



# Construction Electrician Course Outline

**2023-2024**

# 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 and Code Review	PLS 424	42
Thyristors	IE 425	24
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
		240

# TECHNICAL TRAINING COURSE OUTLINE

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

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<b>Level One</b>	<b>8 weeks</b>	<b>240 hours</b>
<b>Safety and Personal Protective Equipment</b>		<b>20 hours</b>
<ul style="list-style-type: none"><li>• describe <i>The Saskatchewan Employment Act</i> and <i>The Occupational Health and Safety Regulations</i> requirements in the electrical trade</li><li>• describe personal protective equipment</li><li>• describe arc flash</li><li>• describe rigging equipment</li><li>• describe applicable health and safety regulation and legislation in rigging applications</li><li>• describe safe hoisting operations</li><li>• describe safe hoisting or pulling operations without a crane</li></ul>		
<b>Introductory Electrical Theory and Practices</b>		<b>48 hours</b>
<ul style="list-style-type: none"><li>• describe the electrician trade in Saskatchewan</li><li>• describe the application of the Canadian Electrical Code</li><li>• describe basic principles of electricity</li><li>• describe basic electrical circuit concepts</li><li>• describe common electrical devices</li><li>• select common fasteners</li><li>• terminate conductors</li><li>• connect basic electrical circuits</li></ul>		
<b>Extra-Low Voltage, Magnetism, and Meters</b>		<b>36 hours</b>
<ul style="list-style-type: none"><li>• describe the principles of electromagnetism</li><li>• describe the operating principles of meters</li><li>• use meters for voltage measurement</li><li>• use meters for current measurement</li><li>• use meters for resistance measurement</li><li>• use meters for power and energy measurement</li><li>• install basic signal systems</li><li>• install remote control relay systems</li></ul>		
<b>Wiring Methods</b>		<b>34 hours</b>
<ul style="list-style-type: none"><li>• install non-metallic sheathed cable</li><li>• install armoured cable</li><li>• describe aluminum sheathed cable</li><li>• describe mineral insulated cable</li><li>• describe raceways</li><li>• describe rigid and flexible conduit</li><li>• describe electrical metallic tubing</li><li>• describe rigid PVC conduit</li></ul>		

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- describe surface raceways
- describe installation requirements for data cabling
- terminate data cabling

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### **Single Dwelling Plans, Lighting, and Services**

**36 hours**

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

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### **Conductors and Branch Circuits**

**30 hours**

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

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### **Solving DC Circuits**

**36 hours**

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

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## Level Two

8 weeks

240 hours

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### 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
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### Motor Starters and Controls

18 hours

- connect manual motor control circuits
  - connect overload protection
  - connect electromagnetic motor control circuits
  - determine motor control (installation standards)
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### Electronic Instruments, Rectification and Filtering

36 hours

- select resistors for electronic circuits
  - use voltmeters in electronic circuits
  - use 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
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### Services Under 900 Square Meters

42 hours

- determine single phase motors (branch circuit and feeder requirements)
  - determine feeder requirements (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
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### Transformers

36 hours

- describe basic transformers
- 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

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**Residential Electric Heat****6 hours**

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

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**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

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**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

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**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

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## Level Three

8 weeks

240 hours

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### 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 (motor control)

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### 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

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### Sensors, Phase Control and Data Cabling

36 hours

- describe temperature sensing devices
- describe optical devices
- describe proximity sensing switches
- connect SCR phase control circuits
- describe J-Fets and Mos-Fets
- terminate data cabling

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### Services for Occupancies Over 900 Square Metres

36 hours

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

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### 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

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## 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

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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



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## Level Four

8 weeks

240 hours

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### 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
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### Thyristors

24 hours

- connect a semi-converter phase control circuit and components
  - connect the inverse-parallel SCR phase control circuit and components
  - connect protective devices for transient voltages and rate-turn on
  - connect a ramp and pedestal firing circuit
  - connect a TRIAC phase control circuit and components
  - connect solid-state contactors
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### 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
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### Primary Metering and High Voltage

30 hours

- determine high voltage metering requirements
  - describe high voltage installation requirements
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### 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
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### 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

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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

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## Three-Phase Four-Wire Services

**42 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
- describe effective trade qualification exam preparation techniques
- identify Canadian Electrical Code rules



# 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. Harmonization for the Construction Electrician trade has been fully implemented for each technical training level.

