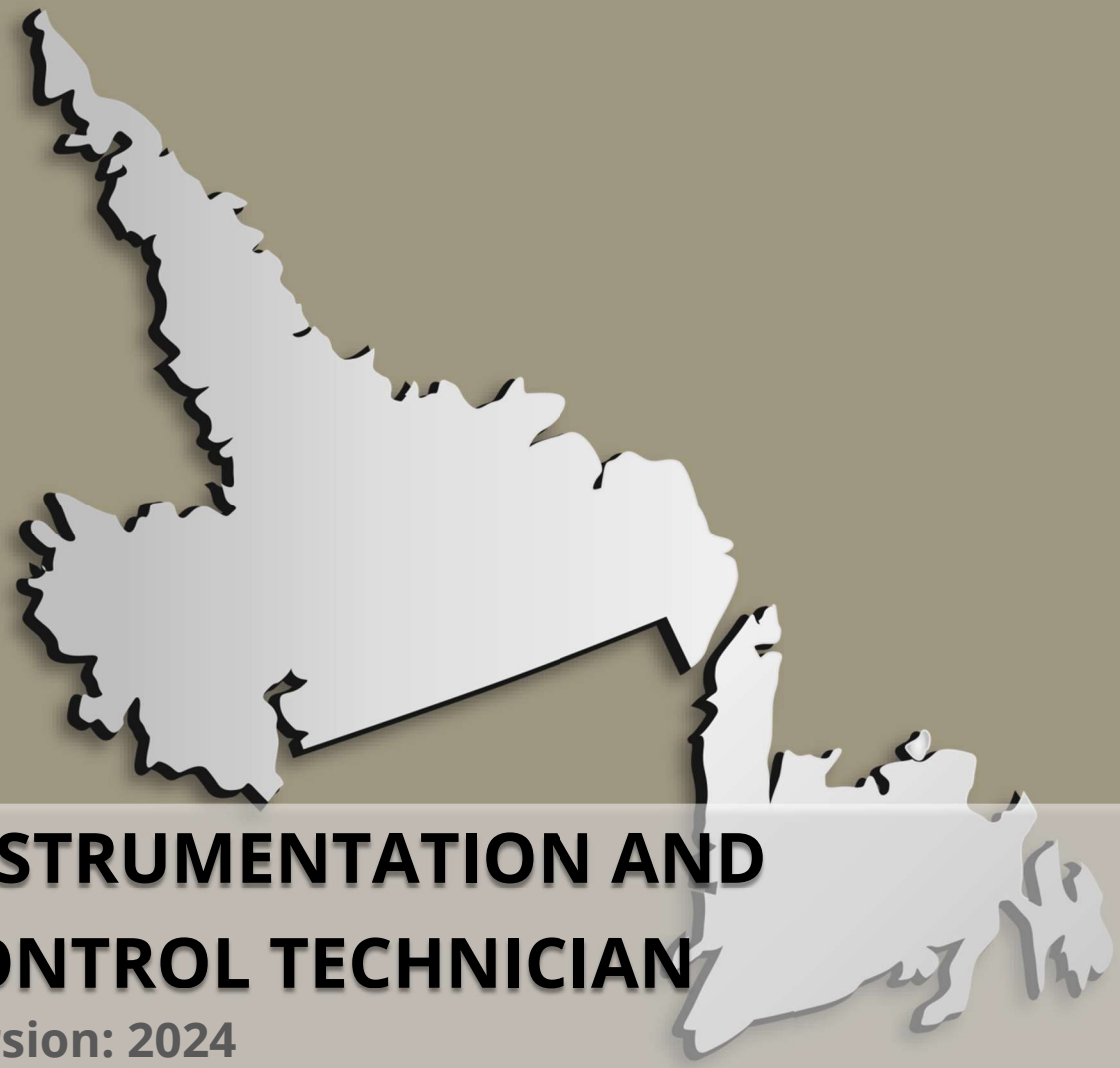
Atlantic Workforce Partnership

Curriculum Standard



INSTRUMENTATION AND CONTROL TECHNICIAN

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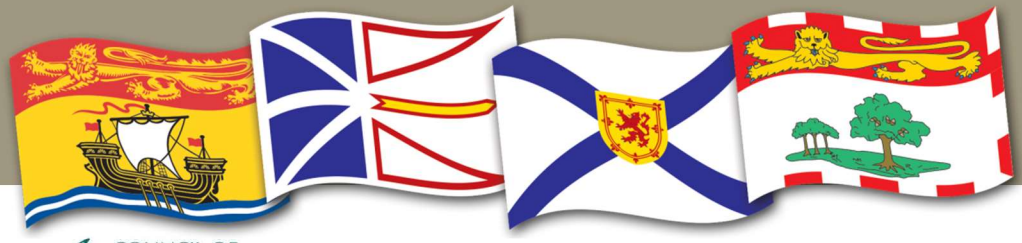
Atlantic Apprenticeship



COUNCIL OF ATLANTIC PREMIERS
CONSEIL DES PREMIERS MINISTRES DE L'ATLANTIQUE

Employment and Social Development Canada
Emploi et Développement social Canada

PLAN OF TRAINING

Atlantic Apprenticeship Curriculum Standard

Instrumentation & Control Technician

December 2024

Government of Newfoundland and Labrador
Department of Jobs, Immigration and Growth
Apprenticeship and Trades Certification Division

Approved by:

Chairperson, Provincial Apprenticeship and Certification Board

Date: Dec. 16, 2024

Atlantic Apprenticeship Curriculum Standard

Instrumentation and Control Technician

Preface

This Atlantic Apprenticeship Curriculum Standard is intended to assist instructional staff in the design and delivery of technical, in-class training in support of the Instrumentation and Control Technician trade.

This document contains all the technical training elements required to complete the Instrumentation and Control Technician apprenticeship program and has been developed based on the 2020 Red Seal Occupational Standard (RSOS). The RSOS can be found on the Red Seal website (www.red-seal.ca).

Implementation of this AACS for Apprenticeship training is outlined in the following table.

Level	Implementation Effective
Level 1	2025-2026
Level 2	2026-2027
Level 3	2027-2028
Level 4	2028-2029

The above implementation schedule was current at time of printing. Please confirm with Apprenticeship Staff prior to commencing training.

Granting of credit or permission to challenge level examinations for pre-employment or pre-apprenticeship training for the Instrumentation and Control Technician trade will be based on the content outlined in this standard. Training providers must contact their provincial apprenticeship authority for more information on the process and requirements for determining eligibility for credit towards an apprenticeship program.

Acknowledgements

The development of the Atlantic Apprenticeship Curriculum Standard (AACS) is an initiative of the Atlantic Apprenticeship Council's Atlantic Apprenticeship Harmonization Partnership (AAHP) through the Atlantic Workforce Partnership.

The AAHP was created in 2014 and funded through contributions from Employment and Social Development Canada (ESDC) and the four Atlantic Provinces. In 2023, Phase III of the AAHP concluded and the AAHP transitioned to a maintenance office supported by the four Atlantic Provinces. The Atlantic Apprenticeship Council would like to thank ESDC for the financial support provided to harmonize the 23 trades in Phase I, II and III of the AAHP.

Advisory committees, industry representatives, instructors and apprenticeship staff provided valuable input to the development of the trade Atlantic Apprenticeship Curriculum Standard (AACS) in 2015 and updating of the trade AACS in 2023. Without their dedication to quality apprenticeship training, this document could not have been produced. The Atlantic Apprenticeship Council wishes to acknowledge the contributions of the industry and instructional representatives who participated in the development of this document.

Table of Contents

User Guide

Atlantic Apprenticeship Curriculum Standards (AACS) are developed based on trade specific national occupational standards, such as the Red Seal Occupational Standard (RSOS), and industry consultation. This document represents the minimum content to be delivered as part of the harmonized Atlantic program for the Instrumentation and Control Technician trade.

The AACSs are deliberately constructed for ease of use and flexibility of structure to adapt to all delivery requirements. They detail units of training, unit outcomes and objectives. They do not impose a delivery model or teaching format.

Jurisdictions and/or training providers will select and develop delivery materials and techniques that accommodate a variety of learning styles and delivery patterns. The AACS does not dictate study materials, textbooks or learning activities to be used in delivery.

The document includes a Level Structure to facilitate mobility for apprentices moving from one jurisdiction to another.

Structure

The content of the AACS is divided into units. Unit codes are used as a means of identification and are not intended to convey the order of delivery. It is at the discretion of the training provider to deliver the content in the required logical sequence of delivery within the level. Jurisdictions are free to deliver units one at a time or concurrently within a level, provided all outcomes are met.

The Learning Outcomes describe what the apprentice should know or be able to do at the end of training. Wording of the Learning Outcomes, “Demonstrate knowledge of…” acknowledges the broad spectrum of ways in which knowledge can be assessed (i.e. practical projects, multiple choice testing, presentations, etc.) by instructional staff within the training.

Summative evaluation will be through a multiple-choice level exam administered through the jurisdictional Apprenticeship Authority.

The Red Seal Occupational Standard (RSOS) to AACS comparison chart outlines the relation between each RSOS sub-task and the AACS units. RSOS references have also been detailed in each unit to highlight the direct link between the unit and relevant sub-tasks in the RSOS.

In the Level Structure section, the document identifies suggested hours in order to provide an indication of the time it should take to cover the material in the unit and is provided as a guide only. Adjustments to the suggested hours for each unit may be required to account for rate of apprentice learning, statutory holidays, storm days, registration and examinations. These suggested hours detailed for each unit will represent both theory and practical training (if relevant) and for consistency will be based on a standard of 30 hours per week of training. The true length of time required to deliver an outcome successfully will depend upon the learning activities and teaching methods used.

There are two types of objectives found in the AACS document: theoretical and practical.

The theoretical objectives represent the material that is to be covered during the technical training in order to convey the required knowledge to the apprentice.

The practical objectives represent the tasks or skills that have been deemed by the Atlantic Trade Advisory Committee as critical for the apprentices to receive exposure to while attending technical training. For example, exposure could be done through instructor demonstration or individual or group performance of the skill or task. Training providers are encouraged to use practical demonstration and opportunities for hands-on learning whenever possible. Practical objectives are not intended to replace the on-the-job training component of the apprentice's program or to mirror or replace the logbook skills that are to be taught and evaluated in the workplace.

Detailed content for each objective has not been developed. Where detail is required for clarity, content has been provided. The AACS should be used in conjunction with the national standard for the trade – the Red Seal Occupational Standard (RSOS).

Glossary of Terms

These definitions are intended as a guide to how language is used in the document.

Adjust	To put in good working order; regulate; bring to a proper state or position.
Application	The use to which something is put and/or the circumstance in which an individual would use it.
Characteristic	A feature that helps to identify, tell apart or describe recognizably; a distinguishing mark or trait.
Component	A part that can be separated from or attached to a system; a segment or unit.
Define	To state the meaning of (a word, phrase, etc.).
Describe	To give a verbal account of; tell about in detail.
Explain	To make plain or clear; illustrate; rationalize.
Identify	To point out or name objectives or types.
Interpret	To translate information from observation, charts, tables, graphs and written material.
Maintain	To keep in a condition of good repair or efficiency.
Method	A means or manner of doing something that has procedures attached to it.
Operate	How an object works; to control or direct the functioning of.
Procedure	A prescribed series of steps taken to accomplish an end.
Purpose	The reason for which something exists or is done, made or used.

Glossary of Terms (continued)

Service	Routine inspection and replacement of worn or deteriorating parts. An act or business function provided to a customer in the course of an individual's profession (e.g., haircut).
Technique	Within a procedure, the manner in which technical skills are applied.
Test	v. To subject to a procedure that ascertains effectiveness, value, proper function or other quality. n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.

Essential Skills Profiles/ Skills for Success

Through extensive research, the Government of Canada and other national and international agencies have identified and validated key essential skills for the workplace. These skills are used in nearly every job and at different levels of complexity. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change. In response to the evolving labour market and changing skill needs, in 2021 the Government of Canada launched a new **Skills for Success** model: QR code #1 or web link below.

https://www.canada.ca/en/services/jobs/training/initiatives/skills-success/new-model.html

The Employment and Social Development Canada (ESDC) website provides information about the Skills for Success, including:

- a brief description of the skill;
- why the skill is important;
- tools to help you improve on each of the skills, and
- Videos to help you improve on each of the skills.

