Construction Electrician

Guide to Course Content

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Recognition:
To promote transparency and consistency, portions of this document have been adapted from the 2021 Construction Electrician 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 GUIDE TO COURSE CONTENT

To facilitate understanding of the occupation, this guide to course content 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. The Task Matrix is broken down into the following:

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.

Training Profile Chart: a chart which outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training.

Technical Training Course Content for the Construction Electrician trade: a chart which outlines the model for SATCC technical training sequencing. For the harmonized level of training, a cross reference to the Harmonized apprenticeship technical training sequencing, at the learning outcome level, is provided.

TRAINING REQUIREMENTS FOR THE CONSTRUCTION ELECTRICIAN 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.

There are four levels of technical training delivered by various providers in Moose Jaw, Regina, and Saskatoon.

Level One:	8 weeks
Level Two:	8 weeks
Level Three:	8 weeks
Level Four:	8 weeks

***Any person who is not a journeyperson construction electrician must become registered as an apprentice to work in this trade.**

The information contained in this document details the technical training delivered for each level of apprenticeship. An apprentice spends approximately 15% of their apprenticeship term in a technical training institute learning the technical and theoretical aspects of the trade. The hours and percentages of technical and practical training may vary according to class needs and progress.

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

Entrance Requirements for Apprenticeship Training

Your grade twelve transcripts (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program and receive journeyperson certification.

Individuals with “modified” or “general” classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or "upgraders" must be able to understand and communicate in the English language.

Designated Trade Name	**Math Credit** at the Indicated Grade Level ❶	**Science Credit** at Grade Level
Construction Electrician	Grade 11	Grade 10

❶- (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre- calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).

*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.

For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/

Individuals not meeting the entrance requirements will be subject to an assessment and any required training

CONSTRUCTION ELECTRICIAN TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2021 Construction Electrician 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 Common Occupational Skills — 11%

A-1 Performs safety-related functions	1.01 Uses personal protective equipment (PPE) and safety equipment 1	1.02 Maintains safe work environment 1	1.03 Performs lock-out and tag-out procedures 1		
A-2 Uses tools and equipment	2.01 Uses common and specialty tools and equipment 1	2.02 Uses access equipment 1	2.03 Uses rigging, hoisting and lifting equipment 1		
A-3 Organizes work	3.01 Interprets plans, drawings and specifications 1 (In Context 2, 3, 4)	3.02 Organizes materials and supplies 1 (In Context 2, 3, 4)	3.03 Plans project tasks and procedures 1 (In Context 2, 3, 4)	3.04 Prepares worksite 1 (In Context 2, 3, 4)	3.05 Finalizes required documentation 1 (In Context 2, 3, 4)
A-4 Fabricates and installs support components	4.01 Fabricates support structures 1 (In Context 2, 3, 4)	4.02 Installs brackets, hangers and fasteners 1 (In Context 2, 3, 4)	4.03 Installs seismic restraint systems 1 (In Context 2, 3, 4)		

A-5 Commissions and decommissions electrical systems	5.01. Performs startup and shutdown procedures 1 (In Context 2, 3, 4)	5.02 Performs commissioning and decommissioning of systems 1 (In Context 2, 3, 4)
A-6 Uses communication and mentoring techniques	6.01 Uses communication techniques 1	6.02 Uses mentoring techniques 4

B – Installs, Services and Maintains Generating, Distribution and Service Systems

28%

B-7 Installs, services and maintains consumer/supply services and metering equipment	7.01 Installs single-phase consumer/supply services and metering equipment 1	7.02 Installs three-phase consumer/supply services and metering equipment 3	7.03 Performs servicing and maintenance of single-phase services and metering equipment 1	7.04 Performs servicing and maintenance of three-phase services and metering equipment 3
B-8 Installs, services and maintains protection devices	8.01 Installs overcurrent protection devices 1 (In Context 2. 3. 4)	8.02 Installs ground fault, arc fault and surge protection devices 1 (In Context 2. 3. 4)	8.03 Performs servicing and maintenance of protection devices 1 (In Context 2. 3. 4)	
B-9 Installs, services and maintains power distribution equipment	9.01 Installs power distribution equipment 1	9.02 Performs servicing and maintenance of power distribution equipment 3		