## A - Performs common occupational skills

**11%**

<b>Task A-1 Performs safety-related functions</b>	<b>1.01 Uses personal protective equipment (PPE) and safety equipment</b>  1	<b>1.02 Maintains safe work environment</b>  1	<b>1.03 Performs lock-out and tag-out procedures</b>  1		
<b>Task A-2 Uses tools and equipment</b>	<b>2.01 Uses common and specialty tools and equipment</b>  1	<b>2.02 Uses access equipment</b>  1	<b>2.03 Uses rigging, hoisting and lifting equipment</b>  1		
<b>Task A-3 Organizes work</b>	<b>3.01 Interprets plans, drawings and specifications</b>  (In Context 1, 2, 3, 4)	<b>3.02 Organizes materials and supplies</b>  (In Context 1, 2, 3, 4)	<b>3.03 Plans project tasks and procedures</b>  (In Context 1, 2, 3, 4)	<b>3.04 Prepares worksite</b>  (In Context 1, 2, 3, 4)	<b>3.05 Finalizes required documentation</b>  (In Context 1, 2, 3, 4)
<b>Task A-4 Fabricates and installs support components</b>	<b>4.01 Fabricates support structures</b>  1 (In Context 2, 3, 4)	<b>4.02 Installs brackets, hangers and fasteners</b>  1 (In Context 2, 3, 4)	<b>4.03 Installs seismic restraint systems</b>  1 (In Context 2, 3, 4)		
<b>Task A-5 Commissions and decommissions electrical systems</b>	<b>5.01. Performs startup and shutdown procedures</b>  (1, 2, 3, 4 In Context)	<b>5.02 Performs commissioning and decommissioning of systems</b>  (1, 2, 3, 4 In Context)			

<b>Task A-6 Uses communication and mentoring techniques</b>	<b>6.01 Uses communication techniques</b>  1	<b>6.02 Uses mentoring techniques</b>  4
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## B – Installs, services and maintains generating, distribution and service systems

**28%**

<b>Task B-7 Installs, services and maintains consumer/supply services and metering equipment</b>	<b>7.01 Installs single-phase consumer/supply services and metering equipment</b>  1	<b>7.02 Installs three-phase consumer/supply services and metering equipment</b>  4	<b>7.03 Performs servicing and maintenance of single-phase services and metering equipment</b>  1	<b>7.04 Performs servicing and maintenance of three-phase services and metering equipment</b>  4
<b>Task B-8 Installs, services and maintains protection devices</b>	<b>8.01 Installs overcurrent protection devices</b>  (In Context 1, 2, 3, 4)	<b>8.02 Installs ground fault, arc fault and surge protection devices</b>  (In Context 1, 2, 3, 4)	<b>8.03 Performs servicing and maintenance of protection devices</b>  (In Context 1, 2, 3, 4)	
<b>Task B-9 Installs, services and maintains power distribution equipment</b>	<b>9.01 Installs power distribution equipment</b>  1, 4	<b>9.02 Performs servicing and maintenance of power distribution equipment</b>  1, 4		
<b>Task B-10 Installs, services and maintains power conditioning, uninterruptible power supply (UPS) and surge suppression systems</b>	<b>10.01 Installs power conditioning, UPS and surge suppression systems</b>  4	<b>10.02 Performs servicing and maintenance of power conditioning, UPS and surge suppression systems</b>  4		

<b>Task B-11 Installs, services and maintains bonding and grounding and ground fault protection and detection systems</b>	<b>11.01 Installs grounding and bonding systems</b>  1, 2, 3, 4	<b>11.02 Installs ground fault and protection and detection systems</b>  1, 2, 3, 4	<b>11.03 Installs lightning protection systems</b>  1, 2, 3, 4	<b>11.04 Performs servicing and maintenance of bonding and grounding systems</b>  1, 4	
<b>Task B-12 Installs, services and maintains power generation and conversion systems</b>	<b>12.01 Installs AC (alternating current) generating systems</b>  3	<b>12.02 Performs servicing and maintenance of AC generating systems</b>  3	<b>B-12.03 Installs DC (direct current) generating systems (NOT COMMON CORE)</b>  2	<b>12.04 Performs servicing and maintenance of DC generating and conversion systems (NOT COMMON CORE)</b>  2	
<b>Task B-13 Installs, services and maintains renewable energy generating and storage systems</b>	<b>13.01 Installs renewable energy generating and storage systems</b>  4	<b>13.02 Performs servicing and maintenance of renewable energy generating and storage systems</b>  4			
<b>Task B-14 Installs, services and maintains high voltage systems</b>	<b>14.01 Installs high voltage equipment</b>  4	<b>14.02 Installs high voltage cables</b>  4	<b>14.03 Performs servicing and maintenance of high voltage systems</b>  4		
<b>Task B-15 Installs, services and maintains transformers</b>	<b>15.01 Installs extra-low voltage transformers</b>  2	<b>15.02 Installs low-voltage single-phase transformers</b>  2	<b>15.03 Installs low-voltage three-phase transformers</b>  3	<b>15.04 Installs high voltage transformers</b>  3	<b>15.05 Performs servicing and maintenance of transformers</b>  3

