

Rail Traction Power Training Content and Standards
Revised in response to APTA comments

ID	<u>Module Title</u>	
		<i>Responsibilities / Course Content</i>
		<i>Tasks / Learning Objectives</i>
100 Level Modules -- Traction Power Systems Introduction and Overview		
100	<i>Introduction to Traction Power (Safety, Security, History)</i>	
100-1	<i>Understanding History of Traction Power Systems</i>	
100-2	<i>Understanding and following Traction Power Safety Practices</i>	
100-2-1	Reference to FRA standards as appropriate	
100-2-2	Explain principles and demonstrate ability to refer to NEC and NFPA 70E	
100-2-3	Review Hazard Risk Assessment (part of NFPA 70E)	
100-2-4	Describe process of interfacing with public safety agencies	
100-2-5	Describe railway safety procedures	
100-2-5-1	Demonstrate process of referring to agency rail roadway worker protection procedures pertaining to track safety	
100-2-6	Explain the risk of working with an energized vs. deenergized system	
100-2-7	Describe principle of grounding of distribution system	
100-2-8	Describe grounding of OCS procedure	
100-2-9	Identify voltage classification of system related to federal, state and agency safety procedures	
100-2-10	Identify safety tools	
100-2-11	Describe purpose of lock-out/tagout and power securing procedures	
100-2-11-1	Describe consequences of an unexpected release of hazardous energy	
100-2-12	Describe automatic ground (Sacto)	
100-2-13	Describe state and federal requirements for lock-out/tag-out and power securing procedures	
100-2-14	Describe process of referring to agency regulations pertaining to lock-out/tag-out	
100-2-15	Describe process of referring to agency regulations pertaining to power securing procedures	
100-2-16	Demonstrate proper use of personal protective equipment	
100-2-17	Explain the remote control capabilities related to substation operation	
100-2-18	Explain and demonstrate safety procedures and safety equipment at your property	
100-2-19	Explain and demonstrate safety procedures for working at heights and fall protection (for OCS properties)	
100-2-20	Explain and demonstrate safety procedures for working in confined spaces	
100-2-21	Explain and demonstrate safety procedures for pole climbing	
100-3	<i>Understanding Traction Power Security Related Procedures</i>	
100-3-1	Explain limited access to substations	
100-3-2	Explain TSA recommended procedures for dealing with suspicious packages	
100-3-3	Explain processes for observing people	
100-4	<i>Understanding Regulatory agency authority</i>	
100-4-1	Describe state and federal regulation related to traction power systems	
100-5	<i>Understanding ANSI System</i>	
100-5-1	Explain design of traction power system includes ANSI and IEEE standards	
100-6	<i>Using specialized Traction Power tools</i>	
100-6-1	Demonstrate ability to use hot stick	
100-6-2	Demonstrate ability to use meters - multimeters, DVM	

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100-6-3		Demonstrate ability to use various hand and power tools, and explain reasons for using double insulated tools and identify tool requirements at your location
100-6-4		Describe specialized tools for maintaining substations and distributions (refer to substation and distribution for tool lists)
100-6-5		Properly use tools for substation maintenance
100-6-6		Describe the use of Hi-Pot testing
100-6-7		Procedures for testing and calibrating test equipment listed above
102	<i>Power Distribution (Intro and Overview of Theory and Operation)</i>	
102-1		<i>Purpose and methods of power distribution</i>
102-1-1		Explain purpose and methods of power distribution
102-1-2		Explain history of power distribution
102-1-3		Describe the varying operating voltages
102-1-4		Describe differences in systems between rail systems
102-2		<i>How a traction power system works</i>
102-2-1		Follow and describe the local functional order of a traction power system, including:
		Utility, through circuitbreaker, to transformer
		AC Switchgear
		Rectifier transformer
		Rectifier
		DC switchgear
		Distribution to OCS / Third Rail
102-2-2		Describe Traction Power control systems
102-2-3		Describe how traction power system works
102-2-4		Explain DC positive feed and its components
102-2-5		Describe negative return and its components
102-2-6		Describe concept of parallel negative return
102-2-7		Describe traction power in context of track circuit

