



Powerline Technician

On-the-Job Training Guide

2024

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Recognition:

To promote transparency and consistency, portions of this document have been adapted from the 2018 Powerline Technician Red Seal Occupational Standard (Employment and Social Development Canada).

A complete version of the Occupational Standard can be found at www.red-seal.ca

STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

Major Work Activity (MWA): the largest division within the standard that is comprised of a distinct set of trade activities.

Task: distinct actions that describe the activities within a major work activity.

Sub-task: distinct actions that describe the activities within a task.

On-the-Job and In-school Training Content for the Powerline Technician Trade: a chart which outlines on-the-job examples for apprentices to achieve relevant experience at work.

TRAINING REQUIREMENTS FOR THE POWERLINE TRADE

To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1800 hours each year. Total trade time required is 7200 hours and at least 4 years in the trade.

Journeyman to apprentice ratio for this trade is: 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentices results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

It is the employer's or journeyman's training responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of tools and equipment
- demonstrate procedures relevant to layout, planning, grounding and tensioning
- further the apprentice's ability to interpret technical drawings and standards
- allow the apprentice to apply procedures used for estimating materials, costing projects and supervising personnel
- ensure that the apprentice can evaluate the final installation
- where possible, expose the apprentice to new technology in the Powerline Technician trade

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

POWERLINE TECHNICIAN TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2018 Powerline Technician Red Seal Occupational Standard. Each sub-task details the corresponding essential skill and level of training where the content is covered. *

* Sub-tasks with numbers in the boxes is where the content will be delivered in training.

A - Performs Routine Occupational Skills

26%

A-1 Performs safety-related functions	1.01 Uses personal protective equipment (PPE) and safety equipment 1 (2, 3, 4 In Context)	1.02 Controls powerline hazards 1 (2, 3, 4 In Context)	1.03 Controls environmental hazards 1 (2, 3, 4 In Context)	1.04 Performs lock-out and tag-out procedures 1 (2, 3, 4 In Context)	1.05 Performs temporary grounding and bonding procedures 1 (2, 3, 4 In Context)
A-2 Uses and maintains tools and equipment	2.01 Uses hand, power and powder-actuated tools and equipment 1 (2, 3, 4 In Context)	2.02 Uses electrical measuring and testing equipment 1 (2, 3, 4 In Context)	2.03 Uses rigging, hoisting and lifting equipment 1 (2, 3, 4 In Context)		
A-3 Organizes work	3.01 Interprets plans, drawings and specifications 1 (2, 3, 4 In Context)	3.02 Prepares worksite 1 (2, 3, 4 In Context)	3.03 Plans job tasks and procedures 1 (2, 3, 4 In Context)		
A-4 Accesses work area	4.01 Climbs poles and steel lattice structures 1	4.02 Uses access equipment 1	4.03 Uses on- and off-road equipment 1		
A-5 Uses live-line methods	5.01 Uses cover-up 1, 2, 3, 4	5.02 Uses rubber gloves 1, 2, 3, 4	5.03 Uses bare-hand methods (Not Common Core) 4	5.04 Uses fibreglass reinforced plastic (FRP) tools (hot sticks) 1, 2, 3, 4	

