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# Pre-Employment Plan of Training Instrumentation & Control Technician



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

March 2017

# PLAN OF TRAINING

## Pre-employment

### Instrumentation and Control Technician

March 2017



**Government of Newfoundland and Labrador  
Department of Advanced Education, Skills and Labour  
Apprenticeship and Trades Certification Division**

Approved by:

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Chairperson, Provincial Apprenticeship and Certification Board

Date: March 30, 2017

### Preface

This curriculum standard is aligned with the 2016 Level 1 Atlantic Apprenticeship Curriculum Standard (AACS) and the 2013 edition of the National Occupational Analysis (NOA) and 2015 Interprovincial Program Guide (IPG) for the Instrumentation and Control Technician trade. It describes the curriculum content for the Instrumentation and Control Technician Pre-employment training program.

### Acknowledgements

The Provincial Trade Advisory Committee (PTAC), industry representatives, instructors and apprenticeship staff provided valuable input to the development of this provincial plan of training. Without their dedication to quality apprenticeship training, this document could not have been produced.

We offer you a sincere thank you.

### Contact Information

Department of Immigration, Population Growth and Skills  
Apprenticeship and Trades Certification Division  
Tel: 709-729-2729  
Toll Free: 1-877-771-3737  
Email: [app@gov.nl.ca](mailto:app@gov.nl.ca)  
Web: [www.gov.nl.ca/atcd](http://www.gov.nl.ca/atcd)

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		September 2018 – Level 2	
		September 2019 – Level 3	
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A. NOA Comparison Chart

A National Occupational Analysis (NOA) comparison chart is located in the Atlantic Apprenticeship Curriculum Standard (AACS).

## B. Program Structure

For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

The order of course delivery within each level can be determined by the training institution, as long as pre-requisite conditions are satisfied.

Upon completion of a Pre-employment program, individuals may be required to complete other certifications (employer or job site specific) in order to gain employment.

A Pre-employment student who becomes an apprentice will also be required to complete Level 2, 3 and 4 in the Atlantic Apprenticeship Curriculum Standard (AACs).

<b>Pre-Employment</b>				
<b>Course No.</b>	<b>AACS No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
TS1510	--	Occupational Health & Safety	6	None
TS1520	--	WHMIS	6	None
TS1530	--	Standard First Aid	14	None
ER1390	ICT-100	Safety	30	None
ER1111	ICT-105	Tools and Equipment	45	ER1390
ER1490	ICT-110	Material Handling Equipment	15	ER1390 TS1520
ER1500	ICT-115	Communication and Trade Documentation	9	None
ER1201	ICT-120	Drawings, Schematics and Specifications	30	ER1500
ER1140	ICT-125	DC Theory	30	None
ER1151	ICT-130	Series and Parallel DC Circuits	45	ER1140
ER1170	ICT-135	Voltage Drop and Power Loss	30	ER1151
ER1510	ICT-140	Conductors and Cables	30	ER1170
ICT-145	ICT-145	On-Off Control Devices	30	None
ER1460	ICT-150	Wireways, Conduit, Electrical Metallic Tubing (EMT) and Fittings	15	None

<b>Pre-Employment</b>				
<b>Course No.</b>	<b>AACS No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
ER2470	---	Pneumatic Supply Systems I	25	ER1460
ER2480	---	Pneumatic Supply Systems II	25	ER2470
ER1420	ICT-155	Introduction to Pressure Measurement and Calibration	70	ER1201
ER1520	ICT-160	Tubing and Piping Systems	30	ER1420
ER1530	---	Introduction to Fluids	25	None
ER1430	---	Flow Measurement	110	ER1420 ER1530 ER1201
ER1440	---	Level and Density Measurement	50	ER1420 ER1201
ER1450	---	Temperature Measurement	60	ER1201
ER1711	---	Signal Transmission Systems	30	ER1420
ER1733	---	Electronics (Circuits and Components)	90	ER1140
AM1000	---	Introduction to Essential Skills	9	None
AP1102	---	Introduction to Apprenticeship	12	None
*AM1101	---	Math Essentials	42	None
AM1191	---	Instrumentation and Control Math Fundamentals	42	AM1101
CM2161	---	Communication Essentials	36	None
SD1761	---	Workplace Essentials	24	None
MC1062	---	Computer Essentials	15	None
<b>Total Pre-Employment Hours</b>			<b>1030</b>	

\*A student who can meet the mathematics requirement through an ACUPLACER® test may be exempted from AM1101 - Math Essentials. Please check with your training institution.

**Required Work Experience**



## Pre-Employment

### TS1510 Occupational Health and Safety

#### Learning Outcomes:

- Demonstrate knowledge of identifying how to prevent accidents and illnesses
- Demonstrate knowledge of improving health and safety conditions in the workplace

**Duration:** 6 Hours

**Pre-Requisite(s):** None

#### Objectives and Content:

1. Interpret the Occupational Health and Safety Act laws and regulations.
  - i. explain the scope of the act
    - application of the act
    - Federal/Provincial jurisdictions
    - Canada Labour Code
    - rules and regulations
    - private home application
    - conformity of the Crown by the Act
2. Explain responsibilities under the Act & Regulations.
  - i. duties of employer, owner, contractors, sub-contractors, employees, and suppliers
3. Explain the purpose of joint health and safety committees.
  - i. formation of committee
  - ii. functions of committee
  - iii. legislated rights
  - iv. health and safety representation
  - v. reporting endangerment to health
  - vi. appropriate remedial action
  - vii. investigation of endangerment
  - viii. committee recommendation
  - ix. employer's responsibility in taking remedial action
4. Examine right to refuse dangerous work.
  - i. reasonable grounds for refusal
  - ii. reporting endangerment to health
  - iii. appropriate remedial action
  - iv. investigation of endangerment
  - v. committee recommendation

- vi. employer's responsibility to take appropriate remedial action
  - vii. action taken when employee does not have reasonable grounds for refusing dangerous work
  - viii. employee's rights
  - ix. assigning another employee to perform duties
  - x. temporary reassignment of employee to perform other duties
  - xi. collective agreement influences
  - xii. wages and benefits
5. State examples of work situations where one might refuse work.
6. Describe discriminatory action.
- i. definition
  - ii. filing a complaint procedure
  - iii. allocated period of time a complaint can be filed with the Commission
  - iv. duties of an arbitrator under the Labour Relations Act
  - v. order in writing inclusion
  - vi. report to commission Allocated period of time to request Arbitrator to deal with the matter of the request
  - vii. notice of application
  - viii. failure to comply with the terms of an order
  - ix. order filed in the court
7. Explain duties of commission officers.
- i. powers and duties of officers
  - ii. procedure for examinations and inspections
  - iii. orders given by officers orally or in writing
  - iv. specifications of an order given by an officer to owner of the place of employment, employer, contractor, sub-contractor, employee, or supplier
  - v. service of an order
  - vi. prohibition of persons towards an officer in the exercise of his/her power or duties
  - vii. rescinding of an order
  - viii. posting a copy of the order
  - ix. illegal removal of an order
8. Interpret appeals of others.
- i. allocated period of time for appeal of an order
  - ii. person who may appeal order
  - iii. action taken by Commission when person involved does not comply with the order
  - iv. enforcement of the order
  - v. notice of application
  - vi. rules of court

9. Explain the process for reporting of accidents.
  - i. application of act
  - ii. report procedure
  - iii. reporting notification of injury
  - iv. reporting accidental explosion or exposure
  - v. posting of act and regulations

**Practical Requirements:**

1. Conduct an interview with someone in your occupation on two or more aspects of the act and report results.
2. Conduct a safety inspection of shop area.

## TS1520 Workplace Hazardous Materials Information System (WHMIS)

### Learning Outcomes:

- Demonstrate knowledge of interpreting and applying the Workplace Hazardous Materials Information System (WHMIS) Regulation under the Occupational Health and Safety Act.