# C – Installs, services and maintains wiring systems

**30%**

<p><b>Task C-16 Installs, services and maintains raceways, cables and enclosures</b></p>	<p><b>16.01 Installs conductors and cables</b></p> <p>1, 2 (3, 4 In Context)</p>	<p><b>16.02 Installs conduit and fittings</b></p> <p>1, 2 (3, 4 In Context)</p>	<p><b>16.03 Installs raceways</b></p> <p>1, 2 (3, 4 In Context)</p>	<p><b>16.04 Installs boxes and enclosures</b></p> <p>1, 2 (3, 4 In Context)</p>	<p><b>16.05 Performs servicing and maintenance of raceways, conductors, cables and enclosures</b></p> <p>1, 2 (3, 4 In Context)</p>
<p><b>Task C-17 Installs, services and maintains branch circuitry and devices</b></p>	<p><b>C-17.01 Installs luminaires</b></p> <p>1, 2, 3</p>	<p><b>17.02 Installs wiring devices</b></p> <p>1, 2, 3</p>	<p><b>17.03 Installs lighting controls</b></p> <p>1, 2, 3</p>	<p><b>17.04 Installs lighting standards</b></p> <p>1, 2, 3</p>	<p><b>17.05 Performs servicing of branch circuitry</b></p> <p>1, 2, 3</p>
	<p><b>17.06 Installs, services and maintains airport visual aid systems</b></p> <p>4</p>	<p><b>17.07 Installs, services and maintains traffic signal lights and controls</b></p> <p>4</p>			
<p><b>Task C-18 Installs, services and maintains heating, ventilating and air-conditioning (HVAC) systems</b></p>	<p><b>18.01 Connects HVAC systems and associated equipment</b></p> <p>2</p>	<p><b>18.02 Installs HVAC controls</b></p> <p>2</p>	<p><b>18.03 Performs servicing and maintenance of HVAC systems and controls</b></p> <p>2</p>		
<p><b>Task C-19 Installs, services and maintains electric heating systems</b></p>	<p><b>19.01 Installs electric heating systems</b></p> <p>2</p>	<p><b>19.02 Installs electric heating system controls</b></p> <p>2</p>	<p><b>19.03 Performs servicing and maintenance of electric heating systems and controls</b></p> <p>2</p>		
<p><b>Task C-20 Installs, services and maintains exit and emergency lighting systems</b></p>	<p><b>20.01 Installs exit and emergency lighting</b></p> <p>2</p>	<p><b>20.02 Performs servicing and maintenance of exit and emergency lighting systems</b></p> <p>2</p>			

<b>Task C-21 Installs, services and maintains cathodic protection systems</b>	<b>21.01 Installs cathodic protection systems</b>  2	<b>21.02 Performs servicing and maintenance of cathodic protection systems</b>  2
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## D – Installs, services and maintains motors and control systems

**21%**

<b>Task D-22 Installs, services and maintains motor starters and controls</b>	<b>22.01 Installs motor starters</b>  2, 3	<b>22.02 Performs servicing and maintenance of motor starters</b>  2, 3	<b>D-22.03 Installs motor devices</b>  2, 3	<b>22.04 Performs servicing and maintenance of motor controls</b>  2, 3	
<b>Task D-23 Installs, services and maintains drives</b>	<b>23.01 Installs AC drives</b>  3	<b>23.02 Performs servicing and maintenance of AC drives</b>  3	<b>23.03 Installs DC drives</b>  3	<b>23.04 Performs servicing and maintenance of DC drives</b>  3	
<b>Task D-24 Installs, services and maintains motors</b>	<b>24.01 Installs single-phase motors</b>  3, 4	<b>24.02 Performs servicing and maintenance of single-phase motors</b>  3, 4	<b>24.03 Installs three-phase motors</b>  3, 4	<b>24.04 Performs servicing and maintenance of three-phase motors</b>  3, 4	<b>24.05 Installs DC motors</b>  2, 3, 4
	<b>24.06 Performs servicing and maintenance of DC motors</b>  2, 3, 4				
<b>Task D-25 Installs, programs, services and maintains automated control systems</b>	<b>25.01 Installs automated control systems</b>  4	<b>25.02 Performs servicing and maintenance of automated control systems</b>  4	<b>25.03 Programs and configures automated control systems</b>  4		

## E – Installs, services and maintains signalling and communication systems

10%

<p>Task E-26 Installs, services and maintains signaling systems</p>	<p>26.01 Installs fire alarm systems</p> <p>4</p>	<p>26.02 Performs servicing and maintenance of fire alarm systems</p> <p>4</p>	<p>26.03 Installs security and surveillance systems</p> <p>1, 4</p>	<p>26.04 Performs servicing and maintenance of security and surveillance systems</p> <p>1, 4</p>
<p>Task E-27 Installs, services and maintains communication systems</p>	<p>27.01 Installs voice/data/video (VDV) and community antenna television (CATV) systems</p> <p>1, 4</p>	<p>27.02 Installs public address (PA) and intercom systems</p> <p>1, 4</p>	<p>27.03 Installs nurse call systems</p> <p>1, 4</p>	<p>27.04 Performs servicing and maintenance of communication systems</p> <p>1, 4</p>
<p>Task E-28 Installs, services and maintains integrated control systems</p>	<p>28.01 Installs building automation systems</p> <p>4</p>	<p>28.02 Installs building control systems</p> <p>4</p>	<p>28.03 Performs servicing and maintenance of integrated control systems</p> <p>4</p>	

\*The Construction Electrician Red Seal Occupational Standard (RSOS), describing the “full scope” of the trade, can be found at [www.red-seal.ca](http://www.red-seal.ca)

For more detailed information on course content, please refer to the Construction Electrician Guide to Course Content at [www.saskapprenticeship.ca](http://www.saskapprenticeship.ca)