A-6 Uses communication and mentoring techniques

6.01 Uses communication Techniques

1

6.02 Uses mentoring techniques

4

B – Installs Structures

13%

B-7 Installs pole structures

7.01 Frames pole structures

1

7.02 Sets pole structures

1

7.03 Installs pole structure guys and anchors

1

B-8 Installs steel lattice structures

8.01 Assembles steel lattice structures

1

8.02 Erects steel lattice structures

1

8.03 Installs steel lattice structure guy wires and anchors

1

C – Installs Conductor Systems

15%

C-9 Installs overhead conductors and cables

9.01 Strings overhead conductors and cables

1, 2, 3, 4

9.02 Sags overhead conductors and cables

1, 2, 3, 4

9.03 Ties-in overhead conductors and cables

1, 2, 3, 4

9.04 Installs splices and connections to overhead conductors and cables

1, 2, 3, 4

C-10 Installs underground and underwater cable

10.01 Installs conduit and cable

2, 3

10.02 Places direct buried cable

2, 3

10.03 Splices underground and underwater cable

2, 3

10.04 Terminates underground and underwater cable

2, 3

D – Installs Auxiliary Equipment

21%

D-11 Installs lighting systems	11.01 Installs street lights 2	11.02 Maintains street lights 2			
D-12 Installs voltage control equipment	12.01 Installs transformers 1, 2, 3	12.02 Installs capacitors 4	12.03 Installs voltage regulators 3, 4	12.04 Installs switches 1, 2, 3	12.05 Installs reactors (Not Common Core) 4
D-13 Installs protection equipment	13.01 Installs reclosers 3, 4	13.02 Installs sectionalizers 3, 4	13.03 Installs fuses 2, 3, 4	13.04 Installs lightning arrestors 2	
D-14 Installs metering equipment	14.01 Installs primary metering equipment 3	14.02 Installs secondary metering equipment 2			
D-15 Installs communication devices	15.01 Installs cellular antennas 4	15.02 Transfers communication lines 1			

E – Performs Operation, Maintenance and Repair

25%

E-16 Operates distribution and transmission systems	16.01 Operates transmission systems 3, 4	16.02 Operates distribution Systems 2, 4	16.03 Performs station switching 4
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E-17 Maintains distribution and transmission systems	17.01 Inspects distribution and transmission systems 3, 4	17.02 Maintains pole structures 2, 3, 4	17.03 Maintains steel lattice structures 4	17.04 Maintains system components 2, 3, 4	17.05 Trims trees 2
E-18 Repairs distribution systems	18.01 Troubleshoots overhead distribution systems 3, 4	18.02 Troubleshoots underground and underwater distribution systems 3, 4	18.03 Repairs overhead distribution systems 2, 3, 4	18.04 Repairs underground and underwater distribution systems 2, 3, 4	
E-19 Repairs transmission systems	19.01 Troubleshoots overhead transmission systems 3, 4	19.02 Troubleshoots underground and underwater transmission systems 3, 4	19.03 Repairs overhead transmission systems 2, 3, 4	19.04 Repairs underground and underwater transmission systems 2, 3, 4	

TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Level One	Transcript Code	Hours
Safety	SFTY 100	
Temporary Bonding and Grounding	BOND 100	
Tools and Equipment	TOOL 100	
Electrical Measuring	EMSR 100	
Rigging, Hoisting and Lifting	RIGG 100	
Job Planning and Organization	JOBP 100	
Pole Climbing, Decay and Decay Calculations	POLE 100	
Work Area Access	ACES 100	
Live Line Methods (Introduction)	LLMI 100	
Overhead Distribution Structures (Introduction)	OHDS 100	
Steel Lattice Structures	SLAT 100	
Overhead Conductors and Cables	OHCC 100	
Overhead Distribution Systems (Introduction)	OSYS 100	
Trade Mathematics	TMET 100	
		127

Level Two	Transcript Code	Hours
Live Line Methods (Intermediate)	LLMI 200	
Overhead Conductors and Cables (Tension Stringing)	OHCC 200	
Underground Distribution Systems	USYS 200	
Street Lighting Systems	STRT 200	
Single-Phase Transformers and Switches	TRNS 200	
Protection Equipment	PROC 200	
Single-Phase Metering	METR 200	
Distribution Systems	OSYS 200	
Distribution and Transmission Maintenance	MAIN 200	
Transmission Systems	TSYS 200	
Electrical Theory	THRY 200	
		112

Level Three	Transcript Code	Hours
3-Phase Transformers	TRNS 300	
Voltage Control Equipment	VCEM 300	
Underground and Underwater Work	UWRK 300	
Load Checks	LOAD 300	
Reclosers, Sectionalizers and Fuses	PROC 300	
Transmission System Troubleshooting	TRBL 300	
Service Installations	SRVC 300	
Switching Devices	SWTC 300	
Instrument Transformers	INST 300	
Conductors and Cables (Distribution Stringing)	OHCC 300	
Hotstick Work	HWRK 300	
		112

Level Four	Transcript Code	Hours
Mentoring	MENT 400	
25KV Rubber Glove	RBGL 400	
Conductors and Cables	OHCC 400	
Capacitors, Regulators and Reactors	CRAR 400	
System Protection Apparatus	SYSP 400	
Introduction to Substations	SUBS 400	
Line Patrol	PRTL 400	
Transmission System Repair	TSYS 400	
Cellular Towers	CELL 400	
		75

ON-THE-JOB AND IN-SCHOOL TRAINING

CONTENT FOR THE POWERLINE TECHNICIAN

TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	12 Days	127 hours
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Safety

- safety equipment, their applications, maintenance and procedures for use
- safe work practices
- regulatory requirements pertaining to safety
- lock-out and tag-out procedures, their applications and use

