they prepare to work in their agency's traction power substation. This course is the second in the 3-course series developed by the national Traction Power Training Consortium.

This course consists of three modules. Within each module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation.

Module 1: Overview to Course

Outcome: This module gives an overview of the course, its focus, as well as introduction to line diagrams and control systems in order to prepare the traction power maintainer for work in the traction power substation.

Module length	5 hours
Number of slides	19
Videos included?	No
Quiz?	Yes

Learning Objectives

- Identify areas of power distribution for inspection and maintenance.
- Describe tools and equipment used for power distribution inspection and maintenance.
- Describe power distribution inspection and maintenance hazards.
- Explain electrolysis and galvanic corrosion concerns.
- Explain ANSI/IEEE nomenclature and reference to substation.

Module 2: Sectionalizing for Inspection and Maintenance

Outcome: This module outlines the steps for the inspection, maintenance, and testing of the AC power systems in the traction power substation.

Module length	2 hours
Number of slides	25
Videos included?	No
Quiz?	Yes

Learning Objectives

- Review the purpose of sectionalizing.
- Explain the process of sectionalizing.
- Utilize a schematic to determine sections for sectionalizing.
- Establish agency protocols for sectionalizing power.
- Establish field verification.

Module 3: Cable and Feeder Inspection and Maintenance

Outcome: This module outlines the steps for the inspection, maintenance, and testing of cable and feeder systems in the traction power distribution systems.

Module length	2 hours
Number of slides	24
Videos included?	No
Quiz?	Yes

Learning Objectives

- Explain a visual inspection of cables and feeders.
- Explain maintenance procedures for cables and feeders.
- Explain types of cable tests

Module 4: Bond Inspection and Maintenance

Outcome: This module outlines the steps for the inspection, maintenance, and testing of bonds in the TPSS.

Module length	1 hour
Number of slides	TBD
Videos included?	No
Quiz?	Yes

Learning Objectives

- Review types of bonds.
- Describe methods of attachment.
- Describe testing methods.

Module 5: Switch Inspection and Maintenance

Outcome: This module outlines the steps for the inspection, maintenance, and testing of switches in the traction power distributions system.

Module length	1 hour
Number of slides	TBD
Videos included?	No
Quiz?	Yes

Learning Objectives

- Review types of switches.
- Explain and perform switch inspection and maintenance.
- Describe the purpose of insulators in sectionalizing text

Module 6: Power Distribution Infrastructure Inspection and Maintenance

Outcome: This module outlines the steps for the inspection, maintenance, and testing of the power distribution infrastructure in a traction power system.

Module length	1 hour
Number of slides	TBD
Videos included?	No
Quiz?	Yes

Learning Objectives

- Define power distribution infrastructure.
- Explain and perform power distribution infrastructure inspection and maintenance.

Module 7: Duct Bank and Manhole Inspection and Maintenance

Outcome: This module explains hazards and safety associated with duct banks and manholes as well as outlines the steps for the inspection, maintenance, and testing of these areas of traction power distribution.

Module length	2 hours
Number of slides	25
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe hazards and safety related to duct bank and manhole inspection and maintenance.
- Explain manhole duct bank and manhole inspection and maintenance.

Module 8: Other Equipment in Power Distribution Inspection and Maintenance

Outcome: This module introduces and outlines the steps for the inspection, maintenance, and testing of the other equipment in power distribution.

Module length	1 hour
Number of slides	25
Videos included?	No
Quiz?	Yes

Learning Objectives

- Explain snow removal equipment inspection and maintenance.
- Explain generator sets and photovoltaic system inspection and maintenance.

Course TP202: *Inspection and Maintenance of Substations*

Course 202, Inspection and Maintenance of Substations, provides participants essential steps in inspecting and maintaining the traction power substation.

Module 1: Overview to Course

Outcome: This module gives the participant an overview of the course that includes general inspection and maintenance procedures, standard tools and test equipment, and other topics in order to prepare the substation maintainer for work in the traction substation.

Module length	TBD
Number of slides	TBD
Videos included?	No
Quiz?	Yes

Learning Objectives

- Recognize safety protocols and procedures in traction substations
- List the systems and key components for regular inspection and maintenance
- Demonstrate standard inspection and maintenance procedures for working in substations
- Describe different inspection methods and tools used in traction substation
- Recognize agency protocols for recording PM procedures

Module 2: AC Switchgear and Transformer

Outcome: This module outlines the steps for the inspection, maintenance, and testing of the AC power systems in the TPSS.

Module length	TBD
Number of slides	TBD
Videos included?	No
Quiz?	Yes

Learning Objectives

- Inspect busbar
- Inspect, maintain, and test disconnect / isolation switches (load and non-load)
- Inspect, maintain, and test AC circuit breakers
- Inspect, maintain, and test transformers
- Perform AC insulation tests
- Interpret SCADA codes specific to AC switchgear

Module 3: Rectifier, DC Circuit Breaker, Feeder Breakers

Outcome: This module outlines the steps for the inspection, maintenance, and testing of the DC power systems in the traction power substation.