This information can be found at: QR code #2 or web link below.
https://www.jobbank.gc.ca/essentialskills

Skills for Success training tools can be found at: QR code #3 or web link below.
https://www.canada.ca/en/services/jobs/training/initiatives/skills-success/tools.html

The development and improvement of these Skills for Success is inherent throughout the apprenticeship training program as apprentices work towards achieving journeyperson status.

#1 The new Skills for Success model – Canada.ca

#2 Explore careers by essential skills – Job Bank

#3 Assessment and training tools – Canada.ca

Level Structure

Level 1 – 8 Weeks

Unit Code	Unit Title	Suggested Hours	Page Number
ICT-100	Safety	12	22
ICT-105	Tools and Test Equipment	12	25
ICT-110	Rigging, Hoisting, Lifting and Access Equipment	6	27
MENT-700	Mentoring I	6	30
ICT-120	Drawings, Schematics, Specifications and Trade Documentation	12	32
ICT-125	Direct Current (DC) Theory	30	34
ICT-130	Series, Parallel and Complex Circuits	30	36
ICT-135	Voltage Drop and Power Loss	12	37
ICT-140	Conductors, Cables and Accessories	18	38
ICT-145	On-off Control Devices	27	40
ICT-150	Wireways, Raceways, Enclosures and Fittings	12	42
ICT-155	Introduction to Pressure Measurement and Calibration	27	44
ICT-160	Pneumatic Supply Systems I	12	47
ICT-165	Final Control Elements I	18	49
ICT-170	Trade Related Computer Use	6	52

Level 2 – 8 Weeks

Unit Code	Unit Title	Suggested Hours	Page Number
ICT-205	Introduction to Fluids Theory	12	56
ICT-235	Final Control Elements II	42	58
ICT-245	Alternating Current (AC) Theory	30	62
ICT-255	Process Measurement	66	64
ICT-260	Hydraulic Supply Systems and Control Devices	24	67
ICT-265	Pneumatic Supply Systems II	24	69
ICT-270	Electronics Components (Circuits and Power Supplies)	42	72

Level Structure (continued)

Level 3 – 7 Weeks

Unit Code	Unit Title	Suggested Hours	Page Number
ICT-300	Process Control I	60	76
ICT-320	Variable Speed Drives (VSD)	30	79
ICT-325	Process Analyzers I	60	81
ICT-330	Equipment Monitoring Devices	12	84
ICT-335	Industrial Communication Systems and Devices	42	86
ICT-345	Job Planning	6	90

Level 4 – 8 Weeks

Unit Code	Unit Title	Suggested Hours	Page Number
ICT-410	Process Control II	39	92
ICT-415	Supervisory Control and Data Acquisition Systems	27	94
ICT-425	Safety Systems and Devices	18	96
ICT-435	Programmable Logic Controller Systems	60	98
ICT-440	Distributed Control Systems	30	100
ICT-445	Process Analyzers II	30	102
MENT-701	Mentoring II	6	105
ICT-600	Program Review	30	106

2020 RSOS Sub-Task to AACS Unit Comparison

RSOS Sub-Task		AACS Unit	
Task 1 – Performs safety-related functions.			
1.01	Maintains safe work environment.	ICT-100	Safety
1.02	Uses personal protective equipment (PPE) and safety equipment.	ICT-100	Safety
1.03	Performs de-energizing, lock-out and tag-out procedures.	ICT-100	Safety
Task 2 – Uses tools and equipment.			
2.01	Uses calibration, configuration and test equipment.	ICT-105	Tools and Test Equipment
2.02	Uses hand and power tools.	ICT-105	Tools and Test Equipment
2.03	Uses access equipment.	ICT-110	Rigging, Hoisting, Lifting and Access Equipment
2.04	Uses rigging, hoisting and lifting equipment.	ICT-110	Rigging, Hoisting, Lifting and Access Equipment
Task 3 – Organizes work.			
3.01	Uses documentation.	ICT-120	Drawings, Schematics, Specifications and Trade Documentation
		ICT-170	Trade Related Computer Use
3.02	Interprets drawings and schematics.	ICT-120	Drawings, Schematics, Specifications and Trade Documentation
		ICT-300	Process Control I
		ICT-410	Process Control II
3.03	Plans tasks.	ICT-345	Job Planning
Task 4 – Uses communication and mentoring techniques.			
4.01	Uses communication techniques.	MENT-700	Mentoring I
		MENT-701	Mentoring II
4.02	Uses mentoring techniques.	MENT-700	Mentoring I
		MENT-701	Mentoring II
Task 5 – Installs and services pressure, temperature, level and flow devices.			
5.01	Installs pressure, temperature, level and flow devices.	ICT-155	Introduction to Pressure Measurement and Calibration
		ICT-255	Process Measurement

RSOS Sub-Task		AACS Unit	
5.02	Maintains pressure, temperature, level and flow devices.	ICT-155	Introduction to Pressure Measurement and Calibration
		ICT-255	Process Measurement
5.03	Diagnoses pressure, temperature, level and flow devices.	ICT-155	Introduction to Pressure Measurement and Calibration
		ICT-255	Process Measurement
5.04	Repairs pressure, temperature, level and flow devices.	ICT-155	Introduction to Pressure Measurement and Calibration
		ICT-255	Process Measurement
Task 6 – Installs and services signal transducers.			
6.01	Performs installation and configuration of signal transducers.	ICT-235	Final Control Elements II
		ICT-255	Process Measurement
6.02	Diagnoses signal transducers.	ICT-235	Final Control Elements II
		ICT-255	Process Measurement
6.03	Performs maintenance and repairs on signal transducers.	ICT-235	Final Control Elements II
		ICT-255	Process Measurement
Task 7 – Installs and services motion, speed, position and vibration devices.			
7.01	Installs motion, speed, position and vibration devices.	ICT-330	Equipment Monitoring Devices
7.02	Maintains motion, speed, position and vibration devices.	ICT-330	Equipment Monitoring Devices
7.03	Diagnoses motion, speed, position and vibration devices.	ICT-330	Equipment Monitoring Devices
7.04	Repairs motion, speed, position and vibration devices.	ICT-330	Equipment Monitoring Devices
Task 8 – Installs and services mass, density and consistency devices.			
8.01	Installs mass, density and consistency devices.	ICT-255	Process Measurement
		ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II
8.02	Maintains mass, density, and consistency devices.	ICT-255	Process Measurement
		ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II
8.03	Diagnoses mass, density, and consistency devices.	ICT-255	Process Measurement
		ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II
8.04	Repairs mass, density and consistency devices.	ICT-255	Process Measurement
		ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II
Task 9 – Installs and services process analyzers.			
9.01	Installs process analyzers.	ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II

RSOS Sub-Task		AACS Unit	
9.02	Maintains process analyzers.	ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II
9.03	Diagnoses process analyzers.	ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II
9.04	Repairs process analyzers.	ICT-325	Process Analyzers I
		ICT-445	Process Analyzers II
Task 10 – Installs and services multiple variable computing devices.			
10.01	Installs multiple variable computing devices.	ICT-415	Supervisory Control and Data Acquisition Systems
10.02	Maintains multiple variable computing devices.	ICT-415	Supervisory Control and Data Acquisition Systems
10.03	Diagnoses multiple variable computing devices.	ICT-415	Supervisory Control and Data Acquisition Systems
10.04	Repairs multiple variable computing devices.	ICT-415	Supervisory Control and Data Acquisition Systems
Task 11 – Installs and services safety systems and devices.			
11.01	Installs safety systems and devices.	ICT-425	Safety Systems and Devices
11.02	Maintains safety systems and devices.	ICT-425	Safety Systems and Devices
11.02	Diagnoses safety systems and devices.	ICT-425	Safety Systems and Devices
11.04	Repairs safety systems and devices.	ICT-425	Safety Systems and Devices
Task 12 – Installs and services facility security systems. (NOT COMMON CORE)			
12.01	Installs facility security systems. (NOT COMMON CORE)		
12.02	Maintains facility security systems. (NOT COMMON CORE)		
12.03	Diagnoses facility security systems. (NOT COMMON CORE)		
12.04	Repairs facility security systems. (NOT COMMON CORE)		
Task 13 – Installs and services safety instrumented systems (SIS).			
13.01	Installs SIS.	ICT-425	Safety Systems and Devices
13.02	Configures SIS.	ICT-425	Safety Systems and Devices
13.03	Maintains SIS.	ICT-425	Safety Systems and Devices
13.04	Diagnoses SIS.	ICT-425	Safety Systems and Devices
13.05	Repairs SIS.	ICT-425	Safety Systems and Devices
Task 14 – Installs and services control devices for hydraulic systems.			

RSOS Sub-Task		AACS Unit	
14.01	Installs control devices for hydraulic systems.	ICT-205	Introduction to Fluids Theory
		ICT-260	Hydraulic Supply Systems and Control Devices
14.02	Diagnoses control devices and hydraulic systems.	ICT-205	Introduction to Fluids Theory
		ICT-260	Hydraulic Supply Systems and Control Devices
14.03	Performs maintenance and repairs on control devices for hydraulic systems.	ICT-205	Introduction to Fluids Theory
		ICT-260	Hydraulic Supply Systems and Control Devices
Task 15 – Installs and services pneumatic equipment.			
15.01	Installs pneumatic equipment.	ICT-155	Introduction to Pressure Measurement and Calibration
		ICT-160	Pneumatic Supply Systems I
		ICT-205	Introduction to Fluids Theory
		ICT-265	Pneumatic Supply Systems II
15.02	Diagnoses pneumatic equipment.	ICT-155	Introduction to Pressure Measurement and Calibration
		ICT-160	Pneumatic Supply Systems I
		ICT-205	Introduction to Fluids Theory
		ICT-265	Pneumatic Supply Systems II
15.03	Performs maintenance and repairs on pneumatic equipment.	ICT-155	Introduction to Pressure Measurement and Calibration
		ICT-160	Pneumatic Supply Systems I
		ICT-205	Introduction to Fluids Theory
		ICT-265	Pneumatic Supply Systems II
Task 16 – Installs and services electrical and electronic equipment.			
16.01	Installs electrical and electronic equipment.	ICT-125	Direct Current (DC) Theory
		ICT-130	Series, Parallel and Complex Circuits
		ICT-135	Voltage Drop and Power Loss
		ICT-140	Conductors, Cables and Accessories
		ICT-145	On-Off Control Devices
		ICT-150	Wireways, Raceways, Enclosures and Fittings
		ICT-245	Alternating Current (AC) Theory
		ICT-270	Electronics Components (Circuits and Power Supplies)
		ICT-320	Variable Speed Drives (VSD)

RSOS Sub-Task		AACS Unit	
16.02	Diagnoses electrical and electronic equipment.	ICT-125	Direct Current (DC) Theory
		ICT-130	Series, Parallel and Complex Circuits
		ICT-135	Voltage Drop and Power Loss
		ICT-140	Conductors, Cables and Accessories
		ICT-145	On-Off Control Devices
		ICT-150	Wireways, Raceways, Enclosures and Fittings
		ICT-245	Alternating Current (AC) Theory
		ICT-270	Electronics Components (Circuits and Power Supplies)
		ICT-320	Variable Speed Drives (VSD)
16.03	Performs maintenance and repairs for electrical and electronic equipment.	ICT-125	Direct Current (DC) Theory
		ICT-130	Series, Parallel and Complex Circuits
		ICT-135	Voltage Drop and Power Loss
		ICT-140	Conductors, Cables and Accessories
		ICT-145	On-Off Control Devices
		ICT-150	Wireways, Raceways, Enclosures and Fittings
		ICT-245	Alternating Current (AC) Theory
		ICT-270	Electronics Components (Circuits and Power Supplies)
		ICT-320	Variable Speed Drives (VSD)
Task 17 – Installs and services valves.			
17.01	Installs valves.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
17.02	Maintains valves.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
17.03	Diagnoses valves.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
17.04	Repairs valves.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
Task 18 – Installs and services actuators.			
18.01	Installs actuators.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
18.02	Maintains actuators.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
18.03	Diagnoses actuators.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II

RSOS Sub-Task		AACS Unit	
18.04	Repairs actuators.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
Task 19 – Installs and services positioners.			
19.01	Installs positioners.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
19.02	Maintains positioners.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
19.03	Diagnoses positioners.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
19.04	Repairs positioners.	ICT-165	Final Control Elements I
		ICT-235	Final Control Elements II
Task 20 – Configures and services variable speed drives (VSD).			
20.01	Configures VSD.	ICT-320	Variable Speed Drives (VSD)
20.02	Maintains VSD.	ICT-320	Variable Speed Drives (VSD)
20.03	Diagnoses VSD.	ICT-320	Variable Speed Drives (VSD)
20.04	Repairs VSD.	ICT-320	Variable Speed Drives (VSD)
Task 21 – Installs and services control network systems.			
21.01	Performs installation and configuration on control network systems.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
21.02	Diagnoses control network systems	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
21.03	Performs maintenance and repairs on control network systems.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems

RSOS Sub-Task		AACS Unit	
Task 22 – Installs and services signal converters.			
22.01	Performs installation and configuration of signal converters.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
22.02	Diagnoses signal converters.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
22.03	Performs maintenance and repairs on signal converters.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
Task 23 – Installs and services gateways, bridges and media converters.			
23.01	Performs installation and configuration of gateways, bridges and media converters.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
23.02	Diagnoses gateways, bridges and media converters.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
23.03	Performs maintenance and repairs on gateways, bridges and media converters.	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems

RSOS Sub-Task		AACS Unit	
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
Task 24 – Establishes and optimizes process control strategies.			
24.01	Determines process control strategy.	ICT-300	Process Control I
		ICT-410	Process Control II
24.02	Optimizes process control.	ICT-300	Process Control I
		ICT-410	Process Control II
Task 25 – Installs and services stand-alone controllers (SAC).			
25.01	Installs stand-alone controller (SAC).	ICT-300	Process Control I
		ICT-410	Process Control II
25.02	Configures stand-alone controller (SAC).	ICT-300	Process Control I
		ICT-410	Process Control II
25.03	Performs maintenance, diagnostics and repairs on stand-alone controller (SAC).	ICT-300	Process Control I
		ICT-410	Process Control II
Task 26 – Installs and services programmable logic controllers (PLC).			
26.01	Installs PLC.	ICT-335	Industrial Communication Systems and Devices
		ICT-435	Programmable Logic Controller Systems
26.02	Configures PLC.	ICT-335	Industrial Communication Systems and Devices
		ICT-435	Programmable Logic Controller Systems
26.03	Performs maintenance, diagnostics and repairs on PLC.	ICT-335	Industrial Communication Systems and Devices
		ICT-435	Programmable Logic Controller Systems
Task 27 – Installs and services distributed control systems (DCS).			
27.01	Installs DCS.	ICT-440	Distributed Control Systems
27.02	Configures DCS.	ICT-440	Distributed Control Systems
27.03	Performs maintenance, diagnostics and repairs on DCS.	ICT-440	Distributed Control Systems
Task 28 – Installs and services human machine interface (HMI).			
28.01	Installs Human Machine Interface (HMI).	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-425	Safety Systems and Devices

RSOS Sub-Task		AACS Unit	
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
28.02	Configures Human Machine Interface (HMI).	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-425	Safety Systems and Devices
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
28.03	Performs maintenance, diagnostics and repairs on Human Machine Interface (HMI).	ICT-335	Industrial Communication Systems and Devices
		ICT-415	Supervisory Control and Data Acquisition Systems
		ICT-425	Safety Systems and Devices
		ICT-435	Programmable Logic Controller Systems
		ICT-440	Distributed Control Systems
Task 29 – Installs and services Supervisory Control and Data Acquisition (SCADA) systems.			
29.01	Installs SCADA systems.	ICT-415	Supervisory Control and Data Acquisition Systems
29.02	Configures SCADA systems.	ICT-415	Supervisory Control and Data Acquisition Systems
29.03	Performs maintenance, diagnosis and repairs on SCADA systems.	ICT-415	Supervisory Control and Data Acquisition Systems

Level 1

ICT-100 Safety

Learning Outcomes:

- Demonstrate knowledge of safety equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of safe work practices (SWP).
- Demonstrate knowledge of regulatory requirements pertaining to safety.

2020 Red Seal Occupational Standard Reference:

1.01 Maintains safe work environment.
1.02 Uses personal protective equipment (PPE) and safety equipment.
1.03 Performs de-energizing, lock-out and tag-out procedures.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Identify hazards and describe safe work practices.
    i) hazards
        - high voltage
        - line of fire
        - rotating equipment
        - nuclear radiation
        - hazardous gases
        - heights
        - noisy locations
        - arc flash
        - confined spaces
        - temperature extremes
        - environmental extremes
        - discharge/spills
        - pressure
    ii) work permit and space work analysis
        - job safety hazard analysis (JSHA)
        - hot work permits
        - field level risk assessments (FLRA)

2. Identify and describe workplace safety and health regulations.
    i) federal
        - Workplace Hazardous Materials Information Systems (WHMIS)
        - Global Harmonized Systems (GHS)

- Safety Data Sheets (SDS)
- Transportation of Dangerous Goods (TDG)
- Nuclear Safety and Control Act

ii) provincial/territorial
- Health and Safety Act

iii) municipal

3. Identify and describe procedures to energize, de-energize, lock-out and tag-out systems and equipment.

i) sources of potential energy (zero energy state)
- electric potential
- radiation sources
- process pressure
- gravitational forces
- hydraulic pressure
- pneumatic pressure

ii) isolation points
- valves
- blinds/blanks on piping systems
- brakes
- local/remote disconnects
- breakers

iii) methods for de-energizing systems
- relieving pressure
- removing electrical potential
- grounding
- releasing brakes

4. Identify types of personal protective equipment (PPE) and describe their applications and limitations.

i) personal protective equipment (CSA approved)
- safety glasses
- safety hats
- safety boots
- gloves
- coveralls
- face shields
- personal monitors
- hearing protection
- arc flash protection
- respirators
- fall protection harness
- self-contained breathing apparatus (SCBA)

5. Describe the procedures used to care for and maintain PPE.

6. Identify types of safety equipment and describe their applications and limitations.
   i) safety equipment
      - first aid kits
      - fire extinguishers
      - eye wash station
      - chemical showers

7. Describe the procedures to care for safety equipment.

Practical Objectives:

N/A

ICT-105 Tools and Test Equipment

Learning Outcomes:

- Demonstrate knowledge of configuration, calibration and test equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of hand and power tools, their components, applications and procedures for use.
- Demonstrate knowledge of inspection procedures.
- Demonstrate knowledge of powder-actuated tools, their applications and certification requirements.

2020 Red Seal Occupational Standard Reference:

2.01 Uses calibration, configuration and test equipment.
2.02 Uses hand and power tools.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Identify types of configuration, calibration and test equipment and describe their applications and procedures for use and their care.
    i) configuration equipment
        - hand-held communicators
        - computers
        - associated industrial software
    ii) calibration and test equipment
        - multimeters
        - process calibrators
            - temperature
            - pressure
            - frequency
        - hand-held communicators
        - dead weight testers
        - networking/communication testers

2. Describe the procedures used to inspect and maintain configuration, calibration and test equipment.

3. Identify types of hand tools and describe their applications and procedures for use.

4. Describe the procedures used to inspect and maintain hand tools.

5. Identify types of portable power tools and describe their applications and procedures for use.
   i) electric
      - corded
      - battery
   ii) hydraulic
   iii) pneumatic
   iv) powder-actuated tools

6. Describe the procedures used to inspect and maintain portable power tools.

7. Identify types of stationary power tools and describe their applications and procedures for use.
   i) electric
   ii) hydraulic
   iii) pneumatic

8. Describe the procedures used to inspect and maintain stationary power tools.

Practical Objectives:

N/A

ICT-110 Rigging, Hoisting, Lifting and Access Equipment

Learning Outcomes:

- Demonstrate knowledge of lifting, rigging and hoisting equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of regulatory requirements pertaining to hoisting, lifting and rigging equipment.
- Demonstrate knowledge of basic hoisting and lifting operations.
- Demonstrate knowledge of access equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of regulatory requirements pertaining to access equipment.

2020 Red Seal Occupational Standard Reference:

2.03 Uses access equipment.
2.04 Uses rigging, hoisting and lifting equipment.

Suggested Hours:

6 Hours

Theoretical Objectives:

1. Define terminology associated with rigging, hoisting, lifting and access equipment.

2. Identity types of rigging, hoisting, lifting and access equipment and accessories and describe their applications and limitations.
    - i) rigging equipment
        - chains
        - ropes
        - cables
        - slings
        - shackles
    - ii) hoisting and lifting equipment
        - pallet jacks
        - forklifts
        - portable and stationary cranes
        - chain falls/come-alongs
    - iii) access equipment
        - ladders
        - elevated/aerial work platforms
        - scaffolding
        - fall protection
            - fall arrest
            - fall restraint

3. Identify hazards and describe safe work practices pertaining to rigging, hoisting, lifting, and access equipment.
   i) hazards
      - overhead hazards/overhead power hazards
      - congested worksites
      - dropped loads
      - damaged rigging hardware
      - confined spaces
      - weather conditions
      - trenches
      - uneven surfaces
      - ladder footing and stability
      - slips, trips and falls
      - tool lanyards

4. Identify codes and regulations pertaining to rigging, hoisting, lifting and access equipment.
   i) regulations
      - inspection documentation
      - training
      - certification/re-certification

5. Describe the procedures used to inspect and store rigging, hoisting, and lifting equipment.

6. Identify basic types of knots, hitches, splices and bends, and describe their applications and procedures used to tie them.
   i) square knot
   ii) bowline knot
   iii) double half hitch
   iv) clove hitch
   v) sheet bend

7. Describe considerations when rigging material/equipment for lifting.
   i) considerations
      - load characteristics
      - work load limit (WLL)
      - equipment and accessories
      - environmental factors
      - anchor points
      - sling angles
      - maximum rated capacity (MRC)

8. Identify and describe procedures used to communicate during hoisting, lifting and rigging operations.

i) procedures
- hand signals
- electronic communications
- audible/visual communications

Practical Objectives:

N/A

MENT-700 Mentoring I

Learning Outcomes:

- Demonstrate knowledge of effective communication practices as a learner.
- Demonstrate knowledge of strategies for learning skills in the workplace.

2020 Red Seal Occupational Standard Reference:

4.01 Uses communication techniques.
4.02 Uses mentoring techniques.

Suggested Hours:

6 Hours

Theoretical Objectives:

1. Describe the importance of one's own individual experiences.

2. Identify behaviours that demonstrate positive learning experiences.

3. Identify the benefits of workplace mentoring for the apprentice, mentor and employer.

4. Identify the partners involved in apprenticeship training.

5. Describe the shared responsibilities for workplace learning in apprenticeship.

6. Identify different learning needs and strategies to address challenges or barriers in the workplace.
   i) learning disabilities
   ii) language
   iii) underrepresentation

7. Identify the components that create a positive and inclusive workplace culture.
   i) workplace characteristics
   ii) individual behaviours

8. Identify various learning styles and determine one’s own learning preferences.

9. Explain how learning preferences impact learning new skills.

10. Identify different learning strategies to meet individual learning needs.

11. Describe the importance of adapting to a variety of teaching and learning methods in the workplace.

12. Identify techniques for effective communication as a learner.
    i) verbal and non-verbal
    ii) active listening

13. Identify and describe personal responsibilities and attitudes that contribute to on-the-job success.
    i) self advocating
    ii) asking questions
    iii) accepting constructive feedback
    iv) working safely
    v) employing time management techniques and being punctual

Practical Objectives:

N/A

ICT-120 Drawings, Schematics, Specifications and Trade Documentation

Learning Outcomes:

- Demonstrate knowledge of drawings, schematics, specifications and their applications.
- Demonstrate knowledge of interpreting and extracting information from drawings, schematics and specifications.
- Demonstrate knowledge of maintaining drawings, schematics and specifications.
- Demonstrate knowledge of trade related documentation and its use.

2020 Red Seal Occupational Standard Reference:

3.01 Uses documentation.
3.02 Interprets drawings and schematics.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Define terminology associated with drawings, schematics, specifications and trade documentation.