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with safety rules such as Minimum Approach Distance, Standard Protection Code, Apprentice Qualifications, Right to Refuse and Hazardous Work*
- *providing WHMIS and OH&S training*
- *familiarizing apprentices with the use of a Modiewark (proximity voltage detector) and testing for absence of potential*
- *identifying lock-out and tag-out requirements and coordinating the process with appropriate authorities, other trades and work groups*
- *familiarizing the apprentice with the procedures used to test for potential on isolated lines with the proper voltage-rated equipment*
- *documenting with the apprentice the lock-out and tag-out process for future reference*

Temporary Bonding and Grounding

- grounding and bonding methods and equipment
- procedures used to install, inspect and maintain grounding and bonding systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with a variety of tools and equipment used to perform temporary grounding and bonding*
- *familiarizing the apprentice with minimum approach distances (MAD) from second point of contact*
- *ensuring the apprentice maintains minimum approach distances (MAD)*
- *familiarizing the apprentice with the procedures to perform a potential check*
- *familiarizing the apprentice with the procedures to install/remove/maintain temporary grounding and bonding equipment*

Tools and Equipment

- tools and equipment, their applications, maintenance and procedures for use

Mentors can assist the apprentice to prepare for this section of technical training by:

- *exposing the apprentice to industry standard tools, components and materials*
- *providing direction on the use, care, storage and maintenance of tools and equipment*
- *familiarizing apprentices with proper techniques and positioning when using various tools*

Electrical Measuring

- power and energy, their characteristics and associated principles
- units of measure and symbols relating to power and energy
- procedures used to measure power and energy

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice is exposed to layout and troubleshooting of basic circuits, providing hands-on experience interpreting schematics and using multimeters and other electronic measuring devices*
- *identifying instruments used for measuring electricity*
- *describe instrument applications and procedures for use*
- *identifying instruments used for measuring*
- *identifying safety requirement such as identifying limits of approach to and appropriate Personal Protective Equipment (PPE) when using electronic measuring devices on energized circuits*

Rigging, Hoisting and Lifting

- rigging, hoisting and lifting equipment, their applications, limitations and procedures for use
- basic rigging, hoisting and lifting techniques

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with a variety of rigging components, techniques, knots*
- *providing training in hand signals*

Job Planning and Organization

- drawings, schematics and specifications and their applications
- interpreting and extracting information from drawings, basic schematics and specifications
- grid map reading
- procedures used to find a land location on a map
- traffic control equipment, their applications, maintenance and procedures for use
- traffic control techniques and procedures
- job tasks, procedures, and the order in which they are completed
- different communication techniques, their applications and use

Mentors can assist the apprentice to prepare for this section of technical training by:

- *involving the apprentices in measuring, laying-out, staking, overhead and underground lines according to design criteria*
- *familiarizing apprentices with the construction standards manual to find appropriate dimensions for framing structures, installing conductors and mounting serialized equipment*
- *creating situations where skills can be practiced safely by the apprentice*
- *passing on best practice procedures through supportive and/or corrective feedback*

Pole Climbing, Decay and Decay Calculations

- pole decay and decay calculations, their application and use
- how to tag and stub a pole, its application and use
- pole climbing, its applications, limitations and procedures for use
- pole climbing equipment, its applications, limitations and procedures for use

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying hazards and describing safe work practices pertaining to pole structure climbing and pole climbing equipment*
- *identifying pole climbing equipment and describing their characteristics and applications*
- *identifying codes and regulations pertaining to pole climbing equipment*
- *reinforcing the importance of conducting a pre-climbing pole inspection*
- *describing the procedures used to perform pole top rescues.*

Work Area Access

- ladders, their applications, limitations and procedures for use
- aerial devices, their applications and operation
- basic hydraulic principles
- hydraulic equipment components, their applications and operation
- on- and off-road equipment, their applications, maintenance and operating procedures

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying hazards and describing safe work practices pertaining to access equipment*
- *describing procedures used to erect and remove access equipment*
- *familiarizing the apprentice with the selection of equipment according to job requirements*
- *familiarizing the apprentice with the procedures used to inspect and ensure safe operation of access equipment*

Live-Line Methods (Introduction)

- principles of live line work
- procedures used to perform live line work
- rubber gloves, their applications, maintenance and use
- insulating sticks, their applications, maintenance and use

Mentors can assist the apprentice to prepare for this section of technical training by:

- *verifying valid test date or expiration date of rubber gloves*
- *performing air and roll tests*
- *understanding the different classification of gloves*
- *understanding the proper positioning and distance to maintain MAD*
- *defining terminology associated with live-line work using FRP tools (hot sticks)*
- *identifying hazards and describing safe work practices pertaining to live-line work using FRP tools (hot sticks)*

Overhead Distribution Structures (Introduction)

- overhead system construction principles
- poles and the procedures to properly setting a pole
- angles and lengths involved in tensioning lines and equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing apprentices with the appropriate line hardware and devices used in building and maintaining overhead and underground facilities*
- *familiarizing apprentices with pole stamp information and ensuring pole meets engineering standards*
- *demonstrating an installation of a ground wire on pole structure to provide a path to ground according to engineering standards and jurisdictional regulations*
- *identifying the tools and equipment used to set pole structures according to job requirements*
- *demonstrating the procedures used to plumb and secure a pole*
- *demonstrating the procedure to set structure guys and anchors*

Steel Lattice Structures

- steel lattice structures, their applications and use
- assemble, erect and install steel lattice structures

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with the correct tools and equipment need to assemble steel lattice structures*
- *familiarizing the apprentice with the procedures used to secure the base or structure of a steel lattice pole on a footing*
- *demonstrating the procedure to use temporary guy wires to ensure stability during erection*

Overhead Conductors and Cables

- effects of sagging on conductors
- procedures used to sag conductors
- conductors and cables and their associated components
- methods of cable protection and their applications
- procedures used to mechanically protect and support cables

Mentors can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with sagging overhead conductors and cables*
- *defining terminology associated with splices connections for overhead conductors and cables*
- *identify types and sizes of overhead conductors and cables and describe their characteristics and applications*
- *demonstrating proper techniques and positioning for stringing and tying in conductors using travelers*
- *familiarizing apprentices on the various types of conductor ties and proper installation of each type*
- *familiarizing apprentices with the various line configurations and insulation requirements*
- *familiarizing apprentice with the procedures to set up and operate stringing equipment*
- *identify conductor and cable protection methods and describe their characteristics, procedures and applications*

Overhead Distribution Systems (Introduction)

- transformer operating principles
- transformer components, their applications and operation
- procedures used to install and maintain transformers
- managing hazardous materials associated with transformers
- procedures used to install, connect, inspect, maintain, repair, troubleshoot and test overhead system components and accessories
- switches and select appropriate switches for their application

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying tools and equipment to install transformers are selected and used according to job requirements*
- *demonstrating the proper procedures to make wiring connections in a single-phase transformer*
- *familiarizing apprentices with the procedure to check voltage and phase rotation*
- *identifying the different types of power transformers and their applications*
- *interpreting information pertaining to transformer banking found on nameplates, drawings and specifications*
- *identifying hazards and describing safe work practice pertaining to transformer work*

Trade Mathematics and Electrical Theory

- basic mathematical principles, their use and applications
- different units of measure used in industry
- fundamental electrical principles
- basic DC series and parallel circuits
- single-phase circuits, their characteristics and operation
- electromagnetic induction, its characteristics and applications

Mentors can assist the apprentice to prepare for this section of technical training by:

- *performing calculations to analyze and measure electrical circuit values*
- *defining terminology associated with electrical characteristics*
- *explaining the atomic structure of matter and electron theory*
- *identifying the forms of energy that produce electricity and describing their associated principles*
- *describing basic electric circuits*
- *identifying basic components found in electric circuits and describing their characteristics and purposes*
- *identifying the basic electrical properties and describing their relationship*
- *identifying the forms of energy that produce electricity and describing their associated principles*
- *describing basic electric circuit characteristics*



Live Line Methods

- principles of live line work
- procedures used to perform live line work
- insulating sticks, their applications, maintenance and use
- principles of live-line work using cover-up resistance and inductive reactance in an AC circuit
- procedures to use cover-up

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the principles of operations and applications of insulated tools, hotsticks, conductor supports and tensioning tools*
- *demonstrating the safe use of insulated hand tools, hotsticks, conductor supports and live line tensioning tools*
- *familiarizing the apprentice with inspection maintenance, care, use and storage of the various types of sticks and attachments*

Overhead Conductors and Cables (Tension Stringing)

- effects of sagging on conductors
- procedures used to sag conductors
- overhead conductors and cables, their characteristics and applications
- conductor and cable protection methods, procedures and their applications
- procedures used to mechanically protect and support cables