**Course Duration:** 6 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

1. Define WHMIS safety.
  - i. rational and key elements
  - ii. history and development of WHMIS
  - iii. WHMIS legislation
  - iv. WHMIS implementation program
  - v. definitions of legal and technical terms
  
2. Examine hazard identification and ingredient disclosure.
  - i. prohibited, restricted and controlled products
  - ii. classification and the application of WHMIS information requirements
  - iii. responsibilities for classification
    - the supplier
    - the employer
    - the worker - Classification: rules and criteria
    - information on classification
    - classes, divisions and subdivision in WHMIS
    - general rules for classification
    - class A - compressed gases
    - class B - flammable and combustible materials
    - class C - oxidizing material
    - class D - poisonous and infectious material
    - class E - corrosive material
    - class F - dangerously reactive material
  - iv. products excluded from the application of WHMIS legislation
    - consumer products
    - explosives
    - cosmetics, drugs, foods and devices
    - pest control products
    - radioactive prescribed substances

- wood or products made of wood
  - manufactured articles
  - tobacco or products of tobacco
  - hazardous wastes
  - products handled or transported pursuant to the Transportation of Dangerous Goods (TDG) Act
  - v. comparison of classification systems - WHMIS and TDG
  - vi. general comparison of classification categories
  - vii. detailed comparison of classified criteria
3. Explain labeling and other forms of warning.
- i. definition of a WHMIS label
    - supplier label
    - workplace label
    - other means of identification
  - ii. responsibility for labels
    - supplier responsibility
    - employer responsibility
    - worker responsibility
  - iii. introduce label content, design and location
    - supplier labels
    - workplace labels
    - other means of identification
4. Introduce material safety data sheets (MSDS).
- i. definition of a material safety data sheet
  - ii. purpose of the data sheet
  - iii. responsibility for the production and availability of data sheets
    - supplier responsibility
    - employer responsibility
    - workers responsibility

**Practical Requirements:**

1. Locate WHMIS label and interpret the information displayed.
2. Locate a MSDS sheet for a product used in the workplace and determine what personal protective equipment and other precautions are required when handling this product.

TS1530 Standard First Aid

**Learning Outcomes:**

- Demonstrate knowledge of recognizing situations requiring emergency action
- Demonstrate knowledge of making appropriate decisions concerning first aid

**Duration:** 14 Hours

**Pre-Requisite(s):** None

**Practical Requirements:**

1. Complete a **St. John Ambulance or Canadian Red Cross** Standard First Aid Certificate course.

ER1390 Safety

**Learning Outcomes:**

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

**Duration:** 30 Hours

**Pre-Requisite(s):** None

**Objectives and Content:**

1. Identify types of personal protective equipment (PPE) and clothing and describe their applications and limitations.
2. Describe the procedures used to care for and maintain PPE.
3. Identify hazards and describe safe work practices.
  - i. personal
  - ii. workplace
    - energy state awareness
    - isolation and de-energizing procedures
    - tag out/lockout
    - confined space
    - fire
    - heights
    - nuclear
    - chemical/gas
    - arc flash
    - temperature extremes
    - high pressure
    - high voltage
    - fire and gas equipment
  - iii. environmental
    - discharge/spills

4. Identify and describe workplace safety, environmental and health regulations.
  - i. federal
    - Atomic Energy Control Act and Regulations
  - ii. provincial/territorial
  - iii. municipal

**Practical Requirements:**

None.



## ER1111 Tools and Equipment

### Learning Outcomes:

- Demonstrate knowledge of tools and equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of installation and mounting hardware and their applications.

**Duration:** 45 Hours

**Pre-Requisite(s):** ER1390

### Objectives and Content:

1. Identify types of hand tools and describe their applications and procedures for use.
2. Describe the procedures used to inspect and maintain hand tools.
3. Identify types of portable power tools and describe their applications and procedures for use.
  - i. electric
  - ii. hydraulic
  - iii. pneumatic
4. Describe the procedures used to inspect and maintain portable power tools.
5. Identify types of stationary power tools and describe their applications and procedures for use.
  - i. electric
  - ii. hydraulic
  - iii. pneumatic
6. Describe the procedures used to inspect and maintain stationary power tools.
7. Identify types of calibration, configuration and test equipment and describe their applications.
8. Identify types of powder actuated tools and describe their applications.
9. Identify types of installation and mounting hardware and describe their applications.

**Practical Requirements:**

1. Selection and proper use of various hand tools.
2. Selection and proper use of various power tools.
3. Demonstrate proper use of powder actuated tools.

## ER1490 Material Handling Equipment

### Learning Outcomes:

- Demonstrate knowledge of material handling equipment and accessories, their applications and limitations.

**Duration:** 15 Hours

**Pre-Requisite(s):** ER1390, TS1520

### Objectives and Content:

1. Define terminology associated with material handling equipment and accessories.
  - i. mechanical advantage
  - ii. safety factor
  - iii. safe work load
  - iv. center of gravity
  - v. load weight
2. Identify hazards and describe safe work practices pertaining to material handling.
  - i. load considerations
  - ii. supervision of material handling
  - iii. securing work area
  - iv. communication
3. Identify codes and regulations pertaining to material handling.
  - i. OSHA regulations
4. Identify types of material handling equipment and accessories and describe their applications and limitations.
  - i. wire rope
  - ii. fiber rope
  - iii. chains
  - iv. rigging hardware
    - drums
    - sheaves
    - hooks
    - rings, links and swivels
    - shackles
    - eye bolts
    - turnbuckles
    - spreader and equalizer beams
    - blocks

- v. slings
  - vi. jacks
  - vii. ladders and scaffolds
  - viii. knots, bends and hitches
5. Describe the procedures used to inspect, maintain and store material handling equipment.

**Practical Requirements:**

1. Tie knots, bends, and hitches used for lifting and moving equipment.
2. Inspect, select and use the appropriate sling to lift a control valve with the proper center of gravity.
3. Select and use ladders appropriate for a given task.

## ER1500 Communication and Trade Documentation

### Learning Outcomes:

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of trade related documentation and its use.

**Duration:** 9 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

1. Describe the importance of effective verbal and non-verbal communication.
  - i. other tradespersons
  - ii. colleagues
  - iii. supervisors
  - iv. suppliers/manufacturers
  - v. Central Control Room Operators (CCRO)
2. Identify types of trade related documentation and describe their purpose, applications and procedures for use.
  - i. manufacturers' specifications
  - ii. codes and standards
    - CSA
    - ISA
  - iii. work orders / work packs
  - iv. maintenance schedules
    - Preventative maintenance
    - Predictive maintenance
  - v. calibration/maintenance records

### Practical Requirements:

1. Complete a calibration Data sheet.
2. Complete an instrument data sheet according to manufacturer's specifications.

## ER1201 Drawings, Schematics and Specifications

### Learning Outcomes:

- Demonstrate knowledge of drawings, schematics and specifications and their applications.
- Demonstrate knowledge of interpreting and extracting information from drawings, schematics and specifications.

**Duration:** 30 Hours

**Pre-Requisite(s):** ER1500

### Objectives and Content:

1. Identify types of drawings and describe their applications.
  - i. civil / site
  - ii. architectural
  - iii. mechanical
  - iv. structural
  - v. electrical
  - vi. shop drawings
  - vii. sketches
  - viii. as-builts
  - ix. piping and instrument drawings (P & IDs)
  - x. installation drawings
  - xi. loop drawings
  - xii. location drawings
  - xiii. logic drawings
2. Review and interpret information from drawings.
  - i. alphabet of lines
  - ii. elevations
  - iii. scales
  - iv. legends
  - v. symbols and abbreviations
  - vi. notes and specifications
3. Review and interpret information from basic drawings, schematics, wiring diagrams and documents.
4. Describe procedures used to obtain material lists.

**Practical Requirements:**

1. Gather and interpret information from various drawings.
2. Determine measurements from scaled drawings.
3. Use information to obtain a materials list for installation.
4. Sketch basic drawing views.

## ER1140 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.

**Duration:** 30 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to DC theory.
2. Describe the atomic structure of matter.
  - i. electron theory
    - matter
    - atoms
    - electric charge
    - protons, electrons, neutron
  - ii. static electricity and electrostatics
    - positive and negative charge
    - electrostatic field
    - transferring static electricity
      - conduction
      - induction
  - iii. discharging static charges
    - electrons in motion
    - causes of current
    - conductors, semi-conductors, insulators
    - electron current flow
    - conventional current flow
3. Identify electrical units and symbols.
  - i. absolute electrical units
    - current
    - voltage



- resistance
  - ii. prefixes for absolute units
- 4. Identify different forms of energy and describe the effects of dynamic electricity.
  - i. different forms of energy to produce electricity
    - chemical action
    - piezoelectric effect
    - magnetism
    - heat
    - light and solar energy
    - friction
  - ii. effects of dynamic electricity
    - heating effects
    - chemical effects
    - magnetic effects
    - psychological and physiological effects
- 5. Identify and analyze the components necessary for the assembly of an electric circuit.
  - i. the electron path (conductors)
  - ii. the load
  - iii. the source
  - iv. the control
  - v. closed circuit
  - vi. open circuit
  - vii. short circuit
- 6. Identify and describe the three basic electrical properties.
  - i. voltage
  - ii. current
  - iii. resistance
- 7. Explain Ohm's Law.
- 8. Describe the following in relation to electricity.
  - i. work
  - ii. power
  - iii. joules and coulombs
  - iv. electrical power (watt)
  - v. combination of the Power formulas and Ohm's Law
  - vi. watts and horsepower
  - vii. BTU
  - viii. kilowatt hours
    - meter reading and cost

9. Identify measuring instruments and describe their applications and procedures for use.
  - i. ammeter
  - ii. voltmeter
  - iii. ohmmeter
  - iv. multimeter
  - v. circuit tester
  - vi. continuity tester
  - vii. megger
  
10. Identify hazards and describe safe work practices pertaining to DC electricity.

**Practical Requirements:**

1. Compute values of electrical energy and power.
2. Use electrical measuring instruments.
3. Use instruments to troubleshoot DC components.
  - i. closed circuit
  - ii. open circuit
  - iii. short circuit
4. Ensure calibration of measuring instruments in accordance with manufacturing specifications.
5. Conduct megger test.

