



Instrumentation and Control Technician

On-the-Job Training Guide

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Saskatchewan
Apprenticeship and
Trade Certification
Commission

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Recognition:

To promote transparency and consistency, this document has been adapted from the 2020 Instrumentation and Control 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 Instrumentation and Control Technician Trade: a chart which outlines the topics of technical training with on-the-job examples for apprentices to achieve relevant experience at work.

TRAINING REQUIREMENTS FOR THE INSTRUMENTATION AND CONTROL TECHNICIAN 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 1700 hours each year. Total trade time required is 6800 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 responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- expose the apprentice to all appropriate equipment
- performance evaluation of measurement and control systems
- demonstrate the techniques for installation, servicing, maintenance and calibration
- where possible, expose the apprentice to new technology in the 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.

INSTRUMENTATION AND CONTROL TECHNICIAN TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2020 Instrumentation and Control Technician Red Seal Occupational Standard.

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

A - Performs Common Occupational Skills

9%

A-1 Performs safety-related functions	1.01 Maintains safe work environment 1 (2, 3, 4 In Context)	1.02 Uses personal protective equipment (PPE) and safety equipment 1 (2, 3, 4 In Context)	1.03 Performs de-energizing, lock-out and tag-out procedures 1 (2, 3, 4 In Context)	
A-2 Uses tools and equipment	A-2.01 Uses calibration, configuration and test equipment 1 (2, 3, 4 In Context)	A-2.02 Uses hand and power tools 1 (2, 3, 4 In Context)	A-2.03 Uses access equipment 1 (2, 3, 4 In Context)	A-2.04 Uses rigging, hoisting and lifting equipment 1 (2, 3, 4 In Context)
A-3 Organizes work	A-3.01 Uses documentation 1	A-3.02 Interprets drawings and schematics 1	A-3.03 Plans tasks 3	
A-4 Uses communication and mentoring techniques	A-4.01 Uses communication techniques 1	A-4.02 Uses mentoring techniques 4		

B – Installs and Services Process Measuring and Indicating Devices

24%

<p>B-5 Installs and services pressure, temperature, level and flow devices</p>	<p>B-5.01 Installs pressure, temperature, level and flow devices</p> <p>1, 2</p>	<p>B-5.02 Maintains pressure, temperature, level and flow devices</p> <p>1, 2</p>	<p>B-5.03 Diagnoses pressure, temperature, level and flow devices</p> <p>1, 2</p>	<p>B-5.04 Repairs pressure, temperature, level and flow devices</p> <p>1, 2</p>
<p>B-6 Installs and services signal transducers</p>	<p>B-6.01 Performs installation and configuration of signal transducers</p> <p>2</p>	<p>B-6.02 Diagnoses signal transducers</p> <p>2</p>	<p>B-6.03 Performs maintenance and repairs on signal transducers</p> <p>2</p>	
<p>B-7 Installs and services motion, speed, position and vibration devices</p>	<p>B-7.01 Installs motion, speed, position and vibration devices</p> <p>3</p>	<p>B-7.02 Maintains motion, speed, position and vibration devices</p> <p>3</p>	<p>B-7.03 Diagnoses motion, speed, position and vibration devices</p> <p>3</p>	<p>B-7.04 Repairs motion, speed, position and vibration devices</p> <p>3</p>
<p>B-8 Installs and services mass, density and consistency devices</p>	<p>B-8.01 Installs mass, density and consistency devices</p> <p>2, 3</p>	<p>B-8.02 Maintains mass, density and consistency devices</p> <p>2, 3</p>	<p>B-8.03 Diagnoses mass, density and consistency devices</p> <p>2, 3</p>	<p>B-8.04 Repairs mass, density and consistency devices</p> <p>2, 3</p>
<p>B-9 Installs and services process analyzers</p>	<p>B-9.01 Installs process analyzers</p> <p>3, 4</p>	<p>B-9.02 Maintains process analyzers</p> <p>3, 4</p>	<p>B-9.03 Diagnoses process analyzers</p> <p>3, 4</p>	<p>B-9.04 Repairs process analyzers</p> <p>3, 4</p>
<p>B-10 Installs and services multiple variable computing devices</p>	<p>B-10.01 Installs multiple variable computing devices</p> <p>4</p>	<p>B-10.02 Maintains multiple variable computing devices</p> <p>4</p>	<p>B-10.03 Diagnoses multiple variable computing devices</p> <p>4</p>	<p>B-10.04 Repairs multiple variable computing devices</p> <p>4</p>