Module length	TBD
Number of slides	TBD
Videos included?	TBD
Quiz?	TBE

Learning Objectives

- Inspect and maintain the rectifier
- Inspection and maintain DC main/cathode breaker
- Inspect and maintain DC feeder breakers
- Inspect and maintain multi-function protection relays
- Perform a dialectic voltage-withstand (Hi-pot) test

Module 4: Batteries and Ancillary Systems

Outcome: This module outlines the steps for the inspection, maintenance, and testing of ancillary and battery backup systems in the TPSS.

Module length	TBD
Number of slides	TBD
Videos included?	TBD
Quiz?	TBD

Learning Objectives

- Inspect and maintain battery backup systems
- Inspect and maintain auxiliary power transformers
- Inspect communication interface systems
- Inspect emergency response equipment
- Inspect lighting, ventilation, and entry alarm systems

Course TP203: *Inspection and Maintenance of Overhead Systems*

This course is a one-day course that provides participants with a guide to inspecting, maintaining, and testing overhead line electrification (OLE) systems as they prepare to work in their agency's traction power overhead systems. This course focuses on standard inspection and maintenance checks, tests, and techniques expected in maintaining overhead traction power systems.

This course consists of three modules. Within each module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation.

Module 1: Safety Review, Preparations and Basic Considerations

Outcome: This module reviews health and safety topics covered in depth in Course TP100, investigates what inspection and maintenance is relevant to our line of work and provides basic considerations needed by traction power maintainers prior to going out into the field.

Module length	90 minutes
Number of slides	45
Videos included?	No
Quiz?	Yes

Learning Objectives

- Outline the standard preparation process prior to working on overhead traction power systems.
- Identify key basic considerations for maintainers prior to their working on overhead traction power systems.

Module 2: Inspection and Maintenance Procedures and Tests for Overhead Systems

Outcome: This module outlines the steps for inspecting, maintaining, checking, and testing of standard overhead systems.

Module length	240 minutes
Number of slides	61
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe the key visual checks and other inspections for each component in the Foundations & Support category
- Describe the key visual checks and other inspections for each component in the Distribution category
- Describe the key visual checks and other inspections for each component in the Cables & Wiring category
- Describe the key visual checks and other inspections for each component in the Insulation category.

Module 3: Inspection and Maintenance of Tensioning Systems

Outcome: This module outlines the steps for inspection and maintenance procedures and practices when performing work on overhead line systems and the subsequent tensioning systems.

Module length	60 minutes
Number of slides	21
Videos included?	No
Quiz?	

Learning Objectives

- Identify the primary methods in the major intervals for tensioning inspection and maintenance
- Examine wire height and stagger inspection and maintenance practices

Course TP204: *Inspection and Maintenance of Third Rail Systems*

This course offers participants an overview to inspection and maintenance procedures, tasks and checks for major components, bond types and bond attachments for third rail systems, approaches to welding versus drilling in third rail, and effects of improper bonding.

This course consists of two modules. Within each module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation.

Module 1: Inspection & Maintenance for Third Rail Infrastructure

Outcome: This module provides an overview to typical checks, tests and inspection procedures commonly performed on third rail infrastructure.

Module length	TBD
Number of slides	~55
Videos included?	No
Quiz?	Yes

Learning Objectives

- Identify the process for clearing right-of-way entry
- Identify the appropriate PPE for preparing to perform work on third rail
- Recall the procedure(s) for de-energization of third rail (section)
- Identify inspection verification procedures
- Summarize the inspection & maintenance procedures, tests, and visual checks to perform for third rail components

Module 2: Inspection & Maintenance for Third Rail Bonding & Attachments

Outcome: This module provides an overview to typical checks, tests and inspection procedures commonly performed on third rail infrastructure, particularly bonding types and attachments.

Module length	TBD
Number of slides	TBD
Videos included?	No
Quiz?	No

Learning Objectives

- Summarize the inspection & maintenance procedures, tests, and visual checks to perform for third rail bonds and attachments

Course TP206: *Rigging and Lifting Operations*

This course is under development. Completion expected by December 2024.

Module 1: Advanced Rigging Techniques

Module 2: Lift Planning

Module 3: Rigging and Load Calculations

Module 4: Rigging Site Planning

300 Level Courses

Course TP300: *Principles of Troubleshooting Traction Power Systems*

Course 300, Principles of Troubleshooting Traction Power Systems, provides participants with an overview to the principles of troubleshooting traction power systems for a public transportation agency.

Module 1: Course Overview

Outcome: This module gives an overview of troubleshooting traction power systems

Module length	1.5 hours
Number of slides	33
Videos included?	No
Quiz?	Yes

Learning Objectives

- Describe the importance of troubleshooting in traction power.
- Explain safety considerations for troubleshooting traction power systems.
- Explain the process of power isolation for troubleshooting.

