



INSULATOR (HEAT AND FROST) 2016

Based on the New Brunswick Curriculum Standard
pg. 6 for Program Structure



PREFACE

This Apprenticeship Standard is based on the 2000 edition of the National Occupational Analysis for the Insulator (Heat & Frost) trade. This document describes the curriculum content for the Insulator (Heat & Frost) apprenticeship training program and outlines each of the technical training units necessary for the completion of apprenticeship.

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PROGRAM CONTENT

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PROGRAM OUTCOMES

Upon completion of the Insulator (Heat and Frost) program, students will have demonstrated the knowledge and skills required to perform the following tasks:

- Task 1 Determines administrative requirements.
- Task 2 Determines production requirements.
- Task 3 Determines site specific requirements.
- Task 4 Checks substrate fro readiness.
- Task 5 Cleans up site after jobs.
- Task 6 Insulates for thermal applications.
- Task 7 Fabricates insulation for tanks, vessels and fittings.
- Task 8 Fabricates removable covers.
- Task 9 Installs protective coverings.
- Task 10 Applies sealants.
- Task 11 Insulates for refractory applications. (1 500°F +).
- Task 12 Insulates for cryogenic applications. (-150°F to absolute zero).
- Task 13 Installs underground insulating systems.
- Task 14 Insulates for sound proofing. (Industrial Application)
- Task 15 Applies fire proofing materials.
- Task 16 Insulates plumbing systems.
- Task 17 Insulates mechanical systems.
- Task 18 Insulates HVAC (heating, ventilation, and air conditioning) systems.
- Task 19 Insulates fittings.
- Task 20 Installs finishing materials.
- Task 21 Insulates for sound proofing. (Commercial Application)
- Task 22 Determines scope of work (unique to this area of the trade).
- Task 23 Removes asbestos in high risk conditions.
- Task 24 Performs maintenance repair.
- Task 25 Encloses asbestos.
- Task 26 Encapsulates asbestos.
- Task 27 Sprays insulations.
- Task 28 Sprays sealers and coatings.
- Task 29 Maintains spray equipment.
- Task 30 Determines required fire stopping system.
- Task 31 Installs fire stopping.

NOVA SCOTIA PROGRAM STRUCTURE

The courses listed below are required technical training in the Nova Scotia Insulator (Heat and Frost) Apprenticeship Program.

LEVEL 1 (6 weeks)			
Code	Title	Suggested Hours	Page #
MENT-1801	Workplace Mentoring I (NS Specific)	N/A	9
INS-100	Safety Measures in Construction	20	10
INS-105	Hand and Power Tools	5	13
INS-110	Shop Tools and Equipment	5	14
INS-115	Math for Insulators	30	15
INS-120	Insulation Principles	10	17
INS-125	Insulation Materials	10	19
INS-130	Insulation Practices	5	21
INS-135	Introduction to Pipe and Piping Systems	10	22
INS-140	Installing Pipe Insulation	40	23
INS-145	Hot Work Practices	20	25
INS-150	Introduction to Asbestos	15	26
INS-155	Asbestos Removal	20	28

LEVEL 2 (6 weeks)			
Code	Title	Suggested Hours	Page #
INS-165	Trade Math	30	31
INS-170	Introduction to Foam Insulation	10	33
INS-175	Installation of Flexible Foam Insulation	20	34
INS-180	Air Handling System Components	10	36
INS-185	Blanket Insulation	10	37
INS-190	Fibrous Board Insulation	10	38

LEVEL 2 (6 weeks) ...cont'd			
Code	Title	Suggested Hours	Page #
INS-195	Insulating Breeching, Flues and Precipitators	10	39
INS-200	Insulating Methods (Cylinders and Heads)	20	40
INS-205	Finishing Methods	15	42
INS-210	Introduction to Cryogenic Work	10	43
INS-215	Insulating Cryogenic Systems	20	44
INS-220	Insulate Underground Piping	20	46