C – Installs and Services Safety and Security Systems and Devices

9%

C-11 Installs and services safety systems and devices	C-11.01 Installs safety systems and devices 4	C-11.02 Maintains safety systems and devices 4	C-11.03 Diagnoses safety systems and devices 4	C-11.04 Repairs safety systems and devices 4	
C-12 Installs and services facility security systems (NOT COMMON CORE)	C-12.01 Installs facility security systems NOT COMMON CORE	C-12.02 Maintains facility security systems NOT COMMON CORE	C-12.03 Diagnoses facility security systems NOT COMMON CORE	C-12.04 Repairs facility security systems NOT COMMON CORE	
C-13 Installs and services safety instrumented systems (SIS)	C-13.01 Installs SIS 4	C-13.02 Configures SIS 4	C-13.03 Maintains SIS 4	C-13.04 Diagnoses SIS 4	C-13.05 Repairs SIS 4

D – Installs and Services Hydraulic, Pneumatic and Electrical Systems

11%

D-14 Installs and services control devices for hydraulic systems	D-14.01 Installs control devices for hydraulic systems 2	D-14.02 Diagnoses control devices for hydraulic systems 2	D-14.03 Performs maintenance and repairs on control devices for hydraulic systems 2
D-15 Installs and services pneumatic equipment	D-15.01 Installs pneumatic equipment 1, 2	D-15.02 Diagnoses pneumatic equipment 1, 2	D-15.03 Performs maintenance and repairs on pneumatic equipment 1, 2

D-16 Installs and services electrical and electronic equipment

D-16.01 Installs electrical and electronic equipment

1, 2
(3, 4 In Context)

D-16.02 Diagnoses electrical and electronic equipment

1, 2
(3, 4 In Context)

D-16.03 Performs maintenance and repairs for electrical and electronic equipment

1, 2
(3, 4 In Context)

E – Installs, Configures and Services Final Control Elements

20%

E-17 Installs and services valves

E-17.01 Installs valves

1, 2

E-17.02 Maintains valves

1, 2

E-17.03 Diagnoses valves

1, 2

E-17.04 Repairs valves

1, 2

E-18 Installs and services actuators

E-18.01 Installs actuators

1, 2

E-18.02 Maintains actuators

1, 2

E-18.03 Diagnoses actuators

1, 2

E-18.04 Repairs actuators

1, 2

E-19 Installs and services positioners

E-19.01 Installs positioners

1, 2

E-19.02 Maintains positioners

1, 2

E-19.03 Diagnoses positioners

1, 2

E-19.04 Repairs positioners

1, 2

E-20 Configures and services variable speed drives (VSD)

E-20.01 Configures VSD

3

E-20.02 Maintains VSD

3

E-20.03 Diagnoses VSD

3

E-20.04 Repairs VSD

3

F – Installs and Services Communication Systems and Devices

10%

F-21 Installs and services control network systems	F-21.01 Performs installation and configuration on control network systems 3, 4	F-21.02 Diagnoses control network systems 3, 4	F-21.03 Performs maintenance and repairs on control network systems 3, 4
F-22 Installs and services signal converters	F-22.01 Performs installation and configuration of signal converters 3, 4	F-22.02 Diagnoses signal converters 3, 4	F-22.03 Performs maintenance and repairs on signal converters 3, 4
F-23 Installs and services gateways, bridges and media converters	F-23.01 Performs installation and configuration of gateways, bridges and media converters 3, 4	F-23.02 Diagnoses gateways, bridges and media converters 3, 4	F-23.03 Performs maintenance and repairs on gateways, bridges and media converters 3, 4

G – Installs and Services Control Systems and Process Control

17%

G-24 Establishes and optimizes process control strategies	G-24.01 Determines process control strategy 3, 4	G-24.02 Optimizes process control 3, 4	
G-25 Installs and services stand-alone controllers (SAC)	G-25.01 Installs SAC 3, 4	G-25.02 Configures SAC 3, 4	G-25.03 Performs maintenance, diagnostics and repairs on SAC 3, 4