## ER1151 Series and Parallel DC Circuits

### Learning Outcomes:

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

**Duration:** 45 Hours

**Pre-Requisite(s):** ER1140

### Objectives and Content:

1. Describe the characteristics of a series circuit and calculate values.
  - i. resistance
  - ii. current
  - iii. voltage
  - iv. power
  - v. open resistor
  - vi. shorted resistor
2. Describe the characteristics of a parallel circuit and calculate values.
  - i. resistance
  - ii. current
  - iii. voltage
  - iv. power
  - i. open resistor
  - ii. shorted resistor
3. Explain Kirchhoff's Laws.
  - i. current law
  - ii. voltage law
4. Describe the characteristics of a combination circuit and calculate values.
5. Describe the procedures used to troubleshoot series, parallel and complex DC circuits.

**Practical Requirements:**

1. Analyze and measure amperage and voltage in series DC circuits.
2. Analyze and measure amperage and voltage in parallel DC circuits.
3. Analyze and measure amperage and voltage in combination DC circuits.
4. Analyze and measure resistance and/or continuity in basic DC circuits.
5. Analyze and measure power consumption in basic DC circuits.

## ER1170 Voltage Drop and Power Loss

### Learning Outcomes:

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

**Duration:** 30 Hours

**Pre-Requisite(s):** ER1151

### Objectives and Content:

1. Identify the types of conductor materials and describe their characteristics.
  - i. aluminum
  - ii. copper
2. Identify types of insulators and describe their characteristics and applications.
3. Explain conductor resistance and its effects on a circuit.
  - i. resistivity
  - ii. cross-sectional area
  - iii. length
  - iv. temperature coefficient of resistance
4. Describe the procedures used to determine conductor resistance.
5. Explain line voltage drop and its effects on a circuit.
  - i. factor affecting voltage drop
  - ii. calculate voltage drop
  - iii. CEC requirements
  - iv. voltage drop percentage
6. Explain power loss and its effects on a circuit.
  - i. calculate power loss
7. Describe the operation of a three-wire system.
  - i. purpose of a three-wire system
  - ii. neutral wire

**Practical Requirements:**

1. Use CEC tables to calculate voltage drop.
2. Calculate the absolute values in three-wire circuits.

## ER1510 Conductors and Cables

### Learning Outcomes:

- Demonstrate knowledge of conductors and cables and their associated components.
- Demonstrate knowledge of the procedures used to install conductors and cables.
- Demonstrate knowledge of the procedures used to terminate conductors.

**Duration:** 30 Hours

**Pre-Requisite(s):** ER1170

### Objectives and Content:

1. Define terminology associated with conductors and cables.
  - i. CSA designations
  - ii. voltage ratings
  - iii. number and size range of conductors
  - iv. number of strands
  - v. conditions of use
  - vi. glanding
  - vii. temperature ratings
2. Identify hazards and describe safe work practices pertaining to conductors and cables.
3. Identify tools and equipment relating to conductors and cables and describe their applications and procedures for use.
4. Interpret codes and regulations pertaining to conductors and cables.
  - i. Canadian Electrical Code (CEC)
  - ii. Canadian Standards Association (CSA)
5. Interpret information pertaining to conductors and cables found on drawings and specifications.
6. Identify types of conductors and cables and describe their characteristics and applications.
7. Identify conductor and cable components and accessories and describe their characteristics and applications.

8. Identify methods of circuit protection and describe their characteristics and applications.
  - i. Zener diodes
  - ii. opto-isolators
  - iii. circuit breakers
  - iv. fuses
9. Identify the considerations used when selecting conductors and cables and their associated components and accessories.
10. Describe the procedures used to install conductors and cables and their associated components and accessories.
11. Describe the procedures used to terminate conductors.

**Practical Requirements:**

1. Select and terminate armored cables.
2. Select and terminate TECK cables.
3. Dress a cable with proper glanding.



## ICT-145 On-Off Control Devices

### Learning Outcomes:

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

**Durations:** 30 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

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.
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. pushbuttons
  - 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 Requirements:**

1. Troubleshoot on/off control devices.

ER1460 Wireways, Conduit, Electrical Metallic Tubing (EMT) and Fittings

**Learning Outcomes:**

- Demonstrate knowledge of wireways, conduit, EMT and fittings, their characteristics and applications.
- Demonstrate knowledge of the procedures used to install wireways, conduit, EMT and fittings.

**Duration:** 30 Hours

**Pre-Requisite(s):** None

**Objectives and Content:**

1. Define terminology associated with wireways, conduit, EMT and fittings.
2. Identify hazards and describe safe work practices pertaining to wireways, conduit, EMT and fittings.
3. Identify tools and equipment relating to wireways, conduit, EMT and fittings and describe their applications and procedures for use.
4. Interpret codes and regulations pertaining to wireways, conduit, EMT and fittings.
5. Interpret information pertaining to wireways, conduit, EMT and fittings found on drawings and specifications.
6. Identify types of wireways, conduit and EMT and describe their characteristics and applications.
7. Identify wireway, conduit and EMT fittings and accessories and describe their characteristics and applications.
8. Describe the procedures used to bend conduit and EMT.
9. Describe the procedures used to install wireways, conduit and EMT and their fittings and accessories.

**Practical Requirements:**

None.

## ER2470 Pneumatic Supply Systems I

### Learning Outcomes:

- Demonstrate knowledge of pneumatic supply systems, their components and operation.
- Demonstrate knowledge of schematics, their use and interpretation.
- Demonstrate knowledge of pneumatic related calculations.

**Duration:** 25 Hours

**Pre-Requisite(s):** ER1460

### Objectives and Content:

1. Define terminology associated with pneumatic supply systems.
2. Identify hazards and describe safe work practices pertaining to pneumatic supply systems.
  - i. energy state awareness
3. Interpret information pertaining to pneumatic supply systems found on drawings and specifications.
4. Identify types of pneumatic supply systems and describe their applications and operation.
  - i. instrument air
  - ii. service air
5. Identify types of pneumatic supply system components and describe their purpose and operation.
  - i. compressors
  - ii. relays
  - iii. valves
  - iv. regulators
  - v. gauges
  - vi. actuators

6. Describe the methods of air treatment in pneumatic supply systems.
  - i. filters
  - ii. dryers
  - iii. after-coolers
  - iv. de-icers
  - v. receivers
7. Interpret schematics to determine the operation of pneumatic supply systems.
8. Perform pneumatic related calculations.

**Practical Requirements:**

1. Simulate or install an actual pneumatic supply system.
2. Maintain pneumatic supply systems.
3. Troubleshoot pneumatic supply systems.

## ER2480 Pneumatic Supply Systems II

### Learning Outcomes:

- Demonstrate knowledge of the procedures used to install, maintain and troubleshoot pneumatic supply system equipment and components.
- Demonstrate knowledge of the procedures used to commission pneumatic supply systems.

**Duration:** 25 Hours

**Pre-Requisite(s):** ER2470

### Objectives and Content:

1. Identify tools and equipment relating to pneumatic supply systems and describe their applications and procedures for use.
2. Describe the procedures used to select and install pneumatic supply systems and components.
3. Describe the procedures used to maintain and troubleshoot pneumatic supply systems and components.
  - i. compressors
  - ii. lubricating fluids (condition and level)
  - iii. dryers
  - iv. de-icers
  - v. hoses, piping and tubing
  - vi. filters
4. Describe the procedures used to commission pneumatic supply systems and components.