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102-2-8		Describe negative feeder cables
102-2-9		Describe operation of Battery Back-up Power systems (UPS)
102-2-10		Describe fault annunciation
102-2-11		Describe transfer trip
102-3		<i>Describe function and components of substations</i>
102-3-1		Explain history of substations
102-3-2		Describe the varying operating voltages for substations
102-3-3		Describe differences in systems between rail systems
102-3-4		Describe purpose of automatic reclose of breakers
102-4		<i>Describe function and components of overhead contact system</i>
102-4-1		Describe difference between overhead contact system and overhead catenary system
102-4-2		Explain how overhead contact systems works
102-4-3		Identify components of overhead contact system and their purpose
102-4-4		Describe process of determining whether energized vs. deenergized (sectioning wiring)
102-5		<i>Describe function and components of overhead catenary system</i>
102-5-1		Describe difference between overhead catenary system and overhead contact system
102-5-2		Explain how overhead catenary systems works
102-5-3		Identify components of overhead catenary system and their purpose
102-5-4		Describe process of determining whether energized vs. deenergized (sectioning wiring)
102-6		<i>Describe function and components of third rail systems</i>
102-6-1		Describe impedance bonds
102-6-2		Describe sectionalization
102-6-3		Explain energized vs. deenergized

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102-6-4		Describe differences between third rail power and overhead power systems
102-6-5		Weld third rail feed cables
102-7		<i>DC Theory and power components</i>
102-7-1		Demonstrate process of isolating system by opening or closing DC switchgear
102-7-2		Demonstrate process of verifying load and no load situation with disconnect switches
102-8		<i>Power Distribution Systems</i>
102-8-1		Describe operations and components of an Overhead Contact System
102-8-2		Describe operations and components of an Overhead Catenary System
102-8-3		Describe operations and components of a Third Rail powered system
102-9		<i>Bond types and methods</i>
102-9-1		Describe types of bonds (Impedance bonds and power bonds)
102-9-2		Describe methods of bond attachment -- cadweld, spot weld, arc weld, mechanical, structure
102-9-3		Describe effect of improper bonding on rail metallurgy and broken rail
102-9-4		Weld extentsions to the structure; create structure bonds
102-10		<i>Impedance bonds</i>
102-10-1		Describe traction power in context of the track circuit
102-10-2		Describe purpose of impedance bonds
102-11		<i>Circuit breakers and protective devices</i>
102-11-1		Explain use and purpose of circuit breakers and protective devices
102-11-2		Demonstrate process of verifying circuit breaker is disconnected before performing maintenance on breakers that can be isolated
102-11-3		Demonstrate how to use Personal Protective Equipment when working on circuit breakers that cannot be disconnected from traction power before performing maintenance
102-12		<i>Understand source of power for switch heaters / snow melters</i>
102-13		<i>Understanding Cathodic Protection</i>
102-13-1		Define cathodic protection principles
102-13-2		Describe principle of stray current
108		<u>Linear induction</u>

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200 Level Modules -- Traction Power Systems Inspection and Maintenance		
200	<u>Understanding and Following PM Programs</u>	
200-1		<i>Add content from agency specific PM programs</i>
200-2		<i>Teach general best practices and concepts of Preventive maintenance</i>
202	<u>Power Distribution and control Systems (Inspection and Maintenance)</u>	
202-1	<i>AC Power systems (Inspection and Maintenance)</i>	
202-1-1		Review of AC Theory
202-1-2		Describe and maintain Instrument Transformers
202-1-3		Maintain Circuit breakers and protective devices
202-1-4		Maintain AC switchgear
202-1-5		Maintain Disconnect switches (load and non load)
202-1-6		Explain Circuit breakers and protective devices
202-1-7		Explain Traction rectifier transformer
		6 pulse vs. 12 pulse
202-1-8		Explain and maintain Rectifier
202-1-9		Maintain Auxiliary transformers
202-2	<i>DC Power systems (Inspection and Maintenance)</i>	
202-2-1		Review of DC Theory
202-2-2		Describe and maintain Instrument Transformers
202-2-3		Maintain Circuit breakers and protective devices
202-2-4		Maintain DC switchgear
202-2-5		Maintain Disconnect switches (load and non load)
202-2-6		Explain and maintain Rectifier
202-2-7		Maintain Auxiliary transformers
202-3	<i>Bond types and methods</i>	
202-3-1		Perform cadweld bonding
202-3-2		Perform spot weld bonding
202-3-3		Perform arc weld bonding
202-3-4		Perform mechanical bonding
202-3-5		Perform impedance bonds
203	<u>Substations (Inspection and Maintenance)</u>	
203-1	<i>Read and interpret circuit prints</i>	
203-1-1		Explain ANSI/IEEE nomenclature
203-1-2		Explain and interpret local prints
203-2	<i>Inspect and maintain substation components</i>	
203-2-1		Inspect and maintain transformers
203-2-2		Inspect and maintain rectifiers
203-2-3		Inspect and maintain AC Breakers
203-2-4		Inspect and maintain DC Breakers