G-26 Installs and services programmable logic controllers (PLC)	G-26.01 Installs PLC 3, 4	G-26.02 Configures PLC 3, 4	G-26.03 Performs maintenance, diagnostics and repairs on PLC 3, 4
G-27 Installs and services distributed control systems (DCS)	G-27.01 Installs DCS 4	G-27.02 Configures DCS 4	G-27.03 Performs maintenance, diagnostics and repairs on DCS 4
G-28 Installs and services human machine interface (HMI)	G-28.01 Installs HMI 3, 4	G-28.02 Configures HMI 3, 4	G-28.03 Performs maintenance, diagnostics and repairs on HMI 3, 4
G-29 Installs and services supervisory control and data acquisition (SCADA) systems	G-29.01 Installs SCADA systems 4	G-29.02 Configures SCADA systems 4	G-29.03 Performs maintenance, diagnostics and repairs on SCADA 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
Basic Electronics	CIRC 109 - Theory	50
	CIRC 110 - Shop	50
Instrument Measurement 1	MEAS 113 - Theory	60
	MEAS 114 - Shop	40
Instrumentation Practices	INST 108	40
Mathematics	MATH 157	30
Physics	PHYS 122	30
		300

Level Two	Transcript Code	Hours
Electronics	CIRC 204	70
Instrument Control 1	CNTR 211 - Theory	30
	CNTR 212 – Shop	30
Final Control Elements	INST 212 – Theory	30
	INST 213 - Shop	30
Instrument Measurement 2	MEAS 203	50
Analytical Instruments 1	MEAS 204	30
Chemistry 1	CHEM 202	30
		300

Level Three	Transcript Code	Hours
Chemistry 2	CHEM 301	30
Instrument Control 2	CNTR 300	40
Instrument Logic	CIRC 300	50
Analytical Instruments 2	MEAS 300	30
Instrument Measurement 3	MEAS 301	50
Project Management	PROJ 302	50
Data Communications 1	CIRC 301	50
		300

Level Four	Transcript Code	Hours
Process Applications	CNTR 400	30
Data Communications 2	CIRC 400	50
Analytical Instruments 3	MEAS 400	30
Programmable Logic Controllers	CIRC 401	60
Distributed Systems	CNTR 401	60
Instrument Control 3	CNTR 402	30
Mentoring	MENT 401	10
Chemistry	CHEM 400	30
		300

ON-THE-JOB AND IN-SCHOOL TRAINING

CONTENT FOR THE INSTRUMENTATION AND CONTROL 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	10 weeks	300 hours
<p>Physics 30 hours</p> <ul style="list-style-type: none"> • calculate the pressures of static and moving liquids • examine the expansion and contraction properties of materials with temperature • compare how matter stores heat with temperature changes • classify three forms of heat transfer • demonstrate four methods of vector addition • differentiate between work, power and energy • compare the mechanical advantage of simple machines <p>Mentors can assist the apprentice to prepare for this section of technical training by:</p> <ul style="list-style-type: none"> • <i>exposure to the force-balance principles of instruments and applications</i> • <i>explaining the principle of thermo-dynamics as it applies to temperature measurement</i> • <i>encouraging the review of manuals to understand the theory of operation</i> 		
<p>Basic Electronics – Theory 50 hours</p> <ul style="list-style-type: none"> • current, voltage and resistance in series, parallel and series-parallel circuits • the effects of resistance/inductance/capacitance (RLC) on AC and DC circuits • transformer types, characteristics and applications • determine R, X, and Z in AC circuits and resonant circuits • solid-state electrical components, their characteristics and applications • types of solid-state circuits, their characteristics and operation 		
<p>Basic Electronics – Shop 50 hours</p> <ul style="list-style-type: none"> • measure current, voltage and resistance in an electrical circuit • analyze Ohm's and Kirchhoff's laws • measure the equivalent resistance of series-parallel circuits • evaluate various theorems • evaluate AC measurements • measure time constant of RC and RL circuits • evaluate voltages and phase angles in AC circuits • measure characteristics of diodes • evaluate the rectified dc power supply using half-wave, full-wave and bridge rectified configurations • measure load regulations for Zener regulator circuits <p>Mentors can assist the apprentice to prepare for this section of technical training by:</p> <ul style="list-style-type: none"> • <i>introducing the apprentice to the basic theory of ac and dc circuits</i> • <i>exposure to the test equipment used in ac and dc circuits</i> • <i>familiarisation with basic electronic schematics and diagrams</i> 		

Instrument Measurement 1 – Theory**60 hours**

- describe transmitter signals and instrumentation terminology
- compare pneumatic and electronic primary sensing elements
- pressure measuring instrument types, relationships, and installation procedures
- level measuring instrument types, relationships, and installation procedures
- flow measuring instrument types, relationships and installation procedures
- temperature instrument types, relationships and installation procedures