2. Identify types of trade-related documentation and describe their purpose, applications and procedures for use.
   - i) calibration sheets
   - ii) data sheets
   - iii) work orders
   - iv) maintenance schedules/records
   - v) drawings
   - vi) manufacturers' specifications/manuals

3. Identify standards and codes used in the trade.
   - i) standards
     - site-specific standards
     - International Society of Automation (ISA)
     - Scientific Apparatus Manufacturers Association (SAMA)
     - Canadian Standards Association (CSA)
   - ii) codes
     - Canadian Electrical Code (CEC)

4. Identify types of drawings, schematics, and specifications used in the trade and describe their applications.

i) mechanical
   - location/plant layout drawings
   - process equipment details

ii) process
   - piping and instrumentation diagrams (P&ID)
   - instrument loop drawings (ILD)
   - process flow diagrams
   - instrument index
   - general specifications/standards
   - installation detail drawings
   - instrument data sheet

iii) electrical
   - schematics
      - logic
      - electrical
   - wiring diagrams

iv) fluid systems
   - pneumatic
   - hydraulic

v) general drawings
   - orthographic
   - isometric

5. Interpret and extract information from drawings, schematics and specifications.
   i) lines
   ii) legends
   iii) symbols and abbreviations
   iv) notes and specifications
   v) dimensions
      - metric
      - Society of Automotive Engineers (SAE)

6. Describe the procedures used to revise drawings, schematics and specifications.
   i) as-builts
   ii) document control

Practical Objectives:

N/A

ICT-125 Direct Current (DC) Theory

Learning Outcomes:

- Demonstrate knowledge of direct current (DC) electricity, its characteristics and associated principles.
- Demonstrate knowledge of Ohm's law.
- Demonstrate knowledge of units of measure and symbols relating to DC electricity.
- Demonstrate knowledge of the instruments and procedures used to measure electricity.
- Demonstrate knowledge of regulatory requirements pertaining to electrical and electronic equipment, and their components.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Performs maintenance and repairs for electrical and electronic equipment.

Suggested Hours:

30 Hours

Theoretical Objectives:

1. Define terminology associated with DC electricity.

2. Identify hazards and describe safe work practices pertaining to DC electricity.

3. Explain the atomic structure of matter.

4. Identify the forms of energy that produce electricity and describe their associated principles.
   i) chemical action
   ii) piezoelectric effect
   iii) magnetism
   iv) heat
   v) light and solar
   vi) friction

5. Identify the components of an electric circuit and describe the procedures used to analyze them.
   i) electron path (conductors)
      - closed circuit
      - open circuit
      - short circuit

ii) load
iii) source
iv) control

6. Identify units of measure and symbols pertaining to DC electricity.

7. Explain Ohm's Law.

8. Identify the basic electrical properties.
   i) voltage
   ii) current
   iii) resistance
   iv) power

9. Explain the effects of resistance/capacitance (RC) on DC circuits.

10. Identify instruments used for measuring electricity and describe their applications and procedures for use.

11. Perform calculations to determine electricity related values.

Practical Objectives:

1. Use multimeters to measure DC components and circuits.

ICT-130 Series, Parallel and Complex Circuits

Learning Outcomes:

- Demonstrate knowledge of series, parallel and complex circuits, their characteristics and operation.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Performs maintenance and repairs for electrical and electronic equipment.

Suggested Hours:

30 Hours

Theoretical Objectives:

1. Define terminology associated with series, parallel and complex circuits.

2. Explain the characteristics and operation of circuits.
   i) series
   ii) parallel
   iii) complex/combination

3. Explain Kirchhoff's Laws.
   i) current
   ii) voltage

4. Perform calculations to determine series, parallel and complex circuit related values.

5. Describe the procedures used to troubleshoot series, parallel and complex circuits.

Practical Objectives:

1. Use multimeters to measure series, parallel and complex circuits.

ICT-135 Voltage Drop and Power Loss

Learning Outcomes:

- Demonstrate knowledge of voltage drop and power loss and its impact on a circuit.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Performs maintenance and repairs for electrical and electronic equipment.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Define terminology associated with voltage drop and power loss.

2. Interpret codes and regulations pertaining to voltage drop and power loss.
   i) Canadian Electrical Code

3. Identify types of conductors and describe their characteristics and applications.

4. Identify the units of measure used to describe conductor size.

5. Identify types of insulators and describe their characteristics and applications.

6. Explain conductor resistance and its effect on a circuit.

7. Describe the procedures used to determine conductor resistance.

8. Explain line voltage drop and its effect on a circuit.

9. Perform calculations to determine line voltage drop and power loss.
   i) individual circuits
   ii) Edison three-wire

10. Explain power loss and its effect on a circuit.

Practical Objectives:

N/A

ICT-140 Conductors, Cables and Accessories

Learning Outcomes:

- Demonstrate knowledge of conductors, cables, and cable components.
- Demonstrate knowledge of conductor and cable accessories.
- Demonstrate knowledge of procedures to install conductors and cables.
- Demonstrate knowledge of procedures to terminate conductors.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Performs maintenance and repairs for electrical and electronic equipment.

Suggested Hours:

18 Hours

Theoretical Objectives:

1. Define terminology associated with conductors and cables.

2. Identify hazards and describe safe work practices pertaining to conductors and cables.

3. Identify tools and equipment relating to conductors, cables and accessories and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to conductors and cables.
   i) Canadian Electrical Code

5. Interpret information pertaining to conductors, cables and accessories found on drawings and specifications.

6. Identify types of conductors, cables and accessories and describe their characteristics and applications.
   i) power/distribution
   ii) signal/control
   iii) communication/data

7. Identify cable components and describe their characteristics and applications.
   i) mechanical
   ii) electrical

8. Identify conductor and cable accessories and describe their characteristics and applications.
   i) connectors
   ii) supports

9. Identify methods of circuit protection and describe their characteristics and applications.
   i) fuses
   ii) circuit breakers

10. Identify considerations used when selecting conductors and cables and their associated components and accessories.

11. Describe the procedures used to install conductors and cables and their associated components and accessories.

12. Describe the procedures used to ground, bond and shield conductors and cables.
   i) power/distribution
   ii) signal/control
   iii) communication/data

13. Describe methods used to terminate conductors.
   i) terminal blocks
   ii) conical springs
      - twist-on wire connectors
      - wire nuts
   iii) crimp lugs
   iv) solder joints

Practical Objectives:

N/A

ICT-145 On-off Control Devices

Learning Outcomes:

- Demonstrate knowledge of on-off control devices, their components and operation.
- Demonstrate knowledge of procedures to install, maintain, troubleshoot and replace on-off control devices.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Performs maintenance and repairs for electrical and electronic equipment.

Suggested Hours:

27 Hours

Theoretical Objectives:

1. Define terminology associated with on-off control devices.

2. Identify hazards and describe safe work practices pertaining to on-off control devices.
   i) energy state awareness

3. Interpret codes and regulations pertaining to on-off control devices.
   i) Canadian Electrical Code (CEC)
      - enclosure types
      - ampacity limitations

4. Interpret information pertaining to on-off control devices found on drawings, specifications and nameplates.

5. Identify types of on-off control devices and describe their characteristics.
   i) push buttons
   ii) switches
      - limit
      - proximity
      - centrifugal
      - thermal
   iii) photo sensors
   iv) relays

6. Identify the applications for on-off control devices.
    i) hazardous locations
    ii) non-hazardous locations
    iii) environment conditions
    iv) process conditions

7. Describe the procedures used to install on-off control devices.

8. Describe the procedures used to maintain, troubleshoot and replace on-off control devices.

Practical Objectives:

1. Install and troubleshoot on/off control devices.

ICT-150 Wireways, Raceways, Enclosures and Fittings

Learning Outcomes:

- Demonstrate knowledge of wireways, raceways, enclosures and fittings, their characteristics and applications.
- Demonstrate knowledge of procedures to install wireways, raceways, enclosures and fittings.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Performs maintenance and repairs for electrical and electronic equipment.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Define terminology associated with wireways, raceways, enclosures and fittings.

2. Identify hazards and describe safe work practices pertaining to wireways, raceways, enclosures and fittings.

3. Identify tools and equipment relating to wireways, raceways, enclosures and fittings and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to wireways, raceways, enclosures and fittings.

5. Interpret information pertaining to wireways, raceways, enclosures and fittings found on drawings and specifications.

6. Identify types of wireways, raceways, enclosures, fittings and accessories, and describe their characteristics and applications.
   - i) cable tray
     - power
     - instrument
   - ii) conduit
     - rigid
     - PVC
     - flexible
     - electrical metallic tubing (EMT)

iii) enclosures
- environmental conditions
- hazardous locations

7 Describe the procedures used to bend conduit and EMT.

8. Describe the procedures used to install wireways, raceways, enclosures and their fittings and accessories.
i) installation trade practices
ii) grounding/bonding/shielding

Practical Objectives:

N/A

ICT-155 Introduction to Pressure Measurement and Calibration

Learning Outcomes:

- Demonstrate knowledge of pressure measurement and calibration.
- Demonstrate knowledge of procedures to install, calibrate, maintain and troubleshoot basic pressure measurement devices.

2020 Red Seal Occupational Standard Reference:

5.01 Installs pressure, temperature, level and flow devices.
5.02 Maintains pressure, temperature, level and flow devices.
5.03 Diagnoses pressure, temperature, level and flow devices.
5.04 Repairs pressure, temperature, level and flow devices.
15.01 Installs pneumatic equipment.
15.02 Diagnose pneumatic equipment.
15.03 Performs maintenance and repairs on pneumatic equipment.

Suggested Hours:

27 Hours

Theoretical Objectives:

1. Define terminology associated with pressure measurement and calibration.

2. Identify hazards and describe safe work practices pertaining to pressure measurement and calibration.
   i) physical locations
   ii) process conditions
   iii) electrical

3. Interpret information pertaining to pressure measuring devices found on drawings, specifications and nameplates.

4. Identify tools and equipment relating to pressure measurement and calibration and describe their applications and procedures for use.

5. Describe the principles and theories of fluids.
   i) Pascal's law
   ii) Boyle's law
   iii) Charles' law
   iv) Gay-Lussac's law
   v) Combined Gas law
   vi) Bernoulli's principle

6. Identify units of measurement and perform calculations relating to pressure measurement.
   i) PSI
   ii) kPa
   iii) bar
   iv) inches of water
   v) inches of mercury
   vi) absolute pressure
   vii) gauge pressure
   viii) vacuum pressure
   ix) differential pressure

7. Explain the principles of pressure measurement and its relationship to temperature, level and flow.

8. Identify types of basic pressure measurement fluid mediums and describe their applications.
   i) pneumatic
   ii) hydraulic

9. Identify types of basic pressure measurement instruments and their applications.
   i) manometers
   ii) bourdon tubes (pressure gauges)
   iii) diaphragms
   iv) load cells
   v) transmitters
      - conventional/analog
      - smart/intelligent
      - wireless

10. Describe the procedures used to install basic pressure measurement devices.
   i) gauges
   ii) recorders
   iii) switches
   iv) transmitters

11. Describe the procedures used to maintain and troubleshoot basic pressure measurement devices.

12. Identify pressure related calibration standards and describe their applications.
   i) primary
   ii) secondary

13. Identify pressure related calibration test equipment and describe their applications and procedures for use.
    i) dead weight tester
    ii) manometer
    iii) test gauges and calibrators

14. Interpret and maintain calibration records.

Practical Objectives:

1. Calibrate basic pressure measurement devices.
    i) conventional/analog
    ii) smart/intelligent

ICT-160 Pneumatic Supply Systems I

Learning Outcomes:

- Demonstrate knowledge of tubing and piping components for pneumatic supply systems.
- Demonstrate knowledge of procedures to install, maintain and troubleshoot tubing for pneumatic supply systems.
- Demonstrate knowledge of procedures to cut, thread and ream pipe for pneumatic supply systems.

2020 Red Seal Occupational Standard Reference:

15.01 Installs pneumatic equipment.
15.02 Diagnoses pneumatic equipment.
15.03 Performs maintenance and repairs on pneumatic equipment.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Define terminology associated with tubing and piping for pneumatic supply systems.

2. Identify hazards and describe safe work practices pertaining to tubing and piping for pneumatic supply systems.
   i) hazards
      - energy state awareness (accumulators and suspended loads)
      - temperature
      - pressure
      - flammability/venting

3. Identify codes and regulations pertaining to the installation of tubing and piping for pneumatic supply systems.

4. Interpret information pertaining to tubing and piping found on drawings and specifications.

5. Identify tools and equipment used to install, maintain and troubleshoot tubing and piping and describe their applications and procedures for use.
   i) tools and equipment
      - infrared thermometers
      - ultrasonic leak detectors

- pressure gauges
- dewpoint detectors
- leak detection solution

6. Identify types of pneumatic supply system components and describe their characteristics and applications.
   i) pneumatic supply system components
      - regulators
      - separators
      - actuators
      - solenoids
      - positioners
      - gauges
      - transmitters
      - converters
      - relays

7. Identify types of tubing and piping systems and describe their applications.
   i) rigid
   ii) flexible
      - tubing
      - hoses
   iii) ferrous
   iv) non-ferrous

8. Identify types of tube fittings and accessories and describe their characteristics and applications.

9. Describe the procedures used to select, bend and install tubing in pneumatic supply systems.

10. Describe the procedures used to maintain and troubleshoot tubing in pneumatic supply systems.

11. Describe the procedures used to cut, thread and ream rigid pipe.

12. Describe the procedures used to perform a pressure test.

Practical Objectives:

1. Perform tube bending, installation and pressure test.

2. Cut, thread and ream rigid pipe.

ICT-165 Final Control Elements I

Learning Outcomes:

- Demonstrate a basic knowledge of final control elements, their accessories, components and operation.
- Demonstrate a basic knowledge of procedures to install, maintain, troubleshoot and replace final control elements, their accessories and components.