B-10 Installs, services and maintains power conditioning, uninterruptible power supply (UPS) and surge suppression systems	**10.01 Installs power conditioning, UPS and surge suppression systems** **4**	**10.02 Performs servicing and maintenance of power conditioning, UPS and surge suppression systems** **4**			
B-11 Installs, services and maintains bonding and grounding and ground fault protection and detection systems	**11.01 Installs grounding and bonding systems** **1, 2, 3**	**11.02 Installs ground fault and protection and detection systems** **2, 3**	**11.03 Installs lightning protection systems** **2, 3**	**11.04 Performs servicing and maintenance of bonding and grounding systems** **4**	
B-12 Installs, services and maintains power generation and conversion systems	**12.01 Installs AC (alternating current) generating systems** **3**	**12.02 Performs servicing and maintenance of AC generating systems** **3**	**12.03 Installs DC (direct current) generating and conversion systems** **2**	**12.04 Performs servicing and maintenance of DC generating and conversion systems** **2**	
B-13 Installs, services and maintains renewable energy generating and storage systems	**13.01 Installs renewable energy generating and storage systems** **2, 4**	**13.02 Performs servicing and maintenance of renewable energy generating and storage systems** **2, 4**			
B-14 Installs, services and maintains high voltage systems	**14.01 Installs high voltage equipment** **4**	**14.02 Installs high voltage cables** **4**	**14.03 Performs servicing and maintenance of high voltage systems** **4**		
B-15 Installs, services and maintains transformers	**15.01 Installs extra-low voltage transformers** **2**	**15.02 Installs low-voltage single-phase transformers** **2**	**15.03 Installs low-voltage three-phase transformers** **3**	**15.04 Installs high voltage transformers** **3**	**15.05 Performs servicing and maintenance of transformers** **3**

C – Installs, Services and Maintains Wiring Systems — 31%

C-16 Installs, services and maintains raceways, conductors, cables and enclosures	16.01 Installs conductors and cables 1, 2 (In Context 3, 4)	16.02 Installs conduit and fittings 1, 2 (In Context 3, 4)	16.03 Installs raceways 1, 2 (In Context 3, 4)	16.04 Installs boxes and enclosures 1, 2 (In Context 3, 4)	16.05 Performs servicing and maintenance of raceways, conductors, cables and enclosures 1, 2 (In Context 3, 4)
C-17 Installs, services and maintains branch circuitry and devices	17.01 Installs luminaires 1, 2, 3	17.02 Installs wiring devices 1, 2, 3	17.03 Installs lighting controls 1, 2, 3	17.04 Installs lighting standards 1, 2, 3	17.05 Performs servicing of branch circuitry 1, 2, 3
	17.06 Installs, services and maintains airport visual aid systems 4	17.07 Installs, services and maintains traffic signal lights and controls 4			
C-18 Installs, services and maintains heating, ventilating and air-conditioning (HVAC) systems	18.01 Connects HVAC systems and associated equipment 2	18.02 Installs HVAC controls 2	18.03 Performs servicing and maintenance of HVAC systems and controls 2		
C-19 Installs, services and maintains electric heating systems	19.01 Installs electric heating systems 2	19.02 Installs electric heating system controls 2	19.03 Performs servicing and maintenance of electric heating systems and controls 2		

C-20 Installs, services and maintains exit and emergency lighting systems	20.01 Installs exit and emergency lighting 2	20.02 Performs servicing and maintenance of exit and emergency lighting systems 2
C-21 Installs, services and maintains cathodic protection systems	21.01 Installs cathodic protection systems 2	21.02 Performs servicing and maintenance of cathodic protection systems 2