Instrument Measurement 1 – Shop**40 hours**

- pneumatic and electrical pressure measuring instrument types, and the procedures to install, maintain and calibrate
- pneumatic and electrical level measuring instrument types, and the procedures to install, maintain and calibrate
- pneumatic and electrical flow measuring instrument types, and the procedures to install, maintain and calibrate
- pneumatic and electrical temperature measuring instrument types, and the procedures to install, maintain and calibrate
- valve types, their components, characteristics, and applications

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

- *exposure to various styles of tubing installations*
- *familiarisation with the test equipment and its application*
- *exposure to the installation, maintenance and calibration of field devices*
- *providing an explanation of the principles of operation for process application*

Instrumentation Practices**40 hours**

- interpret process and instrument diagrams (P&ID), loop diagrams, and safety documentation
- safe working practices
- perform installation of tubing using tube bending techniques
- PPE and safety equipment, their applications, maintenance, and procedures for use
- hand and power tools, their components, applications, and procedures for use

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

- *exposing the apprentice to P&ID, loop and process diagrams and safety documentation*
- *providing training in safe work practices*
- *providing hands-on experience in the use of precision measuring tools*
- *training in the use of common hand tools*
- *training in the safe start-up and use of oxyacetylene welding and cutting equipment*
- *training in electronic soldering*

Mathematics**30 hours**

- perform basic numerical computations
- perform basic algebraic operations
- perform basic trigonometry functions
- perform basic graphing with linear equations
- perform basic operations with exponentials and logarithms

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

- *instruction in mathematically determining outputs with given inputs*
- *training in basic unit conversions*

Level Two

10 weeks

300 hours

Instrument Measurement 2

50 hours

- assess wiring principles for measurement instrumentation
- construct electrical process loop wiring diagrams from piping and instrument drawings (P&ID's) as per ISA (International Society of Automation) Standards
- analyze methods of protection for hazardous locations
- configure process alarms
- interpret the principle of operation of microprocessor-based instruments
- demonstrate knowledge to calibrate conventional and microprocessor-based instruments

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

- *exposure to instrumentation drawings*
 - *training in basic drawings, including CAD*
 - *expose the apprentice to hazardous locations and their requirements*
 - *detailing the operation of microprocessor-based instruments*
 - *introducing the apprentice to calibration procedures for various instruments*
-

Electronics

70 hours

- solid-state device operation and their applications
- analyze the fundamentals of solid-state devices
- differences between analog and digital signals
- logic gates, truth tables and flip flops, use and application
- general network topologies used in local area networks (LANs)

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

- *introducing the set up and operation of electronic equipment*
 - *training in servicing and troubleshooting electronic circuits*
-

Instrument Control 1 – Theory

30 hours

- fundamental elements associated with pneumatic controllers
- commonly used control theory terms and basic types of control modes
- procedures used to install and calibrate pneumatic controllers
- procedures used to troubleshoot and repair pneumatic controllers
- pneumatic controller installation and calibration

Instrument Control 1 – Shop

30 hours

- employ commonly used control modes and terms as they apply to pneumatic analogue controllers
- calibrate single, two, and three mode controllers
- tune single, two, and three mode controllers
- examine advanced control techniques including cascade, feedforward, ratio, and override

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

- *providing hands-on experience with controller tuning and process optimization*
- *providing exposure to different control strategies*
- *demonstration of controller auto/manual transfers*

Final Control Elements – Theory**30 hours**

- compare various final control elements
- actuators, their components, calculations, and operation
- control valves, their components, calculations, and operation
- characteristics and applications of control valve accessories
- operation of pneumatic systems and their components

Final Control Elements – Shop**30 hours**

- procedures used to inspect and overhaul control valves
- procedures used to inspect and overhaul actuators
- procedures used to inspect, overhaul, and calibrate positioners
- perform general maintenance on control valve assemblies
- perform inspection and calibration of current-to-pressure (I/P) transducers
- demonstrate operation of various final control elements

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

- *providing hands-on experience in control valve selection, installation, maintenance and troubleshooting*
- *providing hands-on experience with valve accessories*

Analytical Instruments 1**30 hours**

- process sample systems and conditioning of samples
- process analyzers, their components, purpose, applications, characteristics, and operation
- procedures used to install, maintain, calibrate and troubleshoot process analyzers
- vibration analysis and its importance in rotating equipment
- procedures used for humidity analysis
- procedures used for solution density analysis