LEVEL 3 (7 weeks)			
Code	Title	Suggested Hours	Page #
MENT-1802	Workplace Mentoring II (NS Specific)	N/A	48
INS-160	Blueprint Reading 1	30	49
INS-260	Blueprint Reading 2	30	51
INS-225	Introduction to Parallel Line Development	10	53
INS-230	Introduction to Radial Line Development	10	54
INS-235	Introduction to Triangulation	10	55
INS-240	Tees, Valves and Elbows	20	56
INS-245	Flanges and End Caps	20	58
INS-250	Cones, Bevels and Transitions	20	59
INS-255	Tank Heads	10	61
INS-275	Firestopping	20	62
INS-1830	Program Review	30	64

LEVEL 1

MENT-1801

Workplace Mentoring I (Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for learning workplace skills.
- Demonstrate strategies to assist in learning skills in the workplace.

Objectives and Content:

1. Describe the importance of your own experiences.
2. Identify the partners involved in apprenticeship.
3. Describe the shared responsibilities for workplace learning.
4. Determine your own learning preferences and explain how these relate to learning new skills.
5. Describe the importance of different types of skills in the workplace.
6. Describe the importance of essential skills in the trade.
7. Identify different ways of learning.
8. Identify your learning preferences.
9. Identify different learning needs and strategies to meet learning needs.
10. Identify techniques for effective communication.
11. Identify strategies to assist in learning a skill.

Resource:

- Recommended resource to use in the delivery of this unit:
www.apprenticeship.nsc.ca/mentoring/apprentice.htm

INS-100 Safety Measures in Construction

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will have an understanding of safety practices and procedures as well as an understanding of applicable regulations.

Objectives and Content:

1. Explain the role that safety plays in the construction industry.
 - i) increased need for safety awareness and enforcement
 - ii) terms used in provincial regulations

2. Identify what job-site safety means.
 - i) company safety policies vs. OHS regulations
 - ii) reporting injuries, accidents and incidents
 - iii) employee responsibilities
 - iv) employer responsibilities

3. Identify causes of job site accidents.
 - i) failure to communicate
 - ii) poor work habits
 - iii) alcohol or drug abuse
 - iv) lack of skill
 - v) intentional acts
 - vi) unsafe acts
 - vii) unsafe conditions

4. Describe appropriate safety precautions around common job-site hazards.
 - i) welding
 - ii) motorized vehicles
 - iii) overhead work

5. Explain proximity work.
 - i) safe working distance

6. Identify practices for working safely with common job hazards.
 - i) lock-out / tag-out procedures
 - ii) barriers and barricades

7. Identify proper procedures for lifting heavy objects.
 - i) consequences of back injury
 - ii) posture

- iii) moving cumbersome loads
8. Identify safety measures for working in confined space.
- i) define confined space
 - ii) air sampling
 - iii) work permit
 - iv) emergency intervention
9. Identify safe practices around ladders and scaffolds
- i) safety rules and regulations
 - ii) aerial work (working in elevated locations)
 - iii) ladders
 - types
 - inspection
 - maximum intended load
 - iv) scaffolds
 - types
 - inspection
 - tagging as per OSHA standards
 - v) use of top rails, mid rails, toe boards, cross bracing and planks or platforms
10. Identify basic electrical safety guidelines
- i) proper handling of electric tools in hazardous areas
 - ii) working near energized equipment
 - safe working distance
 - iii) procedures if worker is shocked
11. Describe the procedures to use and care for personal protective equipment (PPE).
- i) PPE applications
 - ii) hard hats
 - iii) safety glasses and goggles
 - iv) gloves
 - v) safety shoes
 - vi) hearing protection
 - vii) respiratory protection
 - viii) fall arrest system
 - safety harness
12. Identify components of WHMIS.
- i) WHMIS labels
 - ii) MSDS (Material Safety Data Sheet)
13. Explain responsibilities as they relate to WHMIS.
- i) supplier's responsibilities
 - ii) employer's responsibilities