### Practical Requirements:

1. Commission a pneumatic supply system.

## ER1420 Introduction to Pressure Measurement and Calibration

### Learning Outcomes:

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

**Duration:** 70 Hours

**Pre-Requisite(s):** ER1201

### Objectives and Content:

1. Define terminology associated with pressure measurement and calibration.
2. Identify hazards and describe safe work practices pertaining to pressure measurement and calibration.
  - i. application of intrinsically safe pressure transmitters
  - ii. safe installation methods for pressure sensors in hazardous environments
  - iii. knowledge of appropriate tubing and hazards of high pressure tubing installations
3. Identify equipment relating to pressure measurement and describe their applications and procedures for use.
  - i. Differential pressure (d/p) cells
  - ii. Pressure switches
  - iii. Pressure gauges
  - iv. Pressure transmitters (wireless, analog, pneumatic, digital, Smart)
  - v. Pressure transducers
  - vi. Pressure recorders
4. Interpret information pertaining to pressure measuring devices found on drawings, specifications and nameplates.
5. Interpret and maintain calibration records.
6. Identify units of measure used to express pressure measurement values.
7. Perform conversions and calculations relating to pressure measurement.
  - i. the formula used to calculate pressure:  $P=F/A$

8. Explain the principles of pressure measurement and its relationship to temperature, level and flow.
9. Identify types of basic pressure measurement devices and describe their applications.
  - i. pneumatic
  - ii. hydraulic
10. Identify pressure related calibration standards and describe their applications.
  - i. manometers
  - ii. dead weight tester
  - iii. test gauges and calibrators
11. Describe the installation procedures for pressure measurement devices in various applications.
12. Describe the procedures used to maintain and troubleshoot basic pressure measurement devices.
  - i. the procedure for placing a pressure instrument into / out of service
  - ii. environmental conditions that can affect transmitter operation
  - iii. the elements of periodic maintenance
13. Discuss the importance of pressure measurement in industry.
14. Describe the configuration of smart transmitters and their applications in relationship to pressure.
  - i. Hart protocol
  - ii. foundation field bus
  - iii. configuring transmitters
15. Describe the configuration of Wireless pressure transmitters and their applications.
  - i. gateway setup
  - ii. configuring transmitters

**Practical Requirements:**

1. Install various pressure measurement instruments as per installation details.
2. Calibrate pressure measurement instruments to include smart, wireless, analog, and record calibration data using latest test equipment.
3. Perform calculations that relate to pressure measurement.



## ER1520 Tubing and Piping Systems

### Learning Outcomes:

- Demonstrate knowledge of tubing and piping systems, their components and operation.
- Demonstrate knowledge of the procedures used to install, maintain and troubleshoot tubing and piping systems and their components.

**Duration:** 30 Hours

**Pre-Requisite(s):** ER1420

### Objectives and Content:

1. Define terminology associated with tubing and piping systems.
2. Identify hazards and describe safe work practices pertaining to tubing and piping systems.
3. Identify tools and equipment relating to tubing and piping systems and describe their applications and procedures for use.
4. Interpret codes and regulations pertaining to tubing and piping systems.
5. Interpret information pertaining to tubing and piping systems found on drawings and specifications.
6. Identify types of tubing and piping systems and describe their applications.
  - i. rigid
  - ii. flexible
    - tubing
    - hoses
  - iii. ferrous
  - iv. non-ferrous
7. Identify types of tubing and piping and describe their compatibility, characteristics and applications.
8. Identify types of tube and pipe fittings and describe their characteristics and applications.
9. Identify tubing and piping system accessories and describe their characteristics and applications.

10. Identify types of valves used in tubing and piping systems and describe their applications and operation.
11. Describe the procedures used to select and install tubing and piping system components and accessories.
12. Perform tube bending and installation.
13. Describe the procedures used to maintain and troubleshoot tubing and piping systems and components.

**Practical Requirements:**

1. Bend tubing based on instructor's template.
2. Install compression tubing fittings to manufacturer's specifications.

## ER1530 Introduction to Fluids

### **Learning Outcomes:**

- Demonstrate knowledge of the principles and applications of fluids.

**Duration:** 25 Hours

**Pre-Requisite(s):** None

### **Objectives and Content:**

1. Define terminology associated with fluids.
2. Identify hazards and describe safe work practices pertaining to fluids.
3. Explain the principles and theories of fluids.
  - i. Pascal's law
  - ii. Boyle's law
  - iii. Charles' law
  - iv. Combined Gas law
  - v. Bernoulli's principle
4. Describe units of measure as they relate to fluids.
5. Identify fluid related formulae and describe their applications.
6. Identify fluid related symbols and abbreviations found on drawings and schematics.

### **Practical Requirements:**

None.

## ER1430 Flow Measurement

### Learning Outcomes:

- Demonstrate knowledge of calibrating and configuring various types of flow instruments and devices
- Demonstrate knowledge of selecting and installing various flow instruments and devices
- Demonstrate knowledge of understanding the principles of operation for flow measurement
- Demonstrate knowledge of safety procedures in relation to flow measurement devices
- Demonstrate knowledge of understanding the guidelines for periodic maintenance and troubleshooting
- Demonstrate knowledge of maintaining flow calibration standards and records
- Demonstrate knowledge of interpreting information on documents and specifications

**Duration:** 110 Hours

**Pre-Requisite(s):** ER1420, ER1530, ER1201

### Objectives and Content:

1. Define terminology associated with flow measurement.
2. Identify hazards and describe safe work practices pertaining to flow measurement and calibration.
  - i. application of intrinsically safe flow transmitters
  - ii. safe installation methods for flow sensors in hazardous environments
  - iii. knowledge of appropriate tubing installations
3. Identify equipment relating to flow measurement and describe their applications and procedures for use.
  - i. continuous flow devices
  - ii. differential pressure (d/p) cells – direct and indirect measurement
  - iii. ultrasonic meters
  - iv. magnetic flow meters
  - v. turbine meters
  - vi. positive displacement meters
  - vii. coriolis meters

- viii. vortex-shedding meters
  - ix. thermal flow meters
  - x. mass flow meters
  - xi. volumetric flow meters
  - xii. variable area flow meters
  - xiii. metering the flow of solid products
  - xiv. flow switches
4. Interpret information pertaining to flow measuring devices found on drawings, specifications and nameplates.
  5. Interpret and maintain flow calibration records.
  6. Identify units of measure used to express mass and volumetric flow measurement values.
  7. Perform conversions and calculations relating to flow measurement.
  8. Explain the principles of flow measurement and its relationship to temperature and pressure.
  9. Describe the procedures used to calibrate and configure flow measuring devices.
  10. Describe the selection and installation procedures for flow measurement devices in various applications.
  11. Describe the procedures used to maintain and troubleshoot basic flow measurement devices.
    - i. the procedure for placing a flow instrument in/out of service
    - ii. the elements of periodic maintenance
  12. Explain the importance of flow measurement in industry.
  13. Describe the configuration of smart transmitters and their applications in relationship to flow.
    - i. Hart protocol
    - ii. foundation field bus
    - iii. configuring transmitters
  14. Describe the configuration of Wireless flow transmitters and their applications.
    - i. gateway setup
    - ii. configuring transmitters

**Practical Requirements:**

1. Install various flow measurement instruments to include volumetric and mass flow.
2. Calibrate various flow measurement instruments using smart, analog, HART, field bus, AMS, wireless, and record calibration data using latest test equipment.
3. Perform calculations that relate to flow measurement and the properties of fluid.

## ER1440 Level and Density Measurement

### Learning Outcomes:

- Demonstrate knowledge of calibrating and configuring various level and density instruments and devices
- Demonstrate knowledge of selecting and installing level and density instruments and devices
- Demonstrate knowledge of understanding the principles of operation for level and density measurement
- Demonstrate knowledge of safety procedures in relation to level and density measurement
- Demonstrate knowledge of maintaining level and density calibration standards and records
- Demonstrate knowledge of understanding guidelines for periodic maintenance and troubleshooting
- Demonstrate knowledge of interpreting information on documents and specifications

**Duration:** 50 Hours

**Pre-Requisite(s):** ER1420, ER1201

### Objectives and content:

1. Define terminology associated with level and density measurement and calibration.
2. Identify hazards and describe safe work practices pertaining to level and density measurement and calibration.
  - i. application of intrinsically safe level and density transmitters
  - ii. safe installation methods for level and density devices
3. Identify equipment relating to level and density measurement and describe their applications and procedures for use.
  - i. continuous level devices
  - ii. differential pressure (d/p) cells
  - iii. ultrasonic
  - iv. capacitance
  - v. nuclear
  - vi. radar /microwave

- vii. magnetic
  - viii. weight systems using load cells
  - ix. level switches
  - x. level gauges
  - xi. level and density transmitters (wireless, analog, pneumatic, digital, Smart)
  - xii. level and density recorders
4. Identify calibration and test equipment relating to level and density measurement and describe their applications and procedures for use.
  5. Interpret information pertaining to level and density measuring devices found on drawings, specifications and nameplates.
  6. Interpret and maintain calibration records.
  7. Identify units of measure used to express level and density measurement values.
  8. Perform conversions and calculations relating to level and density measurement.
  9. Explain the principles of level and density measurement and its relationship to temperature, pressure and flow.
  10. Describe the installation procedures for level and density measurement devices in various applications.
  11. Describe the procedures used to maintain and troubleshoot basic level and density measurement devices.
    - i. the procedure for placing a level and density instrument into / out of service
    - ii. the elements of periodic maintenance
  12. Discuss the importance of level and density measurement in industry.
  13. Describe the configuration of smart transmitters and their applications in relationship to level.
    - i. Hart protocol
    - ii. foundation field bus
    - iii. configuring transmitters
  14. Describe the configuration of Wireless level transmitters and their applications.
    - i. gateway setup
    - ii. configuring transmitters



**Practical Requirements:**

1. Install various level and density measurement instruments as per installation details.
2. Calibrate level and density measurement instruments to include smart, wireless, analog, and record calibration data using latest test equipment.
3. Perform calculations that relate to level and density measurement.