D – Installs, Services and Maintains Motors and Control Systems 20%

D-22 Installs, services and maintains motor starters and controls	22.01 Installs motor starters 2, 3	22.02 Performs servicing and maintenance of motor starters 2, 3	22.03 Installs motor control devices 2, 3	22.04 Performs servicing and maintenance of motor controls 2, 3	
D-23 Installs, services and maintains drives	23.01 Installs AC drives 3	23.02 Performs servicing and maintenance of AC drives 3	23.03 Installs DC drives 3	23.04 Performs servicing and maintenance of DC drives 3	
D-24 Installs, services and maintains motors	24.01 Installs single-phase motors 3, 4	24.02 Performs servicing and maintenance of single-phase motors 3, 4	24.03 Installs three-phase motors 3, 4	24.04 Performs servicing and maintenance of three-phase motors 3, 4	24.05 Installs DC motors 2, 3, 4

	24.06 Performs servicing and maintenance of DC motors 2, 3, 4			
D-25 Installs, programs, services and maintains automated control systems	25.01 Installs automated control systems 4	25.02 Performs servicing and maintenance of automated control systems 4	25.03 Programs and configures automated control systems 4	

E – Installs, Services and Maintains Signalling and Communication Systems

10%

E-26 Installs, services and maintains signaling systems	26.01 Installs fire alarm systems 4	26.02 Performs servicing and maintenance of fire alarm systems 4	26.03 Installs security and surveillance systems 4	26.04 Performs servicing and maintenance of security and surveillance systems 4
E-27 Installs, services and maintains communication systems	27.01 Installs voice/data/video (VDV) and community antenna television (CATV) systems 1, 4	27.02 Installs public address (PA) and intercom systems 1, 4	27.03 Installs nurse call systems 1, 4	27.04 Performs servicing and maintenance of communication systems 4
E-28 Installs, services and maintains integrated control systems	28.01 Installs building automation systems 4	28.02 Installs building control systems 4	28.03 Performs servicing and maintenance of integrated control systems 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 and Personal Protective Equipment	SFTY 131	20
Introductory Electrical Theory and Practices	BT 131	48
Extra-Low Voltage, Magnetism and Meters	BWC 131	36
Wiring Methods	WM 130	34
Single Dwelling Plans, Lighting and Services	PLS 130	36
Solving DC Circuits	BT 130	36
Conductors and Branch Circuits	BWC 130	30
		240

Level Two	Transcript Code	Hours
DC Machines	EMC 225	30
Motor Starters and Controls	EMC 227	18
Electronic Instruments, Rectification, and Filtering	IE 222	36
Services Under 900 Square Meters	PLS 222	42
Transformers	TRNS 220	36
Residential Electric Heat	HC 220	6
Heating and Cooling Systems	HC 221	30
AC Theory and Meters	BT 220	24
Resistive, Inductive, and Capacitive Circuits	BT 224	18
		240

Level Three	Transcript Code	Hours
Motor Starters and Controls	EMC 325	42
Three-Phase Rectification and DC Power Supplies	IE 322	36
Sensors and Phase Control and Data Cabling	IE 323	36
Services for Occupancies Over 900 Square Metres	PLS 323	36
AC Motors	EMC 326	24
Three-Phase Theory/Alternators	BT 300	33
Three-Phase Transformers	TRNS 322	33
		240

Level Four	Transcript Code	Hours
Hazardous Locations	WM 420	18
Power Factor Correction	BT 426	24
Three-Phase Four-Wire Services	PLS 424	36
Programmable Logic Controllers	IE 427	36
Primary Metering and High Voltage	HVM 424	30
Building Systems	BLDG 400	36
Fire Alarm Systems	FA 420	30
Certification Preparation	REV XXX	30
		240

TECHNICAL TRAINING COURSE CONTENT

This chart outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training sequencing. For the harmonized levels of training, a cross reference to the Red Seal Occupational Standard (RSOS) apprenticeship technical training sequencing, at the learning outcome level, is provided.

Sub-tasks listed are the minimum to be covered in a topic. Related sub-tasks not listed may be used as a reference and taught "in context" in other topics.