2020 Red Seal Occupational Standard Reference:

17.01 Installs valves.
17.02 Maintains valves.
17.03 Diagnoses valves.
17.04 Repairs valves.
18.01 Installs actuators.
18.02 Maintains actuators.
18.03 Diagnoses actuators.
18.04 Repairs actuators.
19.01 Installs positioners.
19.02 Maintains positioners.
19.03 Diagnoses positioners.
19.04 Repairs positioners.

Suggested Hours:

18 Hours

Theoretical Objectives:

1. Define basic terminology associated with final control elements.
   - i) action
     - valve assembly
     - valve positioner
     - valve actuator
   - ii) bench set

2. Identify basic hazards and describe safe work practices pertaining to final control elements.
   - i) energy state awareness (process)
     - pressure
     - voltage
     - mechanical
     - temperature
     - flow

ii) energy state awareness (valve assembly)
- spring tension
- pinch points
- diaphragm pressure

iii) hazardous processes

iv) isolation
- venting
- purging

v) lock-out/tag-out

3. Identify basic tools and equipment relating to final control elements and describe their applications and procedures for use.

4. Identify codes and regulations pertaining to final control elements.

5. Interpret basic information pertaining to final control elements found on drawings, specifications and nameplates.

6. Identify basic types of final control elements and describe their components, applications and operation.

i) valves
- isolation
- throttling
- regulating

ii) dampers/louvres

iii) process regulators

7. Identify basic types of energy systems used to operate final control elements and describe their characteristics and applications.

i) hydraulic

ii) pneumatic

iii) electric

iv) manual operation

8. Identify final control element accessories and describe their basic components, purpose and operation.

i) actuators
- hydraulic
- pneumatic
- electric

ii) boosters
- volume
- pressure

iii) positioners
- electric

- pneumatic
- smart

iv) regulators
v) switches
vi) hand wheels

9. Describe the basic procedures used to select, size and install final control elements, their accessories and components.

10. Describe the basic procedures used to maintain, troubleshoot and replace final control elements, their accessories and components.

Practical Objectives:

N/A

ICT-170 Trade Related Computer Use

Learning Outcomes:

- Demonstrate knowledge of trade related computer equipment and accessories and their use.
- Demonstrate knowledge of change management/management of change (MOC) requirements.

2020 Red Seal Occupational Standard Reference:

3.01 Uses documentation.

Suggested Hours:

6 Hours

Theoretical Objectives:

1. Define basic terminology associated with trade related computer use.
   - i) local area network
   - ii) ethernet
   - iii) driver
   - iv) hard drive
   - v) flash drive
   - vi) disc operating system (DOS)
   - vii) icon
   - viii) universal serial bus (USB)
   - ix) bluetooth
   - x) central processing unit (CPU)

2. Identify hazards and describe safe work practices pertaining to trade related computer use.
   - i) online vs. offline applications
   - ii) hazardous locations
   - iii) administrative rights/privileges
   - iv) interfacing practices

3. Identify trade related computer equipment and accessories and describe their characteristics and applications.
   - i) hardware
   - ii) software/firmware
   - iii) interfacing equipment

4. Identify the requirements and describe the procedures used for change management/MOC.
    i) backup/restore data
    ii) file/document control
    iii) equipment configuration

Practical Objectives:

N/A

Level 2

ICT-205 Introduction to Fluids Theory

Learning Outcomes:

- Demonstrate knowledge of the principles and applications of fluids.

2020 Red Seal Occupational Standard Reference:

14.01 Installs control devices for hydraulic systems.
14.02 Diagnoses control devices for hydraulic systems.
14.03 Performs maintenance and repairs on control devices for hydraulic systems.
15.01 Installs pneumatic equipment.
15.02 Diagnoses pneumatic equipment.
15.03 Performs maintenance and repairs on pneumatic equipment.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Define terminology associated with fluids.

2. Identify hazards and describe safe work practices pertaining to fluids.
   i) pressure
   ii) temperature
   iii) chemical

3. Explain the principles and theories of fluids.
   i) Pascal's law
   ii) Boyle's law
   iii) Charles' law
   iv) Gay-Lussac's law
   v) Combined Gas law
   vi) Bernoulli's principle

4. Describe units of measure as they relate to fluids.

5. Identify fluid related calculations/formulas in relation to fluid theories and describe their applications.

6. Identify fluid related symbols and abbreviations found on drawings and schematics.

Practical Objectives:

N/A

ICT-235 Final Control Elements II

Learning Outcomes:

- Demonstrate advanced knowledge of final control elements, their accessories, components and operation.
- Demonstrate advanced knowledge of procedures to install, maintain, troubleshoot and replace final control elements, their accessories and components.

2020 Red Seal Occupational Standard Reference:

6.01 Performs installation and configuration of signal transducers.
6.02 Diagnoses signal transducers.
6.03 Performs maintenance and repairs on signal transducers.
17.01 Installs valves.
17.02 Maintains valves.
17.03 Diagnoses valves.
17.04 Repairs valves.
18.01 Installs actuators.
18.02 Maintains actuators.
18.03 Diagnoses actuators.
18.04 Repairs actuators.
19.01 Installs positioners.
19.02 Maintains positioners.
19.03 Diagnoses positioners.
19.04 Repairs positioners.

Suggested Hours:

42 Hours

Theoretical Objectives:

1. Define advanced terminology associated with final control elements.
    - i) control valve assemblies
        - valve body
        - internal trim parts
        - actuators
        - accessories
    - ii) sliding stem control valves
    - iii) rotary control valves
    - iv) control valve functions and characteristics
        - bench set
        - capacity/flow coefficient (Cv)
        - fail safe positions

- flow characteristics
  - linear
  - quick opening
  - equal percentage
  - on-off
- flashing
- cavitation
- rangeability
- direct action
- reverse action

2. Identify advanced hazards and describe safe work practices pertaining to final control elements.
   i) energy state awareness (process)
      - pressure
      - voltage
      - mechanical
      - temperature
      - flow
   ii) energy state awareness (valve assembly)
      - spring tension
      - pinch points
      - actuator energy
   iii) hazardous processes
   iv) isolation
      - venting
      - purging
   v) lock-out/tag-out

3. Identify advanced tools and equipment relating to final control elements and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to final control elements.

5. Interpret advanced information pertaining to final control elements found on drawings, specifications and nameplates.

6. Identify advanced types of final control elements and describe their components, applications and operation.
   i) valves
      - globe
      - gate
      - pinch/diaphragm
      - butterfly
      - ball

- plug
- safety/relief
- check

ii) dampers/louvres
iii) positive displacement metering pumps
iv) motors
v) process regulators
- variable speed drives (VSD)

7. Identify advanced types of energy systems used to operate final control elements and describe their characteristics and applications.
i) hydraulic
ii) pneumatic
iii) electric
iv) manual operation

8. Identify final control element accessories and describe their advanced components, purpose and operation.
i) control valve body components
- body type
  - single port
  - three-way
  - angle
- bonnet
- cages
- plugs
- seats
- stems
- packing
  - graphite (rings/rope)
  - polytetrafluoroethylene (PTFE)

ii) control valve accessories
- actuators
  - hydraulic
  - pneumatic
  - electric
- boosters
  - volume
  - pressure
- positioners
  - electric
  - pneumatic
  - smart
- regulators
- switches

- hand wheels
- signal transducers
    - I/P
    - E/P

9. Describe the advanced procedures used to select, size and install final control elements, their accessories and components.

10. Describe the advanced procedures used to maintain, troubleshoot and replace final control elements, their accessories and components.

Practical Objectives:

1. Disassemble and assemble a control valve.

2. Install a positioner.

ICT-245 Alternating Current (AC) Theory

Learning Outcomes:

- Demonstrate knowledge of single-phase electricity, its characteristics and associated principles.
- Demonstrate basic knowledge of AC electrical generation, its characteristics and associated principles.
- Demonstrate knowledge of alternating current (AC) devices and their characteristics.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Maintains electrical and electronic equipment.

Suggested Hours:

30 Hours

Theoretical Objectives:

1. Define terminology associated with single-phase electricity.
   i) in-phase
   ii) lead
   iii) lag
   iv) unity
   v) power factor
   vi) period
   vii) cycle
   viii) frequency

2. Identify hazards and describe safe work practices pertaining to single-phase electricity.

3. Identify units of measure and symbols pertaining to single-phase electricity.
   i) volts
   ii) current
   iii) resistance
   iv) impedance
   v) root mean squared (RMS)
   vi) peak
   vii) instantaneous
   viii) average
   ix) frequency

4. Explain the principles of magnetism.

5. Explain the principles of electromagnetism.

6. Explain the principles of electromagnetic induction.

7. Identify types of electromagnetic induction and describe their characteristics and applications.
   i) self-induction
   ii) mutual induction

8. Explain alternating current (AC) generation.
   i) single-phase
   ii) three-phase

9. Identify types of devices used in AC generation and describe their characteristics and applications.

10. Identify types of transformers used in control circuitry and describe their characteristics and applications.

11. Identify types of AC circuits and describe their characteristics.
   i) resistance/capacitance (RC)
   ii) resistance/inductance (RL)
   iii) resistance/inductance/capacitance (RLC)

12. Perform calculations pertaining to single-phase electrical concepts.

13. Describe the use of measurement instruments pertaining to AC generation.
   i) voltmeter
   ii) ohmmeter
   iii) ammeter
   iv) oscilloscope

Practical Objectives:

1. Use instruments to measure AC components and circuits.
   i) voltmeter
   ii) ohmmeter
   iii) ammeter
   iv) oscilloscope

ICT-255 Process Measurement

Learning Outcomes:

- Demonstrate knowledge of process measurement and its associated principles.
- Demonstrate knowledge of process measuring and indicating devices, their components and operation.
- Demonstrate knowledge of procedures to install, calibrate, configure, maintain, troubleshoot and replace process measuring and indicating devices.

2020 Red Seal Occupational Standard Reference:

5.01 Installs pressure, temperature, level and flow devices.
5.02 Maintains pressure, temperature, level and flow devices.
5.03 Diagnoses pressure, temperature, level and flow devices.
5.04 Repairs pressure, temperature, level and flow devices.
6.01 Performs installation and configuration of signal transducers.
6.02 Diagnoses signal transducers.
6.03 Performs maintenance and repairs on signal transducers.
8.01 Installs mass, density and consistency devices.
8.02 Maintains mass, density, and consistency devices.
8.03 Diagnoses mass, density, and consistency devices.
8.04 Repairs mass, density and consistency devices.

Suggested Hours:

66 Hours

Theoretical Objectives:

1. Define terminology associated with process measurement.
   i) primary element
   ii) transducers
   iii) transmitters
   iv) density
   v) specific gravity
   vi) mass

2. Identify hazards and describe safe work practices pertaining to process measurement.
   i) physical locations
   ii) process conditions
   iii) electrical

3. Identify tools and equipment relating to process measuring and indicating devices and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to process measuring and indicating devices.

5. Interpret information pertaining to process measuring and indicating devices found on drawings, specifications and nameplates.

6. Identify units of measure used to express process measurement values.

7. Perform conversions and calculations relating to process measurement.

8. Identify forms of process measurement and explain their associated principles.
   - i) pressure
   - ii) temperature
   - iii) level
   - iv) flow
     - laminar
     - turbulent
     - transitional
     - Reynold's number
     - volumetric flow rate
     - flow velocity

9. Identify types of process primary elements and describe their characteristics, applications and limitations.
   - i) pressure
   - ii) temperature
   - iii) level
   - iv) flow

10. Identify types of mass and density devices used in process measurement and describe their applications.
    - i) load cells
    - ii) strain gauges
    - iii) Coriolis tubes
    - iv) displacers
    - v) refractometers
    - vi) nuclear gauges
    - vii) tuning forks

11. Explain the operation of transmitters used in conjunction with primary elements.
    - i) conventional/analog
      - pneumatic
      - electronic
    - ii) smart/intelligent

12. Identify types of recorders and data loggers used for process measuring and describe their characteristics and applications.