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrate safe use of the tools and equipment used to string overhead conductors and cables*
- *explain the procedure to attach pulling equipment to conductor or rope*
- *explain information required to adjust tension on conductors and cable*
- *demonstrate procedure to secure conductors and cable to dead-end fixtures depending on type and size of conductor*
- *demonstrate how conductors and cables are transferred from travellers to insulators*
- *explain how sleeves are selected and applied on ends of overhead conductors and cables*
- *explain how connectors are selected and applied on ends of overhead conductors and cables*

Underground Distribution Systems

- underground systems, their characteristics and applications
- underground and underwater system construction principles
- procedures used to install, splice and terminate underground and underwater conductors and cables
- procedures used to install, connect, inspect maintain, troubleshoot, repair and test underground and underwater system components and accessories

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining individual and multiple street light systems*
- *providing hands on experience installing and maintaining street lights and street light systems*

Street Lighting Systems

- street lighting systems, their characteristics and applications
- procedures used to install, connect, troubleshoot, inspect, maintain, repair and test street lighting systems
- procedures used to store and dispose of ballasts, capacitors and lamps

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining individual and multiple street light systems*
 - *providing hands on experience installing and maintaining streetlights and street light systems*
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Single-Phase Transformers and Switches

- transformer operating principles
- transformer components, their applications and operation
- procedures used to install and maintain transformers
- managing hazardous materials associated with transformers

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining transformer principles and operations*
 - *familiarizing the apprentice with various transformer connection configurations*
 - *familiarizing the apprentice with various service voltages and load requirements.*
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Protection Equipment

- fuses, their characteristics and applications
- operating principles of fuses
- procedures used to install fuses
- lightning arrestors, their characteristics and applications
- operating principles of lightning arrestors
- procedures used to install lightning arrestors

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating safe use of the tools and equipment used to install fuses*
 - *selecting tools and equipment used to install fuses according to job requirements*
 - *explaining how to select the proper fuse according to company and engineering standards*
 - *demonstrating the procedure to install a fuse into a holder and then placed into switch*
 - *demonstrating procedure to safely energize fuses*
 - *explaining common signs of defective fuses*
 - *demonstrating safe use of the tools uses to install lightning arrestors*
 - *explaining procedure to mount lightning arrestors according to company standards*
 - *inspecting lightning arrestors for defects*
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Single Phase Metering

- single-phase metering equipment, their applications and use
- procedures used to install single-phase metering equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating safe use of the tools and equipment used to install secondary metering equipment*
- *explaining the information used to select correct secondary metering equipment*
- *explaining procedures used to perform a meter base test*
- *recording meter readings*

Distribution Systems

- primary and secondary distribution lines, their applications and operation
- primary and secondary distribution line components, their applications and operation
- procedures used to install, inspect, maintain, repair, troubleshoot and test distribution lines
- overhead systems, their characteristics and applications
- overhead system construction principles
- procedures used to install, connect, inspect, maintain, repair, troubleshoot and test overhead system components and accessories
- underground systems, their characteristics and applications
- underground system construction principles
- procedures used to install, splice and terminate conductors and cables
- procedures used to install, connect, inspect maintain, troubleshoot, repair and test underground system components and accessories

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating the safe use of tools and equipment used to operate overhead, underground, and underwater distribution systems*
- *identifying proper circuits and equipment to prevent switching errors and to ensure work is being performed in the correct location*
- *testing, commissioning and energizing new distribution systems according to engineering standards and work procedures*
- *visually inspecting operation steps are done according to jurisdictional regulations and work procedures*
- *replacing distribution system components according to job requirement and company standards*
- *completing repairs or replacements of components and accessories*

Distribution and Transmission Maintenance

- procedures used to maintain pole structures for distribution and transmission systems
- tree trimming and felling, its procedure and use
- tools and equipment used tree trimming and felling

Mentors can assist the apprentice to prepare for this section of technical training by:

- *removing pole structures and replacing them according to inspection documentation*
- *stubbing, topping, capping and treating pole structures*
- *straightening pole structures*
- *removing contaminants from contacts, disconnect switches and insulators to comply with design specifications*
- *demonstrate safe use of the tools and equipment used in the trimming and felling of trees*
- *explaining the procedures and techniques to safely trim and fell trees*
- *avoiding cross contamination by cleaning equipment and disposing of trimmings*