Level One — 8 weeks — 240 hours

Safety and Personal Protective Equipment — **20 hours**

- describe *The Saskatchewan Employment Act* and *The Occupational Health and Safety Regulations* in the electrical trade
- describe personal protective equipment
- describe arc flash
- describe rigging equipment
- describe applicable health and safety regulation and legislation in rigging applications
- describe a safe hoisting operation
- describe a safe hoisting or pulling operation without a crane

RSOS topics covered in this section of training:

A-1 Performs safety-related functions
A-1.01 Uses personal protective equipment (PPE) and safety equipment
A-1.02 Maintains safe work environment
A-1.03 Performs lock-out and tag-out procedures

A-2 Tools and Equipment
A-2.01 Uses common and specialty tools and equipment
A-2.02 Uses access equipment
A-2.03 Uses rigging, hoisting and lifting equipment

Introductory Electrical Theory and Practices — **48 hours**

- describe the electrician trade in Saskatchewan
- describe the application of the Canadian Electrical Code
- describe basic principles of electricity
- describe basic electrical circuit concepts
- describe common electrical devices
- select common fasteners
- terminate conductors
- connect basic electrical circuits

RSOS topics covered in this section of training:

A-4 Fabricates and installs support components
A-4.01 Fabricates support structures
A-4.02 Installs brackets, hangers and fasteners
A-4.03 Installs seismic restraint systems

A-6 Uses communication and mentoring techniques
A-6.01 Uses communication techniques

Extra-Low Voltage, Magnetism, and Meters — 36 hours

- describe the principles of electromagnetism
- describe the operating principles of meters
- use meters for voltage measurement
- use meters for current measurement
- use meters for resistance measurement
- use meters for power and energy measurement
- install basic signal systems
- install remote control relay systems

RSOS topics covered in this section of training:

E-26 Installs, services, and maintains signaling systems
E-26.03 Installs security and surveillance systems
E-26.04 Performs servicing and maintenance of security and surveillance systems

E-27 Installs, services and maintains communication systems
E-27.01 Installs voice/data/video (VDV) and community antenna television (CATV) systems
E-27.02 Installs public address (PA) and intercom systems
E-27.03 Installs nurse call systems
E-27.04 Performs servicing and maintenance of communication systems

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Wiring Methods — 34 hours

- install non-metallic sheathed cable
- install armoured cable
- describe aluminum sheathed cable
- describe mineral insulated cable
- describe raceways
- describe rigid and flexible conduit
- describe electrical metallic tubing
- describe rigid PVC conduit
- describe surface raceways
- describe installation requirements for data cabling
- terminate data cabling

RSOS topics covered in this section of training:

C-16 Installs, services and maintains raceways, cables and enclosures
C-16.01 Installs conductors and cables
C-16.02 Installs conduit and fittings
C-16.03 Installs raceways
C-16.04 Installs boxes and enclosures
C-16.05 Performs servicing and maintenance of raceways, conductors, cables and enclosures

Single Dwelling Plans, Lighting, and Services — 36 hours

- describe common construction drawings
- describe electrical drawings, symbols and schedules
- determine lighting requirements
- determine single dwelling services
- install single dwelling services

RSOS topics covered in this section of training:

A-3 Organizes Work
A-3.01 Interprets plans, drawings and specifications

B-7 Installs, services and maintains consumer/supply services and metering equipment
B-7.01 Installs single-phase consumer/supply services and metering equipment
B-7.03 Performs servicing and maintenance of single-phase services and metering equipment

B-9 Installs, services and maintains distribution equipment
B-9.01 Installs power distribution equipment
B-9.02 Performs servicing and maintenance of power distribution equipment

B-11 Installs, services and maintains bonding and grounding, and ground fault protection and detection systems
B-11.01 Installs grounding and bonding systems

C-17 Installs, services and maintains branch circuitry and devices
C-17.01 Installs luminaires
C-17.02 Installs wiring devices
C-17.03 Installs lighting controls
C-17.04 Installs lighting standards
C-17.05 Performs servicing of branch circuitry

Conductors and Branch Circuits — 30 hours

- describe common conductors
- calculate conductor resistance and ampacity
- select overcurrent devices
- select bonding conductors
- determine branch circuit requirements

RSOS topics covered in this section of training:

B-8 Installs, Services and Maintains Generating, Distribution and Service Systems
B-8.01 Installs overcurrent protection devices
B-8.02 Installs ground fault and surge protection systems
B-8.03 Performs servicing and maintenance of protection devices