Module 2: The Troubleshooting Process

Outcome: This module provides a general process for troubleshooting as well as best practices for troubleshooting traction power systems

Module length	1.5 hours
Number of slides	32
Videos included?	No
Quiz?	Yes

Learning Objectives

- Identify and describe the general steps for troubleshooting a traction power system.
- Explain best practices for troubleshooting traction power.

Module 3: Traction Power Resources for Troubleshooting

Outcome: This module provides traction power maintainers with a list of resources commonly used for the troubleshooting traction power systems

Module length	3 hours
Number of slides	30
Videos included?	No
Quiz?	Yes

Learning Objectives

- Explain the importance of knowing the system and its parts for troubleshooting.
- Explain resources used in troubleshooting traction power systems.
- Identify power characteristics as related to troubleshooting

Module 4: Agency Troubleshooting Policies and Procedures

Outcome: This module participants with the opportunity to review and discuss agency troubleshooting policies and protocols.

Module length	1 hour
Number of slides	14
Videos included?	No
Quiz?	Yes

Learning Objectives

- Explain agency troubleshooting, repair, and documentation procedures.
- Process for delay repairs.

Course TP301: Troubleshooting Traction Power Distribution Systems

This course helps participants with the essential steps to approach troubleshooting and repair of key areas of traction power distribution system.

The goal of this course is to highlight common troubleshooting scenarios that the traction power technician can analyze and apply to similar situations at the locations where they work. As a participant, you should approach this course in a manner that you reproduce a problem and apply your agency's tools to the problem, and then synthesize your knowledge and skills.

Module 1: Overview to Troubleshooting for Traction Power Distribution

Outcome: This module helps the participant to approach power isolation and using schematics and SCADA when troubleshooting traction power distribution and control systems. The participant should note that the content in this module draws on the many years of combined experience of the subject matter experts in the Consortium as well as resources from their agencies.

Module length	3 hours
Number of slides	44
Videos included?	TBD
Quiz?	Yes

Learning Objectives

- Explain safety for troubleshooting and repair of traction power distribution.
- Describe emergency sectionalizing.
- Describe tools for troubleshooting and repair of traction power distribution.
- Explain agency policies and procedures for troubleshooting and repair of traction power distribution.
- Describe portable generator use when applicable.

Module 2: Power Distribution Troubleshooting Approaches and Scenarios

Outcome: This module provides the technician with methods of troubleshooting the AC power systems in the traction power substation.

Module length	2.5 hours
Number of slides	36
Videos included?	TBD
Quiz?	Yes

Learning Objectives

- Explain methods and approaches for troubleshooting traction power distribution.
- Examine power distribution troubleshooting and repair scenarios and case examples.

Module 3: Direct Current Power Systems

Outcome: This module provides the technician with methods of troubleshooting the DC power systems in the traction power substation.

Module length	TBA
Number of slides	TBA
Videos included?	TBA
Quiz?	TBA

Learning Objectives

- Troubleshoot and repair circuit breakers and protective devices.
- Troubleshoot and repair no-load disconnect.

Course TP302: *Troubleshooting Traction Power Substations*

This course is under development. Completion expected in 2024.

Course TP303: *Troubleshooting Overhead Systems*

The course offers participants an overview to troubleshooting techniques and common strategies to resolve issues with major components of the overhead traction power electrification system.

Module 1: Troubleshooting Overhead Components

Outcome: This module

Module length	TBD
Number of slides	TBD
Videos included?	TBD
Quiz?	TBD

Learning Objectives

- Recall symptoms and probable causes, and describe tests and checks for troubleshooting and resolving issues with foundations & support components.
- Recall symptoms and probable causes, and describe tests and checks for troubleshooting and resolving issues with distribution components.
- Recall symptoms and probable causes, and describe tests and checks for troubleshooting and resolving issues with cables & wiring components.
- Recall symptoms and probable causes, and describe tests and checks for troubleshooting and resolving issues with insulation components.

Course TP304*: *Troubleshooting Third Rail Systems*

**This course is under revision. Completion expected in 2024.*

This course offers participants an overview to troubleshooting procedures, tasks and checks for major components, bond types and bond attachments for third rail systems.

This course consists of two modules. Within each module, there may be several learning application activities and demonstrations. Before beginning instruction, participants are expected to complete a Pre-Course Assessment to assess their knowledge of the subject. Similarly, after instruction of all the modules, participants will complete a Post-Course Assessment as well as a course evaluation.

Module 1: Troubleshooting Third Rail Infrastructure

Outcome: This module provides an overview to typical checks, tests and troubleshooting procedures commonly performed on third rail infrastructure.

Module length	TBD
Number of slides	TBD
Videos included?	TBD
Quiz?	TBD

Learning Objectives

- Summarize the procedures, tests, and visual checks to run troubleshooting for third rail infrastructure and components