13. Describe the procedures used to select and install process measuring and indicating devices.
    i) sample/tap point locations
    ii) orientation
    iii) environment

14. Describe the procedures used to calibrate and configure process measuring and indicating devices.

15. Describe the procedures used to maintain, troubleshoot and replace process measuring and indicating devices.

Practical Objectives:

1. Test, diagnose, and calibrate process measurement devices.

ICT-260 Hydraulic Supply Systems and Control Devices

Learning Outcomes:

- Demonstrate knowledge of hydraulic supply systems, their components and operation.
- Demonstrate knowledge of documentation relating to hydraulic equipment and systems, their use and interpretation.
- Demonstrate knowledge of hydraulic related calculations.
- Demonstrate knowledge of procedures to install hydraulic control devices.
- Demonstrate knowledge of procedures to maintain and troubleshoot hydraulic supply systems and components.

2020 Red Seal Occupational Standard Reference:

14.01 Installs control devices for hydraulic systems.
14.02 Diagnoses control devices for hydraulic systems.
14.03 Performs maintenance and repairs on control devices for hydraulic systems.

Suggested Hours:

24 Hours

Theoretical Objectives:

1. Define terminology associated with hydraulic supply systems.

2. Identify hazards and describe safe work practices pertaining to hydraulic supply systems.
   - i) energy state awareness
     - accumulators
     - suspended loads
   - ii) condition of hoses, piping and tubing
     - system pressure
     - system temperature

3. Interpret information pertaining to hydraulic supply systems found on schematics and specifications.

4. Identify hydraulic supply system components and describe their purpose and operation.
   - i) pumps
   - ii) motors
   - iii) actuators
   - iv) valves
   - v) accumulators
   - vi) control devices

5. Perform hydraulic calculations.

6. Identify types of fluids used in hydraulic supply systems and describe their characteristics and applications.

7. Identify tools and equipment relating to the maintenance and troubleshooting of hydraulic supply systems and describe their applications and procedures for use.

8. Describe the procedures used to install hydraulic control devices.
   - i) solenoids
   - ii) gauges
   - iii) switches
   - iv) actuators

9. Describe the procedures used to maintain and troubleshoot hydraulic supply systems and components.
   - i) check hoses, piping and tubing
   - ii) check fluids
     - condition
     - level
   - iii) check/change filters
   - iv) determine operating parameters
   - v) adjust system pressure, temperature and flow

Practical Objectives:

N/A

ICT-265 Pneumatic Supply Systems II

Learning Outcomes:

- Demonstrate knowledge of advanced pneumatic supply systems, their components and operation.
- Demonstrate knowledge of advanced pneumatic supply system documentation and schematics, their use and interpretation.
- Demonstrate knowledge of advanced pneumatic related calculations.
- Demonstrate knowledge of procedures to install, maintain, commission and troubleshoot advanced pneumatic supply system equipment and components.

2020 Red Seal Occupational Standard Reference:

15.01 Installs pneumatic equipment.
15.02 Diagnoses pneumatic equipment.
15.03 Performs maintenance and repairs on pneumatic equipment.

Suggested Hours:

24 Hours

Theoretical Objectives:

1. Define terminology associated with advanced pneumatic supply systems.

2. Identify hazards and describe safe work practices pertaining to advanced pneumatic supply systems.
   - i) energy state awareness
     - accumulators
     - suspended loads
   - ii) temperature
   - iii) pressure
   - iv) flammability/venting

3. Interpret information pertaining to advanced pneumatic supply systems found on drawings and specifications.

4. Identify types of advanced pneumatic supply systems and describe their applications and operation.
   - i) instrument air
   - ii) instrument gas
   - iii) service/utility air

5. Identify types of advanced pneumatic supply system components and describe their purpose and operation.
   i) compressors
   ii) relays
   iii) valves
   iv) regulators
   v) gauges
   vi) actuators

6. Describe methods of air treatment in advanced pneumatic supply systems.
   i) filters
   ii) dryers
   iii) after-coolers
   iv) de-icers
   v) receivers

7. Interpret documentation to determine the operation of advanced pneumatic supply systems.
   i) schematics
   ii) manufacturer's manuals

8. Perform pneumatic related calculations.
   i) unit conversion
   ii) volume (ideal gas law)

9. Identify classifications and types of compressors, their specifications and applications.
   i) dynamic/centrifugal
   ii) positive displacement

10. Describe the procedures used to select, size and install advanced pneumatic supply systems and components.
   i) compressors
   ii) dryers
   iii) receivers
   iv) piping/tubing

11. Identify tools and equipment relating to advanced pneumatic supply systems and describe their applications and procedures for use.

12. Describe the procedures used to maintain and troubleshoot advanced pneumatic supply systems and their components.
   i) compressors
   ii) lubricating fluids
      - condition
      - level

iii) dryers
iv) de-icers
v) hoses, piping and tubing
vi) filters

13. Describe the procedures used to commission advanced pneumatic supply systems and components.

Practical Objectives:

N/A

ICT-270 Electronic Components (Circuits and Power Supplies)

Learning Outcomes:

- Demonstrate knowledge of AC/DC circuits and their characteristics.
- Demonstrate knowledge of electronics, their components, applications and operation.
- Demonstrate knowledge of procedures to install, maintain, troubleshoot and replace electronic circuits and their components.
- Demonstrate knowledge of power supplies, their components and operation.
- Demonstrate knowledge of procedures to install, maintain, troubleshoot, and replace power supplies.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Maintains electrical and electronic equipment.

Suggested Hours:

42 Hours

Theoretical Objectives:

1. Define terminology associated with electronic components.

2. Identify hazards and describe safe work practices pertaining to electronic components and power supplies.
   i) energy state awareness
   ii) static electricity discharge

3. Identify tools and equipment relating to electronic circuitry and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to electronics and power supplies.

5. Interpret information pertaining to electronics and power supplies found on devices, drawings and specifications.

6. Explain conventional current flow vs. electron flow theory in electronics.

7. Identify number systems used in electronics and describe their applications.
   i) binary
   ii) decimal
   iii) hexadecimal
   iv) octal
   v) binary coded decimal (BCD)
   vi) Gray code
   vii) ASCII

8. Perform conversions between number systems.

9. Identify types of logic gates and describe their applications.
   i) NOT
   ii) AND
   iii) OR
   iv) NAND
   v) NOR
   vi) exclusive NOR
   vii) exclusive OR

10. Identify semiconductor materials used in electronics and describe their characteristics and applications.

11. Identify electronic components and describe their purpose and operation in a circuit.
   i) resistors
   ii) capacitors
   iii) inductors
   iv) diodes
   v) transistors
   vi) op amps
   vii) thyristors
   viii) rectifiers

12. Describe the procedures used to select and install electronic circuits.

13. Describe the procedures used to maintain, troubleshoot and replace electronic circuitry.

14. Perform calculations pertaining to electronics.
   i) power
   ii) current
   iii) voltage
   iv) frequency (timing)
   v) logic

15. Identify types of power supplies and describe their characteristics and operating principles.
    i) AC/DC power supplies
    ii) uninterruptable power supplies (UPS)

16. Describe the procedures used to select and install power supplies.

17. Describe the procedures used to maintain, troubleshoot and replace power supplies.

Practical Objectives:

N/A

Level 3

ICT-300 Process Control I

Learning Outcomes:

- Demonstrate knowledge of basic process control and its purpose.
- Demonstrate knowledge of basic process controllers, their components and operation.
- Demonstrate knowledge of procedures to select, install, configure, calibrate, maintain, and troubleshoot basic process controllers.
- Demonstrate knowledge of procedures to maintain, troubleshoot and tune basic process control systems.
- Demonstrate knowledge of procedures to commission basic process controllers and their systems.

2020 Red Seal Occupational Standard Reference:

3.02 Interprets drawings and schematics.
24.01 Determines process control strategy.
24.02 Optimizes process control.
25.01 Installs stand-alone controller (SAC).
25.02 Configures stand-alone controller (SAC).
25.03 Performs maintenance, diagnostics and repairs on stand-alone controller (SAC).

Suggested Hours:

60 Hours

Theoretical Objectives:

1. Define terminology associated with basic process control.

2. Identify hazards and describe safe work practices pertaining to basic process control.

3. Identify tools, equipment and software used to configure and calibrate process controllers and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to basic process control.

5. Interpret information pertaining to basic process control found on drawings and specifications.
   i) ISA symbols
   ii) SAMA symbols
   iii) piping and instrumentation drawings (P&ID)
   iv) instrument loop diagrams (ILD)
   v) instrument index

vi) schematic diagrams
- electrical
- logic

vii) wiring diagrams

viii) control narratives (functional description)

6. Explain basic process control and its purpose and applications.
   i) control variable
   ii) manipulated variable
   iii) manual control
   iv) automatic control
   v) open loop
   vi) closed loop

7. Identify methods of basic process control and describe their applications.
   i) feedback
   ii) auto selection (override)
   iii) split ranging

8. Identify process control functions and describe their characteristics, operation and combinations.
   i) on-off control (2 position)
   ii) modulating control
   - proportional (P)
   - integral (I)
   - derivative (D)
   - PI, PD, PID

9. Explain process dynamics and their impact on process control.

10. Describe the procedures used to select and install process controllers.

11. Describe the procedures used to configure and calibrate process controllers.

12. Describe the procedures used to tune control loops.
   i) closed loop methods
   ii) open loop methods

13. Describe the procedures used to maintain and troubleshoot process controllers.

14. Describe the procedures used to maintain and troubleshoot process control loops.

15. Describe the procedures used to commission process controllers and their loops.

Practical Objectives:

N/A

ICT-320 Variable Speed Drives (VSD)

Learning Outcomes:

- Demonstrate knowledge of VSD, their components and operation.
- Demonstrate knowledge of procedures to configure/calibrate, commission, maintain and troubleshoot VSD.

2020 Red Seal Occupational Standard Reference:

16.01 Installs electrical and electronic equipment.
16.02 Diagnoses electrical and electronic equipment.
16.03 Maintains electrical and electronic equipment.
20.01 Configures VSD.
20.02 Maintains VSD.
20.03 Diagnoses VSD.
20.04 Repairs VSD.

Suggested Hours:

30 Hours

Theoretical Objectives:

1. Define terminology associated with VSD.

2. Identify hazards and describe safe work practices pertaining to VSD.
   i) energy state awareness
   ii) capacitors
   iii) electrostatic discharge

3. Interpret codes and regulations pertaining to VSD.

4. Interpret information pertaining to VSD found on drawings, specifications and nameplates.

5. Identify power degradation considerations with VSD.
   i) power quality/harmonics
   ii) filters
   iii) cable routing
   iv) motor compatibility

6. Identify types of VSD and describe their characteristics and operating principles.
   i) AC drives
   ii) DC drives

7. Identify types of motors used with VSD and describe their characteristics and operating principles.
   i) DC control
      - servo
      - stepping
   ii) AC single-phase
   iii) AC three-phase
   iv) inverter rated

8. Describe the procedures used to configure/calibrate and commission VSD.

9. Describe the procedures used to maintain and troubleshoot VSD.

Practical Objectives:

1. Configure variable speed drives (VSD).

ICT-325 Process Analyzers I

Learning Outcomes:

- Demonstrate basic knowledge of liquid and nuclear process analyzers, their components and operation.
- Demonstrate basic knowledge of procedures to install, configure, calibrate, maintain, troubleshoot and replace liquid and nuclear process analyzers.
- Demonstrate basic knowledge of process sample systems and conditioning.

2020 Red Seal Occupational Standard Reference:

8.01 Installs mass, density and consistency devices.
8.02 Maintains mass, density, and consistency devices.
8.03 Diagnoses mass, density, and consistency devices.
8.04 Repairs mass, density and consistency devices.
9.01 Installs process analyzers.
9.02 Maintains process analyzers.
9.03 Diagnoses process analyzers.
9.04 Repairs process analyzers.