Solving DC Circuits — 36 hours

- analyze series circuits
- analyze parallel circuits
- analyze combination circuits
- analyze three-wire circuits
- connect cells and batteries

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Level Two | 8 weeks | 240 hours

DC Machines — 30 hours

- describe typical DC machine construction
- describe common DC generator connections
- connect DC generators
- describe DC motor connections
- connect DC motors
- connect DC generators in parallel

RSOS topics covered in this section of training:

B-12 Installs, services, and maintains power generation and conversion systems
B-12.03 Installs direct current (DC) generating systems
B-12.04 Performs servicing and maintenance of DC generating and conversion systems

D-24 Installs, services and maintains motors
D-24.05 Installs DC motors
D-24.06 Performs servicing and maintenance of DC motors

Motor Starters and Controls — 18 hours

- connect manual motor control circuits
- connect overload protection
- connect electromagnetic motor control circuits
- determine motor control (installation standards)

RSOS topics covered in this section of training:

D-22 Installs, services, and maintains motor starters and controls
D-22.01 Installs motor starters
D-22.02 Performs servicing and maintenance of motor starters
D-22.03 Installs motor control devices
D-22.04 Performs servicing and maintenance of motor control devices

Electronic Instruments, Rectification and Filtering — 36 hours

- select resistors for electronic circuits
- use voltmeters in electronic circuits
- use an Oscilloscope to view and measure AC wave forms and DC
- describe semi-conductor junction diodes
- connect single-phase 1/2 wave rectifier circuit
- connect single-phase bi-phase rectifier circuit
- connect single-phase bridge rectifier circuit
- describe resistive/capacitive (RC) time constants
- connect basic rectifier filter circuits
- analyze AC waveforms and DC voltage with an oscilloscope

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Services under 900 Square Meters **42 hours**

- determine branch circuit requirements for single phase motors
- determine feeder requirements for groups of single-phase motors
- determine feeder requirements for motors and other loads combined
- determine service entrance requirements for institutional buildings up to and including 900 sq. meters, (for common institutional and commercial buildings, and for row housing and apartment building complexes)
- renewable energy generating and storage systems
- cathodic protection
- exit and emergency lighting systems

RSOS topics covered in this section of training:

B-11 Installs, services and maintains bonding and grounding protection systems
B-11.01 Installs grounding and bonding systems
B-11.02 Installs ground fault protection and detection systems
B-11.03 Installs lightning protection systems

B-13 Installs, services and maintains renewable energy systems
B-13.01 Installs renewable energy generating and storage systems
B-13.02 Performs servicing and maintenance of renewable energy generating and storage systems

C-16 Installs, services and maintains raceways, cables and enclosures
C-16.01 Installs conductors and cables
C-16.02 Installs conduit and fittings
C-16.03 Installs raceways
C-16.04 Installs boxes and enclosures
C-16.05 Performs servicing and maintenance of raceways, conductors, cables, and enclosures

C-17 Installs, services and maintains branch circuitry and devices
C-17.01 Installs luminaires
C-17.02 Installs wiring devices
C-17.03 Installs lighting controls
C-17.04 Installs lighting standards
C-17.05 Performs servicing of branch circuitry

C-20 Installs, services and maintains exit and emergency lighting systems
C-20.01 Installs exit and emergency lighting
C-20.02 Performs servicing and maintenance of exit and emergency lighting systems

C-21 Installs, services and maintains cathodic protection systems
C-21.01 Installs cathodic protection systems
C-21.02 Performs servicing and maintenance of cathodic protection systems

Transformers — 36 hours

- describe the operation of basic transformer
- describe single-phase transformer construction
- connect typical dual-secondary single-phase transformers
- calculate winding turns, voltages and currents using transformer ratio formulas
- describe basic instrument transformer circuits
- calculate transformer values
- identify unmarked transformer leads
- conduct transformer impedance tests
- connect transformers in parallel
- connect autotransformers

RSOS topics covered in this section of training:

B-15 Installs, services and maintains transformers
B-15.01 Installs extra-low voltage transformers
B-15.02 Installs low-voltage single-phase transformers

Residential Electric Heat — 6 hours

- determine residential electric heating requirements
- describe installation requirements for residential heating