Transmission Systems

- transmission systems, their applications and operation
- transmission system components, their applications and operation
- procedures used to install, inspect, maintain, repair, troubleshoot and test transmission systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *selecting the proper tools and equipment to repair overhead transmission systems according to job specifications*
- *safely following work procedures according to company standards*
- *repairing conductors and cables by splicing*
- *testing cables and equipment with proper equipment to verify integrity or fault repair*

Electrical Theory

- AC circuits, their characteristics and operation
- procedures used to troubleshoot AC circuits
- procedures used to analyze and measure AC circuit values
- series, parallel and combination circuits, their characteristics and operation
- single-phase 3-wire circuits, their characteristics and operation
- inductance and capacitance, their characteristics and associated principles
- how inductance and capacitance are encountered on the job

Mentors can assist the apprentice to prepare for this section of technical training by:

- *performing calculations to analyze and measure electrical circuit values*
- *describing basic electric circuit characteristics and different type of circuits*
- *explaining principles of inductance and capacitance*



3-Phase Transformers*Wye, Delta and Combination Systems*

- connections and characteristics of wye, delta and combination connected systems
- wye, delta and combination connected line and load using vectors
- line and coil values for current and voltage in wye, delta and combination systems
- voltage, current or kVA in a balanced three-phase combination circuit
- three-phase power factor and phase angle in a balanced three-phase combination circuit
- service and system voltage configurations and their line/coil values
- guidelines for connecting a closed transformer bank
- select and connect three transformers to provide single-phase and three-phase service voltage
- guidelines for connecting an open transformer bank
- select and connect two transformers to build an open transformer bank
- guidelines for paralleling three-phase banks
- determine both coil and line current and coil and line voltage values
- procedure to determine the load in kVA on an alive substation or three-phase transformer bank
- rated three-phase capacity of a substation or transformer bank
- fuse and riser sizing for a transformer bank

Mentors can assist the apprentice to prepare for this section of technical training by:

- *reviewing AC and DC principles*
- *explaining and demonstrating three phase connections and load checks*
- *familiarizing the apprentice with various transformer bank connection configurations*
- *familiarizing the apprentice with various service voltages and load requirements*

Service Installation

- five types of service classifications
- regulations of the Electric Service Guide regarding customer interface locations
- conductor for a service installation
- clearance regulations for services
- procedure to install or change a three-phase service

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice is exposed to metering components and installation, and instrument transformers*
- *familiarizing the apprentice with meter installation and removal procedures*
- *familiarizing the apprentice with hazards and PPE requirements for installing and removing meters and instrument transformers*
- *familiarizing the apprentice with meter socket voltage and continuity check procedures*

Instrument Transformers

- construction and function of potential and current transformers
- construction and function of single-phase instrument meters
- components in a single-phase instrument connected service
- billing multiplier, consumption and cost for an instrument connected single-phase service

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice is exposed to metering components and installation, and instrument transformers*
- *familiarizing the apprentice with meter installation and removal procedures*
- *familiarizing the apprentice with hazards and PPE requirements for installing and removing meters and instrument transformers*
- *familiarizing the apprentice with meter socket voltage and continuity check procedures*

Voltage Control Equipment

- procedures used to install and operate voltage regulation and control devices
- potential overvoltage situations
- types of overvoltage protection
- functions and applications of a shield wire
- function of lightning arrestors
- voltage regulation, its application and use
- devices and components used in voltage regulation, their application and use

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with overcurrent and overvoltage protection devices and configurations, and oil circuit recloser*
- *familiarizing the apprentice with fuse coordination principles*
- *familiarizing the apprentice with line loss and loading issues that lead to a requirement for voltage regulation*
- *familiarizing the apprentice with switching devices and Standard Protection Code requirements*
- *familiarizing the apprentice with switching orders and procedures*

Underground and Underwater Work

- underground and underwater systems, their components, characteristics and applications
- underground and underwater system construction principles
- cable protection methods and their applications
- direct buried underground and underwater cable types
- procedures used to install direct buried underground and underwater systems, and their components
- procedures used to terminate and test underground and underwater cables
- procedure to fuse and operate a three-phase underground transformer
- procedure used to install temporary grounds on single-phase underground apparatus
- procedure used to install temporary grounds on a single-phase underground cable

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining underground systems, tools and apparatus*
- *familiarizing the apprentice with underground system maps, field identification and markings*
- *identifying transformers, junction points, switching cubicles, construction standards, overhead/underground transition structures and their functions in the system*
- *familiarizing the apprentice with Standard Protection Code requirements and procedures for working on underground systems*
- *familiarizing the apprentice with safety regulations and requirements such as ground disturbance, locating, interpreting maps and field marking*