## ER1450 Temperature Measurement

### Learning Outcomes:

- Demonstrate knowledge of calibrating and configuring various temperature instruments using different test equipment and standards.
- Demonstrate knowledge of selecting and installing temperature instruments and devices
- Demonstrate knowledge of understanding the principles of operation for temperature measurement
- Demonstrate knowledge of safety procedures in relation to temperature instruments
- Demonstrate knowledge of understanding guidelines for periodic maintenance
- Demonstrate knowledge of maintaining temperature calibration standards and records
- Demonstrate knowledge of interpreting information on documents and specifications

**Duration:** 60 Hours

**Pre-Requisite(s):** ER1201

### Objectives and Content:

1. Define terminology associated with temperature measurement.
2. Identify hazards and describe safe work practices pertaining to temperature measurement and calibration.
  - i. application of intrinsically safe temperature transmitters
  - ii. safe installation methods for temperature sensors in hazardous environments
  - iii. knowledge of appropriate temperature sensor installations
3. Identify equipment relating to temperature measurement and describe their applications and procedures for use.
  - i. thermowell
  - ii. thermometer
  - iii. bimetallic strip
  - iv. resistance temperature detector (rtd)
  - v. thermocouple
  - vi. Temperature gauge

- vii. Pyrometers
  - viii. Thermistor
  - ix. liquid, gas and vapor-filled systems
  - x. temperature switches
4. Correlate changes in temperature with changes in a substance's physical state.
  5. Interpret information pertaining to temperature measuring devices found on drawings, specifications and nameplates.
  6. Interpret and maintain temperature calibration records.
    - i. primary and secondary temperature calibration standards
  7. Identify units of measure used to express temperature measurement values.
  8. Perform conversions and calculations relating to temperature measurement.
  9. Describe the procedures used to calibrate and configure temperature measuring devices.
  10. Describe the selection and installation procedures for temperature measurement devices in various applications.
  11. Describe the procedures used to maintain and troubleshoot basic temperature measurement devices.
    - i. the procedure for placing a temperature instrument into / out of service
    - ii. the elements of periodic maintenance
  12. Explain the importance of temperature measurement in industry.
  13. Describe the configuration of smart transmitters and their applications in relationship to temperature.
    - i. Hart protocol
    - ii. foundation field bus
    - iii. configuring transmitters
  14. Describe the configuration of Wireless temperature transmitters and their applications.
    - i. gateway setup
    - ii. configuring transmitters

**Practical Requirements:**

1. Install various temperature measurement instruments.
2. Calibrate temperature measurement instruments, to include smart, HART, field bus, wireless, analog with approved test equipment and record calibration data.
  - i. Type “K” Temperature Transmitter
  - ii. Type “ J” Temperature Transmitter
  - iii. RTD Temperature Transmitter
3. Perform calculations that relate to temperature measurement.

## ER1711 Signal Transmission Systems

### Learning Outcomes:

- Demonstrate knowledge of signal transmission systems, their components and operation.
- Demonstrate knowledge of the procedures used to install, configure, upgrade, maintain, troubleshoot and replace signal transmission systems.

**Duration:** 30 Hours

**Pre-Requisite(s):** ER1420

### Objectives and Content:

1. Define terminology associated with signal transmission.
2. Identify hazards and describe safe work practices pertaining to signal transmission.
3. Identify tools and equipment relating to signal transmission systems and describe their applications and procedures for use.
4. Interpret codes and regulations pertaining to signal transmission.
5. Interpret information pertaining to signal transmission found on drawings and specifications.
6. Identify types of communication protocols and describe their characteristics and applications.
7. Identify types of signal transmission systems and describe their characteristics and applications.
  - i. pneumatic
  - ii. wired
  - iii. fibre optic
  - iv. wireless
8. Identify signal transmission system components and accessories and describe their purpose and operation.
  - i. tubing
  - ii. cables
  - iii. antennas

- iv. converters
  - v. transducers
  - vi. multi-plexers
  - vii. network switches/hubs
9. Describe the procedures used to select and install signal transmission systems and their components.
10. Describe the procedures used to configure, calibrate and upgrade signal transmission systems and their components.
11. Describe the procedures used to maintain, troubleshoot and replace signal transmission systems and their components.

**Practical Requirements:**

1. Calibrate various signal transducers and related equipment.

## ER1733 Electronics (Circuits and Components)

### Learning Outcomes:

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

**Duration:** 90 Hours

**Pre-Requisite(s):** ER1140

### Objectives and Content:

1. Define terminology associated with electronics.
2. Identify hazards and describe safe work practices pertaining to electronics.
  - 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.
5. Interpret information pertaining to electronics found on devices, drawings and specifications.
6. Describe the operation of a wheatstone bridge circuit.
7. Explain conventional current flow vs. electron flow theory in electronics.
8. Identify number systems used in electronics and describe their applications.
  - i. binary
  - ii. decimal
  - iii. hexadecimal
  - iv. octal
  - v. binary coded decimal (BCD)
9. Perform conversions between number systems.

10. Identify types of logic gates and describe their applications.
11. Identify semiconductor materials used in electronics and describe their characteristics and applications.
12. Identify electronic components and describe their purpose and operation in a circuit.
  - i. rectifiers
  - ii. diodes
  - iii. transistors
  - iv. op amps
  - v. thyristors
13. Describe the procedures used to select and install electronic circuits.
14. Describe the procedures used to maintain, troubleshoot and replace electronic circuitry.
15. Perform calculations pertaining to electronics.
  - i. power
  - ii. current
  - iii. voltage
  - iv. frequency (timing)
  - v. logic

**Practical Requirements:**

1. Troubleshoot basic problems with electronic circuits.



## AM1000 Introduction to Essential Skills

### Learning Outcomes:

- Demonstrate knowledge of the nine nationally recognized essential skills.
- Demonstrate knowledge of the essential skills levels of complexity.
- Demonstrate knowledge of the essential skills required for the learners chosen trade.
- Demonstrate an awareness of essential skills assessments.

**Duration:** 9 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

1. Identify and describe the essential skills recognized by the Government of Canada through the Office of Literacy and Essential Skills (OLES).
  - i. reading
  - ii. document use
  - iii. numeracy
  - iv. writing
  - v. oral communication
  - vi. working with others
  - vii. thinking
  - viii. computer use
  - ix. continuous learning
2. Describe the Levels of Complexity measurement assigned to essential skills.
3. Identify the essential skills, along with their complexity level, identified as necessary for the learner's trade.
  - i. RSOS / NOA content<sup>1</sup>
  - ii. OLES Essential Skills Profiles<sup>2</sup>
  - iii. OLES tools and support for apprentices and tradespersons<sup>3</sup>
4. Describe the nature and purpose of essential skills assessment.
  - i. self-assessment & formal assessment tools
  - ii. indicators of deficiencies
  - iii. suggestions for improvement

5. Describe the benefits of essential skills improvement.
  - i. confidence at work
  - ii. employability
  - iii. success in apprenticeship
  - iv. wage & job advancement

**Practical Requirements:**

1. Complete an essential skills self-assessment addressing numeracy, document use and reading. The online **Government of Canada Essential Skills Indicator<sup>4</sup> and Essential Skills self-assessment for the trades<sup>5</sup>** are to be used unless the instructor provides a similar assessment tool or tools.
2. Participate in a group discussion about the impact of gaps in essential skills that may be revealed by the self-assessments completed, and the value of improving essential skills.

\*Students are graded complete or incomplete on this practical work, no grade is permitted for self-assessment performance. However, completion of the practical requirements is mandatory for completion of this unit.

**Resources:**

All footnotes are in the companion document “Resources for Introduction to Essential Skills” which is available online from Apprenticeship and Trade Certification.

## AP1102 Introduction to Apprenticeship

### Learning Outcomes:

- Demonstrate knowledge of how to become a registered apprentice.
- Demonstrate knowledge of the steps to complete an apprenticeship program.
- Demonstrate knowledge of various stakeholders in the apprenticeship process.
- Demonstrate knowledge of the Red Seal Program.