RSOS topics covered in this section of training:

C-19 Installs, services and maintains electric heating systems
C-19.01 Installs electric heating systems
C-19.02 Installs electric heating system controls
C-19.03 Performs servicing and maintenance of HVAC systems and controls

Heating and Cooling Systems — 30 hours

- install residential heating and cooling systems
- service residential heating and cooling systems
- install commercial and industrial burner controls
- service commercial and industrial burner controls

RSOS topics covered in this section of training:

C-18 Installs, services, and maintains heating, ventilating and air- conditioning (HVAC) systems
C-18.01 Connects HVAC systems and associated equipment
C-18.02 Installs HVAC controls
C-18.03 Performs servicing and maintenance of the HVAC systems and controls

Resistive, Inductive and Capacitive Circuits — 18 hours

- sketch sine wave and phasors for parallel circuits
- solve AC parallel circuits
- calculate AC power units and power formulas
- solve AC series circuit problems

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

AC Theory and Meters **24 hours**

- use analog and digital meters to measure resistance, voltage, and current
- describe power meters
- describe the principles of electromagnetic induction
- describe the operation of an elementary AC generator
- calculate instantaneous, average, and RMS values for sine waves
- compare the effects of resistance, inductive reactance and capacitive reactance in an AC circuit
- draw sine wave and phasor diagrams for AC resistive, inductive, and capacitive circuits

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Level Two topics from the RSOS that are taught in context:

A-3 Organizes work
A-4 Fabricates and installs support components
A-5 Commissions and decommissions systems
B-8 Installs, services and maintains protection devices

Canadian Electrical Code

For details regarding the In Context Topic, see page 26

Level Three — 8 weeks — 240 hours

Motor Starters and Controls — 42 hours

- interpret schematic and wiring diagrams (for various motor control applications)
- install motor control devices (for three phase motors in manual and automatic applications)
- install advanced motor control devices (for three phase motors in manual and automatic applications)
- determine regulatory standards for motor control
- describe principles of motor operation and control.
- describe methods to control starting current and torque for AC motors.

RSOS topics covered in this section of training:

D-22 Installs, services and maintains motor starters and controls
D-22.01 Installs motor starters
D-22.02 Performs servicing and maintenance of motor starters
D-22.03 Installs motor control devices
D-22.04 Performs servicing and maintenance of motor controls

Three Phase Rectification and DC Power Supplies — 36 hours

- connect three-phase wye rectifier circuits
- connect three-phase full-wave bridge rectifier circuits
- describe zener diodes
- describe bi-polar transistors
- connect voltage regulator circuits

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Sensors and Phase Control — 36 hours

- describe temperature sensing devices
- describe optical devices
- describe proximity sensing switches
- connect SCR phase control circuits
- describe J-Fets and Mos-Fets
- describe AC adjustable speed drive types

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Services for Occupancies Over 900 Square Metres — 36 hours

- determine lighting requirements
- determine the requirements for 3-phase squirrel cage and synchronous motor branch circuits and feeders
- calculate the requirements for wound rotor and continuous duty motor branch circuits and feeders
- calculate the requirements for welder branch circuits and feeders
- determine services and feeders for buildings with an area exceeding 900 square metres

RSOS topics covered in this section of training:

B-7 Installs, services and maintains consumer/supply services and metering equipment
B-7.02 Installs Three-phase consumer/supply services and metering equipment
B-7.04 Performs servicing and maintenance of three-phase services and metering equipment

B-11 Installs, services and maintains bonding and grounding protection systems
B-11.01 Installs grounding and bonding systems
B-11.02 Installs ground fault protection and detection systems
B-11.03 Installs lightning protection systems

C-17 Installs services and maintains branch circuitry and devices
C-17.01 Installs luminaires
C-17.02 Installs wiring devices
C-17.03 Installs lighting controls
C-17.04 Installs lighting standards
C-17.05 Performs servicing of branch circuitry

Three-Phase Theory/Alternators — 33 hours

- describe AC generator principles and configurations
- describe AC generators set components
- describe AC generator terminal markings and connections
- connect three-phase loads and solve three-phase load problems
- describe AC generator operation with mixed PF loads
- describe instruments used to find frequency, phase sequence, motor rotation, shaft speed (tachometers), and insulation resistance
- connect AC generator in parallel