Load Checks

- distribution and transmission systems, their characteristics and applications
- procedures used to inspect, maintain and operate overhead, underground and underwater distribution and transmission systems
- pole structures, their characteristics and applications, and maintenance
- procedures used to inspect and maintain system components

Mentors can assist the apprentice to prepare for this section of technical training by:

- *removing contaminants from contacts, disconnect switches and insulators to comply with design specifications*
- *assisting the apprentice in identifying circuits and equipment to prevent switching errors*
- *demonstrate safe work practices pertaining to overhead, underground and underwater transmission systems*
- *familiarizing the apprentice with specifications and regulations pertaining to distribution and transmission systems*

Reclosers, Sectionalizers and Fuses

- procedures used to install different types of reclosers
- coordinated system protection
- operating principles of sectionalizers
- procedures used to install sectionalizers
- operating principles of different types of reclosers, their application and use
- function and installation of both fuses and thermal breakers
- procedures used to install reclosers

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with overcurrent and overvoltage protection devices and configurations, and oil circuit recloser*
- *familiarizing the apprentice with fuse coordination principles*
- *familiarizing the apprentice with line loss and loading issues that lead to a requirement for voltage regulation*
- *familiarizing the apprentice with switching devices and Standard Protection Code requirements*
- *familiarizing the apprentice with switching orders and procedures*

Transmission System Troubleshooting

- overhead transmission systems, their characteristics and applications
- procedures to troubleshoot and test overhead transmission systems, and their components and accessories
- procedures used in temporary grounding and bonding of overhead transmission systems
- underground and underwater transmission systems, and their characteristics and applications

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrate safe usage of test equipment and tools used to troubleshoot transmission systems*
- *demonstrate the procedure to isolate section of transmission line by operating equipment and devices according to switching authority*
- *explain how switching procedures are documented and why*
- *demonstrating troubleshooting techniques*
- *demonstrate the removal of components to access lines*
- *demonstrate the procedure to repair a line by splicing*
- *demonstrate the procedure to return the line to service*



Conductors and Cables (Distribution Stringing)

- procedures used to string distribution lines
- distribution and transmission lines, their components, applications and operation
- splices and connections for overhead conductors and cables
- conductor and cable protection methods for splices and connections

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrate safe use of the tools and equipment used to string overhead conductors and cables*
- *explain the procedure to attach travellers on pole and steel lattice structures*
- *explain information required to adjust tension on conductors and cable*
- *demonstrate procedure to secure conductors and cable to dead-end fixtures depending on type and size of conductor*
- *demonstrate how conductors and cables are transferred from travellers to insulators*
- *explain how sleeves are selected and applied on ends of overhead conductors and cables*
- *explain how connectors are selected and applied on ends of overhead conductors and cables*

Hotstick Work

- live-line work using FRP tools (hot sticks)
- principles of live-line work using rubber gloves
- procedures to identify and maintain FRP tools (hot sticks) and their associated tools
- procedures to identify the FRP tools (hot sticks) required to replace system components
- procedures to use cover-up
- procedures used to calculate the weight and dead-end tension of a conductor

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with inspection, care use, storage and testing of live-line tools*
- *familiarizing the apprentice with load charts and capacities of various live-line tools and accessories*
- *explaining live-line tool use and work procedures*
- *familiarizing the apprentice with Limits of Approach, second point of contact, body positioning and other techniques*
- *familiarizing the apprentice with conductor weights and forces*

Switching Devices

- function, types and installation of cutouts
- procedure used to operate a cutout
- function and operation of primary single-phase and three-phase switching devices
- function and operation of secondary switching devices

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with overcurrent and overvoltage protection devices and configurations, and oil circuit recloser*
- *familiarizing the apprentice with fuse coordination principles*
- *familiarizing the apprentice with line loss and loading issues that lead to a requirement for voltage regulation*
- *familiarizing the apprentice with switching devices and Standard Protection Code requirements*
- *familiarizing the apprentice with switching orders and procedures*

25kV Rubber Glove

- different classes of rubber gloves and how to select them according to voltage
- procedures used to inspect and clean conductor supports and hotsticks
- limits of approach on a 25kV system
- safe work procedures with regard to rubber glove use
- conditions required for safe removal of rubber gloves