Suggested Hours:

60 Hours

Theoretical Objectives:

1. Define terminology associated with process analyzers.

2. Identify hazards and describe safe work practices pertaining to process analyzers.
   i) chemical
   ii) temperature
   iii) pressure
   iv) radiation
   v) biological

3. Identify tools and equipment relating to process analyzers and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to process analyzers.
   i) environmental regulations
   ii) installation codes

5. Interpret information pertaining to process analyzers found on drawings and specifications.

6. Explain the basic principles of operation for liquid and nuclear process analyzers.

7. Identify types of process analyzers and describe their characteristics pertaining to basic applications.
   i) liquid analyzers
      - pH
      - oxidation reduction potential (ORP)
      - conductivity
      - dissolved oxygen
      - mass and density
      - viscosity
      - consistency
      - turbidity
      - specific ion
   ii) nuclear
      - solids composition
      - liquids composition

8. Identify process analyzer components and describe their purpose and basic operation.

9. Describe the procedures used to select and install liquid process analyzers and their components.

10. Describe the procedures used to configure and calibrate liquid process analyzers.

11. Describe the procedures used to maintain, troubleshoot and replace liquid process analyzers and their components.

12. Describe process sampling and its importance to process analysis.
   i) in situ installations
   ii) extraction sample systems
   iii) sample conditioning
      - temperature
      - pressure
      - filtering
      - coalescers

13. Describe the procedures and equipment used to obtain and condition samples for process analysis.

Practical Objectives:

1. Configure and calibrate process analyzers.

ICT-330 Equipment Monitoring Devices

Learning Outcomes:

- Demonstrate knowledge of equipment monitoring and its associated principles.
- Demonstrate knowledge of equipment monitoring devices, their components and operation.
- Demonstrate knowledge of procedures to install, calibrate, configure, maintain, troubleshoot and replace equipment monitoring devices.

2020 Red Seal Occupational Standard Reference:

7.01 Installs motion, speed, position and vibration devices.
7.02 Maintains motion, speed, position and vibration devices.
7.03 Diagnoses motion, speed, position and vibration devices.
7.04 Repairs motion, speed, position and vibration devices.

Suggested Hours:

12 Hours

Theoretical Objectives:

1. Define terminology associated with equipment monitoring devices.

2. Identify hazards and describe safe work practices pertaining to equipment monitoring devices.

3. Identify tools and equipment relating to equipment monitoring devices and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to equipment monitoring devices.

5. Interpret information pertaining to equipment monitoring devices found on drawings and specifications.

6. Identify units of measure used to express equipment monitoring values.

7. Perform calculations relating to equipment monitoring.

8. Identify types of equipment monitoring devices and describe their characteristics and applications.
   i) vibration
   ii) motion

iii) speed
iv) position
v) current
vi) temperature

9. Describe the procedures used to select and install equipment monitoring devices.

10. Describe the procedures used to calibrate and configure equipment monitoring devices.

11. Describe the procedures used to maintain, troubleshoot and replace equipment monitoring devices.

Practical Objectives:

N/A

ICT-335 Industrial Communication Systems and Devices

Learning Outcomes:

- Demonstrate knowledge of industrial communication systems and devices, their components and operation.
- Demonstrate knowledge of procedures to install, configure, upgrade, maintain, troubleshoot and replace industrial communication systems and devices.
- Demonstrate knowledge of integrating communication systems with programmable logic controllers (PLC) in industrial settings.

2020 Red Seal Occupational Standard Reference:

21.01 Performs installation and configuration on control network systems.
21.02 Diagnoses control network systems.
21.03 Performs maintenance and repairs on control network systems.
22.01 Performs installation and configuration of signal converters.
22.02 Diagnoses signal converters.
22.03 Performs maintenance and repairs on signal converters.
23.01 Performs installation and configuration of gateways, bridges and media converters.
23.02 Diagnoses gateways, bridges and media converters.
23.03 Performs maintenance and repairs on gateways, bridges and media converters.
26.01 Installs PLC.
26.02 Configures PLC.
26.03 Performs maintenance, diagnostics and repairs on PLC.
28.01 Installs Human Machine Interface (HMI).
28.02 Configures Human Machine Interface (HMI).
28.03 Performs maintenance, diagnostics and repairs on Human Machine Interface (HMI).

Suggested Hours:

42 Hours

Theoretical Objectives:

1. Define terminology associated with industrial communication systems and devices.

2. Identify hazards and describe safe work practices pertaining to industrial communication systems and devices.

3. Identify tools and equipment relating to industrial communication systems and devices and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to industrial communication systems and devices.

5. Interpret information pertaining to industrial communication systems and devices found on drawings and specifications.

6. Identify types of common communication topologies and describe their characteristics and applications.
   i) ring
   ii) bus
   iii) star
   iv) tree
   v) mesh

7. Identify types of communication protocols and describe their characteristics and applications.
   i) Fieldbus
   ii) Profibus
   iii) Modbus
   iv) Transport Control Protocol/Internet Protocol (TCP/IP)
   v) Highway Addressable Remote Transducer (HART)
   vi) Devicenet/Controlnet
   vii) BACnet MSTP/IP

8. Identify types of communication standards and describe their characteristics and applications.
   i) RS232
   ii) RS422
   iii) RS423
   iv) RS485
   v) Ethernet/HSE
   vi) USB

9. Identify types of communication system mediums and describe their characteristics and applications.
   i) pneumatic/hydraulic
      - tubing
   ii) cables/conductors
   iii) fibre optic
   iv) wireless

10. Identify communication system components and accessories and describe their purpose and operation.
    i) antennas
    ii) converters
    iii) transducers
    iv) multiplexers
    v) network switches/hubs
    vi) I/O interface
    vii) HMI
    viii) PLC hardware
        - controller
        - rack
        - I/O cards
        - power supply
        - communication cards

11. Identify HMI components and their characteristics and applications.
    i) hardware
        - computer
        - monitor
        - keyboard
        - mouse
        - printers
        - scanners
        - recorder/data loggers
        - annunciator
    ii) software
        - engineering/design
        - operations/application

12. Identify HMI operator displays and their characteristics and applications.
    i) overview
    ii) group
    iii) detail
    iv) graphic
    v) alarm summary
    vi) annunciator
    vii) trend
    viii) text

13. Perform conversions and calculations relating to communication systems and devices.
    i) analogue to digital conversions
    ii) current to pressure (I to P)
    iii) decibel measurements of loss

14. Describe the procedures used to select and install communication systems and devices and their components.

15. Describe the procedures used to configure, calibrate and upgrade communication systems and devices and their components.

16. Describe the procedures used to maintain, troubleshoot and replace communication systems and devices and their components.

17. Describe the procedures to minimize electrical noise and attenuation.
    i) grounding
    ii) shielding
    iii) electromagnetic compatibility (EMC)

18. Describe the benefits and process of integrating communication systems with programmable logic controllers (PLC) in industrial settings.

Practical Objectives:

N/A

ICT-345 Job Planning

Learning Outcomes:

- Demonstrate knowledge of the procedures used to plan and organize jobs.

2020 Red Seal Occupational Standard Reference:

3.03 Plans tasks.

Suggested Hours:

6 Hours

Theoretical Objectives:

1. Identify sources of information relevant to job planning.
   - i) documentation
   - ii) drawings
   - iii) related professionals
   - iv) clients

2. Describe considerations for determining job requirements.
   - i) personnel
   - ii) schedules
   - iii) uses of tools and equipment
   - iv) materials/parts
   - v) permits
   - vi) safety planning

3. Describe the procedures used to plan job tasks.

4. Explain the importance of maintaining a parts inventory.
   - i) consumables
   - ii) replacement parts

Practical Objectives:

N/A

Level 4

ICT-410 Process Control II

Learning Outcomes:

- Demonstrate knowledge of advanced process control and its purpose.
- Demonstrate knowledge of procedures to configure, tune, maintain, and troubleshoot advanced process control systems.
- Demonstrate knowledge of procedures to commission and optimize advanced process control systems.

2020 Red Seal Occupational Standard Reference:

3.02 Interprets drawings and schematics.
24.01 Determines process control strategy.
24.02 Optimizes process control.
25.01 Installs stand-alone controller (SAC).
25.02 Configures stand-alone controller (SAC).
25.03 Performs maintenance, diagnostics and repairs on stand-alone controller (SAC).

Suggested Hours:

39 Hours

Theoretical Objectives:

1. Define terminology associated with advanced process control.

2. Identify hazards and describe safe work practices pertaining to advanced process control.

3. Identify tools, equipment and software used to configure and calibrate process controllers and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to advanced process control.

5. Interpret information pertaining to advanced process control found on drawings and specifications.
   i) ISA symbols
   ii) SAMA symbols
   iii) piping and instrumentation drawings (P&ID)
   iv) instrument loop diagrams
   v) instrument index
   vi) schematic diagrams

vii) wiring diagrams
viii) control narratives (functional description)

6. Explain advanced process control and its purpose and applications.
   i) control variable
   ii) manipulated variable
   iii) manual control
   iv) automatic control
   v) open loop
   vi) closed loop

7. Identify methods of advanced process control and describe their applications.
   i) ratio
   ii) feed forward
   iii) adaptive
   iv) cascade

8. Explain process loop interactions and their impact on process control.
   i) boiler control systems

9. Describe the procedures used to configure and tune advanced process control systems.
   i) closed loop methods
   ii) open loop methods

10. Describe the procedures used to maintain and troubleshoot advanced process control systems.

11. Describe the procedures used to commission and optimize advanced process control systems.

Practical Objectives:

N/A

ICT-415 Supervisory Control and Data Acquisition Systems

Learning Outcomes:

- Demonstrate knowledge of supervisory control and data acquisition (SCADA) systems, their components and operation.
- Demonstrate knowledge of procedures to install, configure, upgrade maintain, troubleshoot, replace, backup and restore SCADA systems and components.

2020 Red Seal Occupational Standard Reference:

10.01 Installs multiple variable computing devices.
10.02 Maintains multiple variable computing devices.
10.03 Diagnoses multiple variable computing devices.
10.04 Repairs multiple variable computing devices.
21.01 Performs installation and configuration on control network systems.
21.02 Diagnoses control network systems.
21.03 Performs maintenance and repairs on control network systems.
22.01 Performs installation and configuration of signal converters.
22.02 Diagnoses signal converters.
22.03 Performs maintenance and repairs on signal converters.
23.01 Performs installation and configuration of gateways, bridges and media converters.
23.02 Diagnoses gateways, bridges and media converters.
23.03 Performs maintenance and repairs on gateways, bridges and media converters.
28.01 Installs Human Machine Interface (HMI).
28.02 Configures Human Machine Interface (HMI).
28.03 Performs maintenance, diagnostics and repairs on Human Machine Interface (HMI).
29.01 Installs SCADA systems.
29.02 Configures SCADA systems.
29.03 Performs maintenance, diagnostics and repairs on SCADA systems.

Suggested Hours:

27 Hours

Theoretical Objectives:

1. Define terminology associated with SCADA systems.

2. Identify hazards and describe safe work practices pertaining to SCADA systems.

3. Identify tools, equipment, and software relating to SCADA systems and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to SCADA systems.

5. Interpret information pertaining to SCADA systems found on drawings and specifications.

6. Identify sources of information pertaining to SCADA systems maintenance, configuration and programming.

7. Describe the procedures used to program a SCADA system.

8. Identify SCADA system components and describe their purpose and operation.
   i) hardware
      - MTU
      - RTU
      - PLC
      - HMI
      - multiple variable computing devices
   ii) software
   iii) communication systems and interconnected media

9. Describe the procedures used to select and install SCADA systems and their components.

10. Describe the procedures used to backup, configure, upgrade and restore SCADA systems and their components.

11. Describe the procedures used to maintain, troubleshoot and replace SCADA systems and their components.

Practical Objectives:

N/A

ICT-425 Safety Systems and Devices

Learning Outcomes:

- Demonstrate knowledge of safety systems and devices, their components and operation.
- Demonstrate knowledge of procedures to install, maintain, troubleshoot, configure, calibrate and replace safety systems and devices and their components.
- Demonstrate knowledge of Safety Instrumented Systems (SIS) and their components.

2020 Red Seal Occupational Standard Reference:

11.01 Installs safety systems and devices.
11.02 Maintains safety systems and devices.
11.03 Diagnoses safety systems and devices.
11.04 Repairs safety systems and devices.
13.01 Installs SIS.
13.02 Configures SIS.
13.03 Maintains SIS.
13.04 Diagnoses SIS.
13.05 Repairs SIS.
28.01 Installs Human Machine Interface (HMI).
28.02 Configures Human Machine Interface (HMI).
28.03 Performs maintenance, diagnostics and repairs on Human Machine Interface (HMI).