**Duration:** 12 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

1. Define terminology associated with apprenticeship.
  - i. apprentice
  - ii. registered apprentice
  - iii. trade qualifier
  - iv. journeyperson
  - v. certified journeyperson
  - vi. Certificate of Apprenticeship
  - vii. Certificate of Qualification
  - viii. dual certification
  - ix. compulsory trades
  
2. Explain the roles and responsibilities of those involved in the apprenticeship system in Newfoundland and Labrador.
  - i. registered apprentice
  - ii. training institution
  - iii. employer
  - iv. journeyperson
  - v. mentor
  - vi. Department of Immigration, Population Growth and Skills
    - Industrial Training section
    - Standards and Curriculum section
  - vii. Provincial Trade Advisory Committees (PTAC)
  - viii. Provincial Apprenticeship and Certification Board (PACB)
  
3. Describe the training components of an apprenticeship.
  - i. in-school
    - Pre-employment / Level 1
    - advanced levels
  - ii. workplace experience

4. Explain the steps in the registered apprenticeship process.
  - i. meet entrance requirements
    - education
    - employment
    - Recognition of Prior Learning (RPL) - if applicable
  - ii. complete the registration process
    - application
    - required documents
  - iii. complete the Memorandum of Understanding (MOU)
    - contract responsibilities
    - probation period
    - cancellation
  - iv. maintain Record of Occupational Progress (Logbook)
    - sign off skills
    - record hours
    - update Apprenticeship Program Officer (APO) on progress
  - v. class calls
    - hour requirements
    - EI eligibility
    - training schedule
  - vi. level examinations - if applicable
  - vii. progression schedule
    - apprenticeship level
    - wage rates
  - viii. certification examinations
    - Provincial
    - Interprovincial
      - written
      - practical - if applicable
  - ix. certification
    - Certificate of Apprenticeship
    - Certificate of Qualification
    - Provincial journey person - Blue Seal
    - Interprovincial journey person - Red Seal endorsement (RSE)
5. Identify the Conditions Governing Apprenticeship.
6. Discuss cancellation of apprenticeship.
  - i. failure to notify of address change
  - ii. extended periods of unemployment
  - iii. lack of contact with an APO for an extended period
  - iv. failure to respond to class calls
  - v. declining of multiple class calls

7. Explain the Interprovincial Standards Red Seal program.
  - i. designated Red Seal trades
  - ii. the Red Seal Occupational Standard (RSOS)
  - iii. relationship of RSOS to IP examination
  - iv. national qualification recognition and mobility
8. Identify the current financial incentives available to apprentices.
  - i. Federal
  - ii. Provincial
9. Explain the Provincial / Territorial Apprentice Mobility Guidelines.
  - i. temporary mobility
  - ii. permanent mobility
10. Describe Atlantic and National Harmonization initiatives.

**Practical Requirements:**

1. Use the Provincial Apprenticeship and Trades Certification website at <https://www.gov.nl.ca/atcd/>.
  - i. locate, download, and complete the Application for Apprenticeship and Memorandum of Understanding (MOU)
  - ii. locate the address of the Industrial Training office closest to this campus
  - iii. locate the training schedule and identify the start date of the next class call for this trade
  - iv. locate and review the learning resources applicable to this trade
    - Study Guide
    - Exam Preparation Guide
    - Plan of Training
2. Use the Plan of Training applicable to this trade.
  - i. locate the hours for the trade
    - total in-school
    - total required for certification
  - ii. locate the number of levels
  - iii. locate the courses in each level
  - iv. locate the hours required for progression to a Level 2 apprentice and the wage percentage of that level

## AM1101 Math Essentials

Note: It is recommended that AM1101 be delivered in the first semester of the Pre-employment program.

### Learning Outcomes:

- Demonstrate knowledge of essential numeracy skills.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of mathematical principles in trade problem solving situations.
- Demonstrate the ability to solve simple mathematical word problems.

**Duration:** 42 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Describe whole number operations.
  - i. read, write, count, round off, add, subtract, multiply and divide whole numbers.
2. Describe the application of the order of operations in math problems.
3. Describe fraction and mixed number operations.
  - i. read, write, add, subtract, multiply and divide fractions.
4. Describe decimal operations.
  - i. read, write, round off, add, subtract, multiply and divide decimals.
5. Describe percent/decimal/fraction conversion and comparison.
  - i. convert between fractions, decimals and percents.
6. Identify percentage operations.
  - i. read and write percentages
  - ii. calculate base, rates and percentages
7. Identify ratio and proportion operations.
  - i. use a ratio comparing two quantities with the same units
  - ii. use a proportion comparing two ratios

8. Describe the use of the imperial measurement system in math problems.
  - i. identify units of measurement
    - length
    - mass
    - area
    - volume
    - capacity
  
9. Describe the use of the metric measurement system in math problems.
  - i. identify units of measurement
    - length
    - mass
    - area
    - volume
    - capacity
  
10. Identify angles, lines and geometric shapes.
  - i. use a protractor to measure angles
  - ii. determine whether an angle is right, acute or obtuse
  - iii. identify parallel, perpendicular, horizontal and vertical lines
  - iv. identify types of triangles, quadrilaterals, and 3-dimensional shapes
  
11. Describe estimation strategies.
  - i. estimate a linear measure using a referent
  - ii. estimate length, area and volume of objects in metric and imperial systems
  
12. Describe problem solving that involves linear measurement using instruments such as rulers or tape measures, in the metric and imperial systems.

**Practical Requirements:**

1. To emphasize or further develop specific knowledge objectives, students will be required to complete practical demonstrations, which confirm proper application of mathematical theory to job skills.

## AM1191 Instrumentation and Control Math Fundamentals

### Learning Outcomes:

- Demonstrate knowledge of mathematical concepts in the performance of trade practices.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Solve mathematical word problems.
- Demonstrate knowledge of mathematical principles for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

**Duration:** 42 Hours

**Pre-Requisite(s):** AM1101

### Objectives and Content:

The instructor is required to use trade specific examples to reinforce the course objectives.

1. Describe percent/decimal/fraction conversions and comparisons in trade specific situations.
2. Describe ratios and proportions as they relate to trade specific problems.
3. Describe the use of the Imperial and Metric measurement systems in trade specific applications.
4. Describe Imperial and Metric conversions in trade specific situations.
  - i. convert between imperial and metric measurements
  - ii. convert to another unit within the same measurement system
5. Describe how to manipulate formulas using cross multiplication, dividing throughout, elimination, and substitution to solve trade specific problems.
  - i. right angle triangles
  - ii. area
  - iii. volume
  - iv. perimeter
  - v. density



6. Identify calculations involving geometry that are relevant to the trade.
  - i. angle calculations
  - ii. circle calculations
  
7. Identify math processes used to complete administrative trade tasks.
  - i. material estimation
  - ii. material costing
  - iii. time & labour estimates
  - iv. taxes & surcharges
  - v. markup & projecting revenue

**Practical Requirements:**

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations, which confirm proper application of mathematical theory to job skills.

**Note:** This course is **Non-Transferable** to other trades programs, and **Not Eligible for Prior Learning Assessment**. Students completing training in this trade program are required to complete this math course. Apprentice transfers under Provincial / Territorial Mobility agreements may be exempt from this requirement.

## CM2161 Communication Essentials

### Learning Outcomes:

- Demonstrate knowledge of the importance of well-developed writing and oral communication skills in the workplace.
- Demonstrate knowledge of the principles of effective workplace writing.
- Demonstrate knowledge of the purpose of various types of workplace documentation and workplace meetings.
- Demonstrate knowledge of the importance of effective interpersonal skills in the workplace.
- Demonstrate knowledge of effective job search techniques

**Duration:** 36 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Define communications terminology used in the trade.
2. Identify the principles of effective workplace writing.
  - i. grammar, punctuation, mechanics
  - ii. sentence and paragraph construction
  - iii. tone, language, and word choice
  - iv. the writing process
    - planning
    - writing
    - editing/revising
3. Identify sources of information used to communicate in the workplace.
  - i. regulations
  - ii. codes
  - iii. OH&S requirements
  - iv. prints, drawings and specifications
  - v. company and client documentation
4. Identify types and purposes of informal workplace documents.
  - i. reports
    - incident
    - process
    - progress

- ii. common trade specific forms
  - iii. primary and secondary methods of information gathering
  - iv. accuracy and completeness in reports and forms
5. Demonstrate an understanding of interpersonal communications in the workplace.
- i. recognize group dynamics
  - ii. contribute information and expertise
  - iii. individual learning styles
    - audible
    - visual
    - experiential
    - theoretical
  - iv. recognize respectful and open communication
  - v. accept and provide feedback
  - vi. interpret non-verbal communication cues
    - body language
    - signals
6. Demonstrate an understanding of effective oral communication skills.
- i. listening
    - receiving, understanding, remembering, reflecting, evaluating, paraphrasing, and responding
  - ii. speaking
    - using clear and proper words
    - tone, style, and vocabulary
    - brevity
  - iii. common workplace oral communication situations
    - introducing self and others
    - telephone conversations
    - tool box/safety talks
    - face-to-face conversations
    - communicating with co-workers, supervisors, clients, and other trades people
7. Identify common practices related to workplace meetings.
- i. meeting formats
  - ii. meeting preparation
  - iii. agendas and minutes
  - iv. roles, responsibilities, and etiquette of meeting participants
8. Identify acceptable workplace use of communication technologies.
- i. cell / smart phone etiquette
  - ii. voice mail
  - iii. e-mail
  - iv. texting / messaging through social media

- v. teleconferencing / videoconferencing for meetings and interviews
  - vi. social networking
  - vii. other emerging technologies
9. Demonstrate an understanding of effective job search techniques.
- i. employment trends, opportunities, and sources of employment
  - ii. job ads and the importance of fitting qualifications to job requirements
  - iii. resumes
    - characteristics of effective resumes
    - types of resumes
    - principles of resume formatting
  - iv. effective cover letters
  - v. job interview process
    - pre-interview preparation
    - interview conduct
    - post-interview follow up

**Practical Requirements:**

1. Write a well-developed, coherent, unified paragraph.
2. Complete a trade-related form.
3. Prepare an agenda for a toolbox safety talk.
4. Participate in a simulated oral workplace communication situation.
5. Prepare a resume.