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

- *providing training using sampling systems*
- *providing background information regarding the operation of analyzers*
- *introducing vibration and its effects on equipment*

Chemistry 1**30 hours**

- demonstrate safe laboratory protocol
- classify periodic table elements and examine the chemical nomenclature of ionic and molecular compounds
- solve problems involving stoichiometric values in chemical reactions
- solve problems involving solubilities of gases, liquids, and solids
- solve problems involving the density of gases, liquids, and solids
- solve problems involving humidity in the calculation of condensation dew points
- demonstrate knowledge of mass, density and consistency

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

- *explaining the how the process is affected by changes to the inputs*
- *helping an apprentice to recognize abnormal changes to the process*

Level Three

10 weeks

300 hours

Chemistry 2

40 hours

- acid/base chemistry using pH calculations and measurements
- measure and calculate the correlation between ionic solution concentrations and conductivity measurements
- measure and calculate the relationship of chemical oxidation-reduction reactions to electrode potentials in voltaic and concentration electrolytic cells
- demonstrate and measure the process of UV light absorption in quantitatively measuring solution turbidity, suspension, and dissolved solids concentration
- measure and calculate dissolved oxygen concentrations due to changes in soluble salts, turbulence, aeration, pollution, temperature, and pressure

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

- *providing exposure to the theory of analytical instrumentation*
 - *making available the chemical theory of process*
-

Project Management

50 hours

- examine project management concepts
- perform the steps required to initiate an industrial instrumentation project
- demonstrate how to develop a comprehensive project plan
- identify the resources required to execute a project plan
- identify the monitoring and controlling requirements of a project plan
- identify closing requirements of a project plan

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

- *having the apprentice participate in task planning*
 - *assisting the apprentice in ordering required equipment*
 - *explaining the importance of a schedule and how it affects other trades*
-

Instrument Control 2

40 hours

- feedforward process control applications
- selective process control applications
- ratio control process control applications
- cascade control process control applications
- multivariable control process control applications

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

- *providing continued hands-on experience with controller tuning and process optimization*
 - *assisting the apprentice to understand the advantages and disadvantages of a control strategy based on the process*
 - *demonstrating the differences between different process control strategies*
-

Instrument Logic

50 hours

- electromechanical relays, terminology and related devices used in building relay logic circuits
- application of relays and switches in the design of functional relay logic circuits
- PLCs and related devices used in building logic circuits
- apply knowledge of PLC programming in the design of various logic circuits
- explain the operation and features of Variable Frequency Drives (VFDs)
- apply knowledge of VFD operation in the control of motors

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

- *providing training on the installation, programming and troubleshooting of PLCs and hard-wired relay circuits*
- *reviewing PLC and P&ID drawings and discussing the relationship*
- *have the apprentice simple relay circuits*

Analytical Instruments 2

40 hours

- pH measurement principles
- ORP measurement principles
- conductivity measurement principles
- turbidity measurement principles
- dissolved oxygen measurement principles

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

- *demonstrating the difference between turbidity and dissolved solids*
- *assisting the apprentice in understanding the pH scales*
- *explaining the conductivity and it's use in the trade*

Instrument Measurement 3

80 hours

- perform configurations, calibrations, and asset management using industrial database software
- demonstrate the capabilities of a Digital Valve Controller
- procedures to safely install, maintain, calibrate, and troubleshoot microprocessor-based pressure transmitters
- procedures to safely install, maintain, calibrate, and troubleshoot microprocessor-based level transmitters
- procedures to safely install, maintain, calibrate, and troubleshoot microprocessor-based flow transmitters
- procedures to safely install, maintain, calibrate, and troubleshoot microprocessor-based temperature transmitters

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

- *providing hands-on experience with the installation and configuration of smart transmitters and control valves*
- *training in troubleshooting and servicing of all transmitters and controlling equipment*
- *providing access to loop wiring diagrams and maintenance documentation*

Data Communications 1

50 hours

- classify various types of communication media
- apply knowledge of existing traditional and current communication protocols
- examine various types of Industrial Local Area Network (ILAN) topologies
- differentiate network media access techniques
- categorize various encoding and error checking methods
- classify various types of network architecture