Suggested Hours:

18 Hours

Theoretical Objectives:

1. Define terminology associated with safety systems and devices.
2. Identify hazards and describe safe work practices pertaining to safety systems and devices.
3. Identify tools and equipment relating to safety systems and devices and describe their applications and procedures for use.
4. Interpret codes and regulations pertaining to safety systems and devices.
5. Interpret information pertaining to safety systems and devices found on drawings and specifications.

6. Identify types of safety systems and devices and describe their components, characteristics and applications.
   i) safety
      - gas detection
      - heat detection
      - fire detection
      - smoke detection
      - spill detection
      - water quality
      - vibration
      - radiation
   ii) personal protective devices
      - portable gas detectors
      - dosimeters
   iii) safety instrumented systems (SIS)
      - emergency stop monitoring
      - safety sensors and devices
   iv) network security

7. Describe the purpose and operation of SIS systems and their components.
   i) layers of protection analysis (LOPA)
   ii) safety integrity level (SIL)
   iii) safety instrumented functions (SIF)
   iv) process control systems vs. SIS systems

8. Describe the procedures used to select and install safety systems and devices and their components.

9. Describe the procedures used to configure and calibrate safety systems and devices and their components.

10. Describe the procedures used to maintain, troubleshoot and replace safety systems and devices and their components.

Practical Objectives:

N/A

ICT-435 Programmable Logic Controller Systems

Learning Outcomes:

- Demonstrate knowledge of programming languages.
- Demonstrate knowledge of programmable logic controller (PLC) systems, their components and operation.
- Demonstrate knowledge of procedures to install, configure, commission, maintain, troubleshoot and replace PLC systems.

2020 Red Seal Occupational Standard Reference:

21.01 Performs installation and configuration on control network systems.
21.02 Diagnoses control network systems.
21.03 Performs maintenance and repairs on control network systems.
22.01 Performs installation and configuration of signal converters.
22.02 Diagnoses signal converters.
22.03 Performs maintenance and repairs on signal converters.
23.01 Performs installation and configuration of gateways, bridges and media converters.
23.02 Diagnoses gateways, bridges and media converters.
23.03 Performs maintenance and repairs on gateways, bridges and media converters.
26.01 Installs PLC.
26.02 Configures PLC.
26.03 Performs maintenance, diagnostics and repairs on PLC.
28.01 Installs Human Machine Interface (HMI).
28.02 Configures Human Machine Interface (HMI).
28.03 Performs maintenance, diagnostics and repairs on Human Machine Interface (HMI).

Suggested Hours:

60 Hours

Theoretical Objectives:

1. Define terminology associated with PLC systems.

2. Identify hazards and describe safe work practices pertaining to PLC systems.
   i) online vs. offline applications
   ii) hazardous locations
   iii) forces, jumpers and interlocks

3. Interpret codes and regulations pertaining to PLC systems.

4. Interpret information pertaining to PLC systems found on drawings and specifications.

5. Identify programming languages used to program PLC systems.
   i) ladder diagram (LD)
   ii) function block diagram (FBD)
   iii) structured text (ST)
   iv) instruction list (IL)
   v) sequential function chart (SFC)
   vi) Boolean logic diagrams/gates

6. Interpret programming languages and describe their applications and the procedures used to program PLC systems.
   i) ladder diagram (LD)
   ii) function block diagram (FBD)
   iii) sequential function chart (SFC)

7. Identify numbering systems and gates pertaining to PLC systems.
   i) binary
   ii) decimal
   iii) hexadecimal
   iv) octal

8. Identify PLC components and systems and describe their purpose and operation.
   i) hardware
      - local I/O assemblies
      - remote I/O assemblies
      - HMI
   ii) software
   iii) communications

9. Describe the procedures used to select and install PLC systems and their components.

10. Describe the procedures used to configure/ program and commission PLC systems and their components.
   i) I/O configuration
   ii) tags, registers, data file and addressing
   iii) user program
   iv) communication interface

11. Describe the procedures used to maintain, troubleshoot and replace PLC systems and their components.

Practical Objectives:

1. Configure, program and run a PLC.

ICT-440 Distributed Control Systems

Learning Outcomes:

- Demonstrate knowledge of distributed control systems (DCS), their components and operation.
- Demonstrate knowledge of procedures to install, configure, upgrade, maintain, troubleshoot, replace, backup and restore DCS and components.

2020 Red Seal Occupational Standard Reference:

21.01 Performs installation and configuration on control network systems.
21.02 Diagnoses control network systems.
21.03 Performs maintenance and repairs on control network systems.
22.01 Performs installation and configuration of signal converters.
22.02 Diagnoses signal converters.
22.03 Performs maintenance and repairs on signal converters.
23.01 Performs installation and configuration of gateways, bridges and media converters.
23.02 Diagnoses gateways, bridges and media converters.
23.03 Performs maintenance and repairs on gateways, bridges and media converters.
27.01 Installs DCS.
27.02 Configures DCS.
27.03 Performs maintenance, diagnostics and repairs on DCS.
28.01 Installs Human Machine Interface (HMI).
28.02 Configures Human Machine Interface (HMI).
28.03 Performs maintenance, diagnostics and repairs on Human Machine Interface (HMI).

Suggested Hours:

30 Hours

Theoretical Objectives:

1. Define terminology associated with DCS.

2. Identify hazards and describe safe work practices pertaining to DCS.

3. Identify tools, equipment and software relating to DCS and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to DCS.

5. Interpret information pertaining to DCS found on drawings and specifications.

6. Identify sources of information pertaining to DCS maintenance, configuration and programming.

7. Describe the procedures used to configure and program a DCS.

8. Identify DCS components and systems and describe their purpose and operation.
   - i) hardware
     - input /output interface (cards/points)
     - HMI
       - monitor
       - keyboard/mouse
       - printers/scanners
       - recorder/data loggers
       - annunciator
   - ii) software
     - HMI
       - engineering/design
       - operation/application
   - iii) communications

9. Identify types of DCS HMI operator displays and their purpose.
   - i) overview
   - ii) group
   - iii) detail
   - iv) graphic
   - v) alarm summary
   - vi) annunciator
   - vii) trend

10. Describe the procedures used to select and install DCS components.

11. Describe the procedures used to backup, configure, upgrade and restore DCS and their components.

12. Describe the procedures used to maintain, troubleshoot and replace DCS and their components.

Practical Objectives:

N/A

ICT-445 Process Analyzers II

Learning Outcomes:

- Demonstrate advanced knowledge of gas, x-ray and environmental process analyzers, their components and operation.
- Demonstrate advanced knowledge of procedures to install, configure, calibrate, maintain, troubleshoot and replace gas, x-ray and environmental process analyzers.
- Demonstrate advanced knowledge of process sample systems and conditioning.

2020 Red Seal Occupational Standard Reference:

8.01 Installs mass, density and consistency devices.
8.02 Maintains mass, density, and consistency devices.
8.03 Diagnoses mass, density, and consistency devices.
8.04 Repairs mass, density and consistency devices.
9.01 Installs process analyzers.
9.02 Maintains process analyzers.
9.03 Diagnoses process analyzers.
9.04 Repairs process analyzers.

Suggested Hours:

30 Hours

Theoretical Objectives:

1. Define terminology associated with process analyzers.

2. Identify hazards and describe safe work practices pertaining to process analyzers.
   i) chemical
   ii) temperature
   iii) pressure
   iv) radiation
   v) biological

3. Identify tools and equipment relating to process analyzers and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to process analyzers.
   i) environmental regulations
   ii) installation codes

5. Interpret information pertaining to process analyzers found on drawings and specifications.

6. Explain the advanced principles of operation for gas, x-ray and environmental process analyzers.

7. Identify types of process analyzers and describe their characteristics pertaining to advanced applications.
   - i) liquid analyzers
     - pH
     - oxidation reduction potential (ORP)
     - conductivity
     - dissolved oxygen
     - mass and density
     - viscosity
     - consistency
     - turbidity
     - specific ion
   - ii) gas analyzers
     - chromatography
     - humidity
     - spectrographic
     - flue gas analyzer
   - iii) x-ray
   - iv) nuclear
     - solids composition
     - liquids composition
   - v) environmental
     - gas
     - noise
     - fluids
     - solids

8. Identify process analyzer components and describe their purpose and advanced operation.

9. Describe the procedures used to select and install gas, x-ray and environmental process analyzers and their components.

10. Describe the procedures used to configure and calibrate gas, x-ray and environmental process analyzers.

11. Describe the procedures used to maintain, troubleshoot and replace gas, x-ray and environmental process analyzers and their components.

12. Describe the procedures and equipment used to obtain and condition samples for process analysis.

Practical Objectives:

1. Configure and calibrate process analyzers.

MENT-701 Mentoring II

Learning Outcomes:

- Demonstrate knowledge of effective communication practices as a mentor.
- Demonstrate knowledge of strategies for teaching workplace skills.

2020 Red Seal Occupational Standard Reference:

4.01 Uses communication techniques.
4.02 Uses mentoring techniques.

Suggested Hours:

6 Hours

Theoretical Objectives:

1. Identify the different roles played by a workplace mentor.

2. Identify strategies to create a supportive learning environment.

3. Identify techniques for effective communication as a mentor.
   i) constructive feedback
   ii) active listening
   iii) leading meetings and one-on-one sessions

4. Describe the steps in teaching a skill.
   i) identifying the point of lesson
   ii) linking the lesson
   iii) demonstrating the skill
   iv) providing practice
   v) giving feedback
   vi) assessing skill and progress

5. Identify strategies to assist in teaching a skill while meeting individual learning needs.
   i) principles of instruction
   ii) coaching skills

6. Explain how to adjust a lesson for various situations.

Practical Objectives:

N/A

ICT-600 Program Review

Learning Outcomes:

- Demonstrate knowledge of the Red Seal Occupational Standard and its relationship to the Red Seal exam.
- Demonstrate knowledge of overall comprehension of the trade in preparation for the Red Seal exam.

2020 Red Seal Occupational Standard:

Entire Red Seal Occupational Standard (RSOS).

Suggested Hours:

30 Hours

Theoretical Objectives:

1. Define terminology associated with an RSOS.
   - i) major work activity
   - ii) levels
   - iii) tasks
   - iv) sub-tasks

2. Explain how an RSOS is developed and the link it has with the Red Seal exam.
   - i) development
   - ii) validation
   - iii) level and task weighting
   - iv) examination breakdown (pie-chart)

3. Identify Red Seal products and describe their use for preparing for the Red Seal exam.
   - i) Red Seal website
   - ii) examination preparation guide
   - iii) sample questions
   - iv) exam breakdown
   - v) self-assessment

4. Explain the relationship between the RSOS and the AACS.

5. Review Common Occupational Skills for the ICT trade as identified in the RSOS.
   - i) safety-related functions
   - ii) tools and equipment
   - iii) organizes work

iv) communication and mentoring techniques

6. Review Process Measuring and Indicating Devices for the ICT trade as identified in the RSOS.
   i) pressure, temperature, level and flow
   ii) signal transducers
   iii) motion, speed, position and vibration
   iv) mass, density and consistency
   v) process analyzers
   vi) multiple variable computing devices

7. Review Safety and Security Systems and Devices for the ICT trade as identified in the RSOS.
   i) safety systems
   ii) safety instrumented systems (SIS)

8. Review Hydraulic, Pneumatic and Electrical Systems for the ICT trade as identified in the RSOS.
   i) hydraulic control devices
   ii) pneumatic equipment
   iii) electrical and electronic equipment

9. Review Final Control Elements for the ICT trade as identified in the RSOS.
   i) valves
   ii) actuators
   iii) positioners
   iv) variable speed drives (VSD)

10. Review Communication Systems and Devices for the ICT trade as identified in the RSOS.
   i) control network systems
   ii) signal converters
   iii) gateways, bridges and media converters

11. Review Control Systems and Process Control for the ICT trade as identified in the RSOS.
   i) process control strategies
   ii) stand-alone controllers (SAC)
   iii) programmable logic controllers (PLC)
   iv) distributed control systems (DCS)
   v) human machine interfaces (HMI)
   vi) supervisory control and data acquisition (SCADA)

Practical Objectives:

N/A

Feedback and Revisions

This AACS will be amended periodically; comments or suggestions for improvements should be directed to:

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Any comments or suggestions received will be reviewed and considered to determine the course of action required. If the changes are deemed to be minor, they will be held for implementation during the next review cycle. If immediate change is deemed appropriate and approved by the Atlantic Trade Advisory Committee, it will result in a revision to this version of the AACS and will be detailed in the following section.

Version Changes

Revision Date	Section	Description of Change
2024	All sections	Update to align with national occupational standard