## SD1761 Workplace Essentials

Note: It is recommended that SD1761 be delivered in the second half of Pre-employment training.

### **Learning Outcomes:**

- Demonstrate knowledge of workplace requirements in the areas of personal responsibility, unions, workers compensation, workers' rights, and human rights.
- Demonstrate knowledge of quality customer service.

**Duration:** 24 Hours

**Pre-Requisite(s):** None

### **Objectives and Content:**

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify personal responsibilities and attitudes that contribute to on-the-job success.
  - i. asking questions
  - ii. working safely
  - iii. accepting constructive feedback
  - iv. time management & punctuality
  - v. respect for authority
  - vi. stewardship of materials, tools and properties
2. Define unions and identify their role in the workplace.
  - i. purpose of unions
  - ii. common union structure
  - iii. unions in this trade
3. Demonstrate an understanding of the Worker's Compensation process.
  - i. aims, objectives, and benefits of the Workplace Health, Safety and Compensation Commission
  - ii. role of the workers advisor
  - iii. internal review process

4. Demonstrate an understanding of worker's rights.
  - i. labour standards
  - ii. regulations, including:
    - hours of work & overtime
    - termination of employment
    - minimum wages & allowable deductions
    - statutory holidays, vacation time, and vacation pay
  
5. Demonstrate an understanding of human rights issues.
  - i. awareness of the Human Rights Code and the role of the Human Rights Commission
  - ii. categories of discrimination and strategies for prevention
    - direct
    - systemic
    - adverse effect
  - iii. types of discrimination
    - race
    - ethnic origin
    - colour
    - religion
    - age
    - gender identify
    - sexual orientation
    - marital status
    - family status
    - disability
    - criminal conviction that has been pardoned
  - iv. conduct that constitutes harassment and discrimination
    - objectionable conduct
    - comments or displays made either on a one-time or continuous basis that demeans, belittles, or causes personal humiliation or embarrassment to the recipient
  - v. the value of diversity in the workplace
    - culture
    - gender identify
    - sexual orientation
  
6. Demonstrate an understanding of quality customer service.
  - i. importance of quality service
  - ii. barriers to quality service
    - physical and physiological
    - cultural
    - technological

- iii. customer needs & common methods for meeting them
- iv. characteristics & importance of a positive attitude
- v. interactions with challenging customers
- vi. addressing complaints and resolve conflict

**Practical Requirements:**

None.

## MC1062 Computer Essentials

### Learning Outcomes:

- Demonstrate knowledge of desktop/laptop and mobile computers and their operation.
- Demonstrate knowledge of word processing and spreadsheet software, internet browsers and their applications.
- Demonstrate knowledge of e-mail applications and procedures.
- Demonstrate an awareness of security issues related to computers.
- Demonstrate an awareness of online learning using computers.

**Duration:** 15 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

When possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify computer types used in the workplace, and the characteristics of each.
  - i. desktop/laptop computers
  - ii. tablets
  - iii. smartphones
2. Identify common desktop and mobile operating systems.
  - i. Windows
  - ii. Mac OS
  - iii. iOS
  - iv. Android
3. Describe the use of Windows operating system software.
  - i. start and end a program
  - ii. use the help function
  - iii. use the find function
  - iv. maximize and minimize a window
  - v. open and scroll through multiple windows
  - vi. use the task bar
    - adjust desktop settings such as screen savers, screen resolution, and backgrounds
  - vii. shut down a computer



4. Identify the skills necessary to perform file management commands.
  - i. create folders
  - ii. copy files and folders
  - iii. move files and folders
  - iv. rename files and folders
  - v. delete files and folders
  
5. Describe the use of word processing software to create documents.
  - i. enter & edit text
  - ii. indent and tab text
  - iii. change text attributes
    - bold
    - underline
    - font
  - iv. change layout format
    - margins
    - alignment
    - line spacing
  - v. spell check and proofread
  - vi. save, close & reopen a document
  - vii. print document
  
6. Describe the use of spreadsheet software to create documents.
  - i. enter data in cells
  - ii. format data in cells
  - iii. create formulas to add, subtract, multiply and divide
  - iv. save, close & reopen a spreadsheet
  - v. print spreadsheet
  
7. Describe the use of the internet in the workplace.
  - i. web browsers
  - ii. search engines
  - iii. security issues
  - iv. personal responsibility for internet use at work
  
8. Describe the role of e-mail.
  - i. e-mail etiquette
    - grammar and punctuation
    - privacy issues when sharing and forwarding e-mail
    - work appropriate content
    - awareness of employer policies
  - ii. managing e-mail
    - using folders
    - deleting, forwarding, replying

- iii. adding attachments to e-mail
  - iv. view e-mail attachments
  - v. printing e-mail
9. Describe computer use for online learning.
- i. online training
  - ii. level exams
  - iii. study guides
  - iv. practice exams

**Practical Requirements:**

- 1. Create, save and print a document using word processing software.
- 2. Create, save and print a document using spreadsheet software.
- 3. Send and receive an e-mail with an attachment.

## C. Conditions Governing Apprenticeship Training

### 1.0 General

The following general conditions apply to all apprenticeship training programs approved by the Provincial Apprenticeship and Certification Board (PACB) in accordance with the **Apprenticeship Training and Certification Act (1999)**. If an occupation requires additional conditions, these will be noted in the specific Plan of Training for the occupation. In no case should there be a conflict between these conditions and the additional requirements specified in a certain Plan of Training. All references to Memorandum of Understanding will also apply to Letter of Understanding (LOU) agreements.

### 2.0 Entrance Requirements

#### 2.1 Entry into the occupation as an apprentice requires:

Indenturing into the occupation by an employer who agrees to provide the appropriate training and work experiences as outlined in the Plan of Training.

#### 2.2 Notwithstanding the above, each candidate must have successfully completed a high school program or equivalent, and in addition may be required to have completed certain academic subjects as specified in a particular Plan of Training. Mature students, at the discretion of the Director of Apprenticeship and Trades Certification, may be registered. A mature student is defined as one who has reached the age of 19 and who can demonstrate the ability and the interest to complete the requirements for certification.

#### 2.3 At the discretion of the Director of Apprenticeship and Trades Certification, credit toward the apprenticeship program may be awarded to an apprentice for previous work experience and/or training as validated through prior learning assessment.

#### 2.4 An Application for Apprenticeship form must be duly completed along with a Memorandum of Understanding as applicable to be indentured into an Apprenticeship. The Memorandum of Understanding must contain signatures of an authorized employer representative, the apprentice and an official representing the Provincial Apprenticeship and Certification Board to be valid.

#### 2.5 A new Memorandum of Understanding must be completed for each change in an employer during the apprenticeship term.

### **3.0 Probationary Period**

The probationary period for each Memorandum of Understanding will be six months or 900 employment credit hours. Within that period the memorandum may be terminated by either party upon giving the other party and the PACB one week notice in writing.

### **4.0 Termination of a Memorandum of Understanding**

After the probationary period referred to in Section 3.0, the Memorandum of Understanding may be terminated by the PACB by mutual consent of the parties involved, or cancelled by the PACB for proper and sufficient cause in the opinion of the PACB, such as that stated in Section 14.