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

- *exposure to failure documentation, maintenance logs and technical reports*
- *emphasizing the importance of communications within operations*
- *assisting the apprentice in troubleshooting LAN networks*
- *explaining the importance of error checking and how it affects data transmission*
- *exposing the apprentice to different types of network architecture*

Level Four

10 weeks

300 hours

Process Applications

30 hours

- describe basic industrial boiler control
- apply boiler control principles using simulation software
- describe fundamental process of pulp and paper production
- describe fundamental process of mining
- describe fundamental aspects of petroleum refining

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

- *providing familiarization with boiler systems and controls*
 - *providing training in the plant processes*
 - *familiarizing the apprentice with boiler safety procedures*
-

Data Communications 2

50 hours

- examine the convergence of information technology (IT) and operational technology (OT)
- apply fundamental concepts of transmission control/internet protocol (TCP/IP) addressing
- analyze design methods for Industrial local area networks (ILANs)
- apply fundamental concepts of SCADA systems
- apply methods used to install, configure, and maintain SCADA systems
- apply methods used to troubleshoot SCADA systems
- examine open platform communications (OPC) unified architecture

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

- *providing training in the communication systems of the plant*
 - *assisting the apprentice with addressing, configuration and set up of devices*
 - *have the apprentice assist with commissioning*
-

Analytical Instruments 3 – Gas Analyzers

30 hours

- gas chromatography measurement principles
- toxic and combustible gas measurement principles
- flue gas measurement principles
- oxygen gas measurement principles

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

- *providing hands-on training on available analytical instrumentation*
 - *reviewing the manufacturer manuals with the apprentice*
 - *providing the apprentice with experience installing analyzers and how the location can affect readings*
-

Programmable Logic Controllers

60 hours

- categorize the different aspects of modular programmable logic controllers (PLCs)
- configure a modular programmable logic controller
- compare the various aspects of process control using modular PLCs
- apply design principles using a modular PLC
- procedures to troubleshoot a PLC system
- procedures to commission a PLC system applying safety instrumented systems principles

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

- *providing training on the installation, programming and troubleshooting of PLCs*
- *having the apprentice assist in commissioning activities*
- *review design principles and manufacturer limitations with the apprentice*

Distributed Systems

60 hours

- levels and different components included in DCS architecture
- configuration of components required in control modules
- develop a human machine interface (HMI) to represent a control process
- tune control loops using tools included in a modern DCS
- explain the need for safety instrumented systems (SIS) in DCS applications

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

- *providing exposure to DCS system*
- *if possible, training in configuration, operation and troubleshooting of a DCS system*
- *providing opportunities to observe a control loop*
- *discuss how changes to one or more of the inputs with affect the output of the loop*

Instrument Control 3

30 hours

- basic concepts of fuzzy logic control
- understand the concept of developing a model, based on the laws of science
- understand the concept of model-based control
- understand the concepts of process control strategies used in industry

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

- *providing hands-on experience with controller tuning and process optimization*
- *providing exposure to a variety of control strategies and their limitations*

Mentoring

10 hours

- purpose and benefits of workplace mentorship
- signs and implications of workplace stress
- workplace harassment policies

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

- *providing positive examples of mentorship*
- *creating opportunities for the apprentice to take on leadership responsibilities*
- *discussing workplace harassment and how it can affect the job*

Chemistry 3

30 hours

- procedures to partition coefficients using molecular weight in gas chromatography
- demonstrate the electron orbital configurations affecting the magnetic properties of oxygen used in gas analyzers
- chemical reactions of oxygen and hydrogen using oxidation and reduction potentials
- chemical production and low explosive limit of harmful environmental gases
- chemical solubilities of liquid-liquid, solid-liquid and gas-liquid phases used in ultraviolet and infrared spectrophotometers

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

- *exposing the apprentice to various analyzing and sampling systems*
- *discussing the sample results and what is required for the process*
- *reviewing UEL and LEL of different types of gasses found on site*

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.

Saskatchewan Apprenticeship & Trade Certification Commission

2140 Hamilton St Regina SK S4P 2E3

Tel: (306) 787-2444

Fax: (306) 787-5105

Toll Free: 1-877-363-0536

Website: www.saskapprenticeship.ca

District Offices

Estevan (306) 637-4930

La Ronge (306) 425-4385

Moose Jaw (306) 694-3735

North Battleford (306) 446-7409

Prince Albert (306) 953-2632

Saskatoon (306) 933-8476

Swift Current (306) 778-8945

Yorkton (306) 786-1394