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with inspection, care, use, storage and testing of rubber gloves*
- *familiarizing the apprentice with inspection, care, use, maintenance and testing of insulated aerial devices*
- *familiarizing the apprentice with positioning and set-up of insulated aerial devices*
- *familiarizing the apprentice with load charts and capacities of insulated aerial devices and components*
- *familiarizing the apprentice with conductor weights and forces*

Mentoring

- strategies for teaching workplace skills

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating effective communication techniques*
- *familiarizing the apprentice with constructive criticism*
- *demonstrating best practices and effective communication*

Conductors and Cables (Transmission Stringing)

- transmission lines, their applications and operation
- procedures used to sag overhead conductors and cables
- distribution and transmission lines, their components, applications and operation

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating procedures to install travellers and pulling rope*
- *familiarizing the apprentice with the set-up of stringing equipment*
- *familiarizing the apprentice with utility standards and regulations*
- *demonstrating effective conductor and cable protection methods*
- *demonstrating procedure to tension conductors*

Capacitors, Regulators and Reactors

- capacitors, their characteristics and applications
- procedures used to install, operate, protect, inspect and test capacitors
- voltage regulation and control devices, their characteristics and applications
- procedures used to install and operate voltage regulation and control devices
- reactors, their characteristics and applications

Mentors can assist the apprentice to prepare for this section of technical training by:

- *familiarizing the apprentice with overcurrent and overvoltage protection devices and configurations, and oil circuit recloser*
- *familiarizing the apprentice with fuse coordination principles*
- *familiarizing the apprentice with line loss and loading issues that lead to a requirement for voltage regulation*
- *familiarizing the apprentice with switching devices and Standard Protection Code requirements*
- *familiarizing the apprentice with switching orders and procedures*

Introduction to Substations

- hazards and describe safe work practices pertaining to substations
- components and accessories used in substations
- primary protective devices used in a substation
- substation, switching station and terminal components and describe their operation
- different types of substations, switching stations and terminals and describe their characteristics and applications
- procedures used to inspect and maintain substations, and their components and accessories

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrate operation of system equipment according to work procedures*
- *familiarize the apprentice with testing, commissioning and energization procedures*
- *familiarize the apprentice with supply authority specifications and installation requirements*
- *familiarize the apprentice with overhead components and accessories used in a substation*

Line Patrol

- tools and equipment pertaining to the maintenance of system components and describe their applications and procedures for use
- procedures used to inspect and maintain system components
- electrical principles, hazards and describe safe work practices pertaining to maintenance of system components during line patrol
- terminology and measurements associated with line patrol
- procedures used to properly diagnose and remove a fault during line patrol
- common causes for faults and outages
- transformers and power transformers, their components, applications and operation
- system components and describe their characteristics, applications and accessories

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrate the use of common test equipment and techniques used to diagnose a fault*
- *demonstrating the documentation of deficiencies and the method to repair*
- *demonstrating the use of load checks to identify imbalanced or overloaded circuits*
- *familiarizing the apprentice with safe work practices and identifying hazards*
- *familiarizing apprentices with the types of distribution and transmission systems*
- *familiarizing the apprentice with system components, installation and use*

Transmission System Repair

- procedures used to troubleshoot and test underground and underwater transmission systems, their components and accessories
- procedures used to repair and test overhead transmission system components and accessories

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating the use of testing equipment and techniques to troubleshoot a system*
- *demonstrating the procedure to isolate a fault, damage or hazards*
- *familiarizing the apprentice with the types of overhead transmission systems*
- *demonstrating the procedure to temporarily bond/ground of overhead transmission systems*
- *demonstrating the procedure to splice and repair damaged cables*
- *demonstrating the procedure to complete a repair and re-energize*

Cellular Towers

- cellular antenna operating principles

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrate the use of tools and equipment related to cellular installation and repair*
- *demonstrate the procedure to mount and secure an antenna according to manufacturer's specifications*
- *demonstrate the installation of fibre and power cables to the structure according to company standards or manufacturer's specifications*
- *familiarize the apprentice with the types of antennas and their applications*
- *familiarize the apprentice with the hazards associated with an operating antenna*

System Protection Apparatus

- 25kV GOPT switches, their application and use
- procedures used to operate a system with reclosers and an interlock
- safe work practices pertaining to recloser use
- types of distribution reclosers, their applications and use
- controllers used with distribution reclosers
- recloser applications in relation to line protection coordination
- sectionalizer applications in relation to line protection coordination
- fuse application in relation to line protection coordination

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining how protection systems operate*
- *familiarizing the apprentice with safety rules Standard Protection Code and procedures for system/substation switching*



Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

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