RSOS topics covered in this section of training:

B-12 Installs, services and maintains power generation and conversion systems
B-12.01 Installs alternating current (AC) generating systems
B-12.02 Performs servicing and maintenance of AC generating systems

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Three-Phase Transformers — 33 hours

- describe transformers
- describe the characteristics of various three-phase transformer connections
- determine Canadian Electrical Code requirements for transformer installations
- connect three phase transformers

RSOS topics covered in this section of training:

B-15 Installs, services and maintains transformers
B-15.03 Installs low-voltage three-phase transformers
B-15.04 Installs high-voltage transformers
B-15.05 Performs servicing and maintenance of transformers

AC Motors **24 hours**

- describe the construction and operation of three-phase AC motors
- connect three-phase squirrel cage motors
- connect three-phase wound rotor motors
- connect three-phase synchronous motors
- describe the maintenance requirements of three-phase motors
- describe the construction and operation of single-phase AC motors
- connect single-phase squirrel cage split phase induction motors
- describe single-phase repulsion motors
- describe the maintenance requirements of single-phase motors

RSOS topics covered in this section of training:

D-23 Installs, services and maintains drives
D-23.01 Installs AC drives
D-23.02 Performs servicing and maintenance of AC drives
D-23.03 Installs DC drives
D-23.04 Performs servicing and maintenance of DC drives

D-24 Installs, services and maintains motors
D-24.01 Installs single-phase motors
D-24.02 Performs servicing and maintenance of single-phase motors
D-24.03 Installs three-phase motors
D-24.04 Performs servicing and maintenance of three-phase motors
D-24.05 Installs DC motors
D-24.06 Performs servicing and maintenance of DC motors

Level Three topics from the RSOS that are taught in context:

A-3 Organizes work
A-4 Fabricates and installs support components
A-5 Commissions and decommissions systems
B-8 Installs, services and maintains protection devices
C-16 Installs, services and maintains raceways cables and enclosures

Canadian Electrical Code

For details regarding the In Context Topic, see page 26

Level Four — 8 weeks — 240 hours

Power Factor Correction — 24 hours

- describe power factor correction
- apply power factor correction to AC induction motors
- describe power factor correction principles using synchronous motors

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Programmable Logic Controllers — 36 hours

- connect standard logic gate control circuits
- connect inverted logic gate control circuits
- describe numbering systems used in programmable controllers
- connect programmable logic controller hardware
- describe programmable logic controller memory structure, addressing, and control sequence
- program a programmable logic controller for digital control
- program a programmable logic controller for analog control

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Primary Metering and High Voltage — 30 hours

- determine high voltage metering requirements
- describe high voltage installation requirements
- describe safe high voltage system practices including PPE and arc flash awareness

RSOS topics covered in this section of training:

B-14 Installs high voltage equipment
B-14.01 Installs high voltage equipment
B-14.02 Installs high voltage cables
B-14.03 Performs servicing and maintenance of high voltage systems

Hazardous Locations — 18 hours

- describe installation requirements for hazardous locations
- describe installation requirements for flammable liquid and dispensing areas
- describe installation requirements for areas of harmful and corrosive liquids
- describe installation requirements for patient care specification areas

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Fire Alarm Systems — 30 hours

- describe fire alarm systems and components
- determine fire alarm system requirements
- determine wiring requirements for fire alarm systems
- connect typical fire alarm panels
- troubleshoot typical fire alarm systems

RSOS topics covered in this section of training:

E-26 Installs, services and maintains signalling systems
E-26.01 Installs fire alarm systems
E-26.02 Performs servicing and maintenance of fire alarm systems
E-26.03 Installs security and surveillance systems
E-26.04 Performs servicing and maintenance of security and surveillance systems

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Building Systems — 36 hours

- describe Building automation systems
- describe UPS and surge suppression systems
- describe renewable energy generating and storage systems
- describe automated control systems
- describe communication systems

RSOS topics covered in this section of training:

B-10 Installs, services and maintains power conditioning uninterruptible power supply (UPS) and surge suppression systems
B-10.01 Installs power conditioning, UPS and surge suppression systems
B-10.02 Performs servicing and maintenance of power conditioning, UPS and surge suppression systems

B-13 Installs, services and maintains renewable energy generating and storage systems
B-13.01 Installs renewable energy generating and storage systems
B-13.02 Performs servicing and maintenance of renewable energy generating and storage systems

D-25 Installs, programs, services and maintains automated control systems
D-25.01 Installs automated control systems
D-25.02 Performs servicing and maintenance of automated control systems
D-25.03 Programs and configures automated control systems

E-27 Installs, services and maintains communication systems
E-27.01 Installs voice/data/video (VDV) and community antenna television (CATV) systems
E-27.02 Installs public address (PA) and intercom systems
E-27.03 Installs nurse call systems
E-27.04 Performs servicing and maintenance of communication systems

E-28 Installs, services and maintains integrated control systems
E-28.01 Installs building automation systems
E-28.02 Installs building control systems
E-28.03 Performs servicing and maintenance of integrated control systems

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Three-Phase Four-Wire Services — 36 hours

- describe three-phase circuit loading characteristics of three-phase three-wire and three-phase four-wire circuits
- calculate the requirements for services and feeders for buildings to be supplied with three-phase energy
- determine electrical requirements considering conductor voltage drop
- determine the installation requirements for specialized wiring methods
- describe thermit weld conductor terminations

RSOS topics covered in this section of training:

B-7 Installs, services and maintains consumer/supply services and metering equipment (three- Phase)
B-7.02 Installs three-phase consumer/supply services and metering equipment
B-7.04 Performs servicing and maintenance of three-phase services and metering equipment

C-17 Installs, services and maintains branch circuitry and devices (Three-Phase)
C-17.01 Install luminaires
C-17.02 Installs wiring devices
C-17.03 Installs lighting controls
C-17.04 Install lighting standards
C-17.05 Performs servicing on branch circuitry
C-17.06 Installs, services and maintains airport visual aid systems
C-17.07 Installs, services and maintains traffic signal lights and controls

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Certification Preparation **30 hours**

- describe effective trade qualification exam preparation techniques and identify available resources
- describe basic workplace safety, read various drawings, and take electrical measurements
- describe the installation, service and maintenance of electrical services, transformers, generators, power quality systems, measurement instruments and high voltage installations
- installs, services and maintains wiring systems, including conductors, raceways, specialized lighting and protection systems, residential and commercial heating systems
- explain the construction, operation and maintenance of various motors, apply motor control principles for single and three phase systems
- explain installation and maintenance requirements for signal, automated control, communication, data cabling and fire alarm systems

This section of training exceeds the minimum sequencing as set out by the Construction Electrician RSOS.

Level Four topics from the RSOS that are taught in context:

A-3 Organizes work
A-4 Fabricates and installs support components A-
A-5 Commissions and decommissions systems
B-8 Installs, services and maintains protection devices
C-16 Installs, services and maintains raceways cables and enclosures

Canadian Electrical Code

For details regarding the In Context Topic, see page 26

In Context Topics

In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

A-3 Organizes Work
A-3.01 Organizes project tasks and procedures
A-3.02 Organizes materials and supplies

A-4 Fabricates and installs support components
A-4.02 Installs brackets, hangers and fasteners
A-4.03 Installs seismic restraint systems

A-5 Commissions and decommissions electrical systems
A-5.01 Performs start-up and shutdown procedures
A-5.02 Performs commissioning and decommissioning of systems

B-8 Installs, services and maintains protection devices
B-8.01 Installs overcurrent protection devices
B-8.02 Installs ground fault, arc fault and surge protection devices
B-8.03 Performs servicing and maintenance of ground fault, arc fault and surge protection devices

C-16 Installs, services and maintains raceways cables and enclosures
C-16.01 Installs conductors and cables
C-16.02 Installs conduit and fittings
C-16.03 Installs raceways
C-16.04 Installs boxes and enclosures
C-16.05 Performs servicing and maintenance of raceways, conductors, cables and enclosures