### **5.0 Apprenticeship Progression Schedule, Wage Rates and Advanced Training Criteria**

### Progression Schedule

Instrumentation & Control Technician - 7200 Hours			
Apprenticeship Level And Wages			
Level	Wage Rate	Requirements for Progression to Next Level	Next Level
1	60%	<ul style="list-style-type: none"> <li>▪ Completion of Pre-Employment training / AACS Level 1 training</li> <li>▪ Registration as an apprentice</li> <li>▪ Pass Level 1 exam*</li> <li>▪ Minimum 1800 hours of combined relevant work experience and training</li> </ul>	2 <sup>nd</sup> Year
2	70%	<ul style="list-style-type: none"> <li>▪ Completion of Level 2 training</li> <li>▪ Pass Level 2 exam*</li> <li>▪ Minimum 3600 hours of combined relevant work experience and training</li> </ul>	3 <sup>rd</sup> Year
3	80%	<ul style="list-style-type: none"> <li>▪ Completion of Level 3 training</li> <li>▪ Pass Level 3 exam*</li> <li>▪ Minimum 5400 hours of combined relevant work experience and training</li> </ul>	4 <sup>th</sup> Year
4	90%	<ul style="list-style-type: none"> <li>▪ Completion of Level 4 training</li> <li>▪ Pass Level 4 exam*</li> <li>▪ Minimum 7200 hours of combined relevant work experience and training</li> <li>▪ Sign-off of all workplace skills in apprentice logbook</li> <li>▪ Pass certification exam</li> </ul>	Journeyman Certification
<p>Wage Rates</p> <ul style="list-style-type: none"> <li>▪ Rates are percentages of the prevailing journeyman's wage rate in the place of employment of the apprentice.</li> <li>▪ Rates must not be less than the wage rate established by the Labour Standards Act (1990), as now in force or as hereafter amended, or by other order, as amended from time to time replacing the first mentioned order.</li> <li>▪ Rates must not be less than the wage rate established by any collective agreement, which may be in force at the apprentice's workplace.</li> <li>▪ Employers are free to pay wage rates above the minimums specified.</li> </ul> <p>Level Exams*</p> <ul style="list-style-type: none"> <li>▪ This program may <b>not</b> currently contain level exams, in which case this requirement will be waived until such time as level exams are available.</li> </ul>			

Instrumentation & Control Technician - 7200 Hours		
Class Calls (After Apprenticeship Registration)		
Call Level	Requirements for Class Call	Hours awarded for In-School Training
Direct Entry Level 1	<ul style="list-style-type: none"> <li>▪ Minimum of 1800 hours of relevant work experience</li> <li>▪ Prior Learning Assessment (PLA) at designated college (if applicable)</li> </ul>	210
Level 2	<ul style="list-style-type: none"> <li>▪ Minimum of 3000 hours of relevant work experience and training</li> </ul>	240
Level 3	<ul style="list-style-type: none"> <li>▪ Minimum of 5400 hours of relevant work experience and training</li> </ul>	210
Level 4	<ul style="list-style-type: none"> <li>▪ Minimum of 7000 hours of relevant work experience and training</li> </ul>	210
<p>Class Calls at Minimum Hours</p> <ul style="list-style-type: none"> <li>▪ Class calls may not always occur at the minimum hours indicated. Some variation is permitted to allow for the availability of training resources and apprentices.</li> </ul>		

## 6.0 Tools

Apprentices shall be required to obtain their own hand tools applicable for the designated occupation of registration or tools as specified by the PACB.

## 7.0 Periodic Examinations and Evaluation

- 7.1 Every apprentice shall submit to such occupational tests and examinations as the PACB shall direct. If after such occupational tests and examinations the apprentice is found to be making unsatisfactory progress, his/her apprenticeship level and rate of wage shall not be advanced as provided in Section 5 until his/her progress is satisfactory to the Director of Apprenticeship and Trades Certification and his/her date of completion shall be deferred accordingly. Persistent failure to pass required tests shall be a cause for revocation of his/her Memorandum of Understanding.
- 7.2 Upon receipt of reports of accelerated progress of the apprentice, the PACB may shorten the term of apprenticeship and advance the date of completion accordingly.

7.3 For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

7.4 Course credits may be granted through the use of a PACB approved matrix which identifies course equivalencies between designated trades and between current and historical Plans of Training for the same trade.

## **8.0 Granting of Certificates of Apprenticeship**

Upon the successful completion of apprenticeship, the PACB shall issue a Certificate of Apprenticeship.

## **9.0 Hours of Work**

Any hours employed in the performance of duties related to the designated occupation will be credited towards the completion of the term of apprenticeship. Appropriate documentation of these hours must be provided.

## **10.0 Copies of the Registration for Apprenticeship**

The Director of Apprenticeship and Trades Certification shall provide copies of the Registration for Apprenticeship form to all signatories to the document.

## **11.0 Ratio of Apprentices to Journeypersons**

Under normal practice, the ratio of apprentices to journeypersons shall not exceed two apprentices to every one journeyperson employed. Other ratio arrangements would be determined and approved by the PACB.

## **12.0 Relationship to a Collective Bargaining Agreement**

Where applicable in Section 5 of these conditions, Collective Agreements take precedence.

## **13.0 Amendments to a Plan of Apprenticeship Training**

A Plan of Training may be amended at any time by the PACB.

## **14.0 Employment, Re-Employment and Training Requirements**

14.1 The Plan of Training requires apprentices to regularly attend their place of employment.

- 14.2 The Plan of Training requires apprentices to attend training for that occupation as prescribed by the PACB.
- 14.3 Failure to comply with Sections 14.1 and/or 14.2 will result in cancellation of the Memorandum of Understanding. Apprentices may have their MOUs reinstated by the PACB but would be subject to a commitment to complete the entire program as outlined in the General Conditions of Apprenticeship. Permanent cancellation in the said occupation is the result of non-compliance.
- 14.4 Cancellation of the Memorandum of Understanding to challenge journey person examinations, if unsuccessful, would require an apprentice to serve a time penalty of two (2) years before reinstatement as an apprentice or qualifying to receive a class call to training as a registered Trade Qualifier. Cancellation must be mutually agreed upon by the employer and the apprentice.
- 14.5 An employer shall ensure that each apprentice is under the direct supervision of an approved journey person supervisor who is located at the same worksite as the apprentice, and that the apprentice is able to communicate with the journey person with respect to the task, activity or function that is being supervised.
- 14.6 Under the Plan of Training the employer is required to keep each apprentice employed as long as work is available, and if the apprentice is laid off due to lack of work, to give first opportunity to be hired before another is hired.
- 14.7 The employer will permit each apprentice to attend training programs as prescribed by the PACB.
- 14.8 Apprentices who cannot acquire all the workplace skills at their place of employment will have to be evaluated in a simulated work environment at a PACB authorized training institution and have sign-off done by instructors to meet the requirements for certification.

**15.0 Appeals to Decisions Based on Conditions Governing Apprenticeship Training**

Persons wishing to appeal any decisions based on the above conditions must do so in writing to the Minister of Immigration, Population Growth and Skills within 30 days of the decision.



**D. Requirements for Red Seal Endorsement**

1. Evidence the required work experiences outlined in this Plan of Training have been obtained. This evidence must be in a format clearly outlining the experiences and must be signed by an appropriate person or persons attesting that these experiences have been obtained to the level required.
2. Successful completion of all required courses in the program.
3. A combination of training from an approved training program and suitable work experience totaling 7200 hours.

**Or**

A total of 10,800 hours of suitable work experience.

4. Completion of a National Red Seal examination, to be set at a place and time determined by the Apprenticeship and Trades Certification Division.

## E. Roles and Responsibilities of Stakeholders in the Apprenticeship Process

The apprenticeship process involves a number of stakeholders playing significant roles in the training of apprentices. This section outlines these roles and the responsibilities resulting from them.

### **The Apprentice:**

- completes all required technical training courses as approved by the PACB.
- finds appropriate employment.
- completes all required work experiences in combination with the required hours.
- ensures work experiences are well documented.
- approaches apprenticeship training with an attitude and commitment that fosters the qualities necessary for a successful career as a qualified journeyman.
- obtains the required hand tools as specified by the PACB for each period of training of the apprenticeship program.

**The Employer:**

- provides high quality work experiences in an environment conducive to learning.
- remunerates apprentices as set out in the Plan of Training or Collective Agreements.
- provides feedback to training institutions, Apprenticeship and Trades Certification Division and apprentices in an effort to establish a process of continuous quality improvement.
- where appropriate, releases apprentices for the purpose of returning to a training institution to complete the necessary technical courses.
- ensures work experiences of the apprentice are documented.
- ensures a certified journeyperson is currently on staff in the same trade area as the apprentice and whose certification is recognized by the NL Department of Immigration, Population Growth and Skills.

**The Training Institution:**

- provides a high quality learning environment.
- provides the necessary student support services that will enhance an apprentice's ability to be successful.
- participates with other stakeholders in the continual updating of programs.

### **The Apprenticeship and Trades Certification Division:**

- establishes and maintains program advisory committees under the direction of the PACB.
- promotes apprenticeship training as a viable career option to prospective apprentices and other appropriate persons involved, such as career guidance counsellors, teachers, parents, etc.
- establishes and maintains a protocol with training institutions, employers and other appropriate stakeholders to ensure the quality of apprenticeship training programs.
- ensures all apprentices are appropriately registered and records are maintained as required.
- schedules all necessary technical training periods for apprentices to complete requirements for certification.
- administers level, provincial and interprovincial examinations.

### **The Provincial Apprenticeship and Certification Board:**

- sets policies to ensure the provisions of the **Apprenticeship and Certification Act (1999)** are implemented.
- ensures advisory and examination committees are established and maintained.
- accredits institutions to deliver apprenticeship training programs.
- designates occupations for apprenticeship training and/or certification.