- ii) employee's responsibilities
14. Identify fire related safety precautions.
- i) components of fire (fire triangle)
 - fuel
 - heat
 - oxygen
 - ii) fire prevention techniques
 - fire watch
 - use of flammable products
 - storage of combustible materials
15. Identify the types of fire extinguishers and their applications.
- i) classes of fire
 - ii) procedures to extinguish fires using an extinguisher
16. Describe safety procedures used in the shop.
- i) location of emergency exits
 - ii) emergency phone numbers
 - iii) head count procedures
 - iv) developing escape route

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Use fire extinguishers.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify, use, and maintain hand and power tools.

Objectives and Content:

1. Identify common hand tools.
 - i) hammers and mallets
 - ii) screw drivers
 - iii) pliers and wire cutters
 - iv) levels
 - v) squares
 - vi) measuring tools
 - vii) clamps and temporary holding devices
 - viii) saws
 - ix) banding gear
 - x) sheet metal shears
 - aviation snips
 - metal cutting snips
2. Describe the procedures to use and maintain various hand tools.
3. Identify common power tools.
 - i) drills and drill bits
 - ii) saws
 - electric shears
 - circular saw
 - iii) hand grinder
 - iv) stud and pin welder
4. Describe the procedures to use and maintain power tools.
5. Identify safety consideration when using hand and power tools.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

INS-110

Shop Tools and Equipment

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify, use, and maintain shop tools and equipment.

Objectives and Content:

1. Identify various shop tools and equipment.
 - i) lock former
 - ii) EZ edger
 - iii) combination machine (Beader/Crimper)
 - iv) sheet metal break
 - v) metal shear
 - vi) metal roller
 - vii) band saw
 - viii) pedestal grinder
2. Describe the procedures to operate shop tools and equipment.
3. Identify maintenance procedures for shop tools and equipment.
4. Identify safety precautions to be considered when working with shop tools and equipment.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to demonstrate knowledge of basic mathematical operations.

Objectives and Content:

1. Describe the procedures to perform basic math functions using whole numbers.
 - i) addition
 - ii) subtraction
 - iii) multiplication
 - iv) division
2. Describe the procedures to perform basic math functions using fractions.
 - i) addition
 - ii) subtraction
 - iii) multiplication
 - iv) division
3. Describe the procedures to perform basic math functions using decimals.
 - i) addition
 - ii) subtraction
 - iii) multiplication
 - iv) division
4. Describe the procedures to convert the following:
 - i) common fraction to decimal
 - ii) decimal to fraction
 - iii) decimal to nearest practical fraction
5. Describe the procedures to perform math calculations involving percentages and ratio.
 - i) calculating ratio and proportion
 - ii) converting percent to decimal or fraction
 - iii) determining percent of one number is of another
 - iv) determining base given rate and percentage
6. Describe the procedures to calculate perimeter, area and volume of simple shapes.
 - i) perimeter
 - rectangle
 - triangle
 - circle (circumference)

- ii) area
 - rectangle
 - triangle
 - circle
 - iii) volume
 - rectangular vessel
 - spherical vessel
 - cylindrical vessel
7. Describe the procedures to calculate surface area of solids.
- i) rectangular shapes
 - ii) cylindrical shapes
 - excluding ends
 - including ends
 - iii) conical shapes
 - iv) spherical
8. Describe the procedures to perform metric to imperial conversions and imperial to metric conversions.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Perform calculations.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to demonstrate general knowledge of insulating principles and identify systems requiring insulation.

Objectives and Content:

1. Define terminology relating to the insulating occupation.
 - i) heat related terms
 - ii) cold related terms
 - iii) thermal temperature range
2. Describe the principles and function of insulation.
3. Identify the factors to be considered in selection of insulation.
 - i) insulating ability
 - ii) temperature
 - ambient temperature
 - service temperature
 - iii) location
 - iv) durability
 - v) compatibility
 - vi) cost
4. Identify the various systems requiring insulation.
 - i) commercial
 - plumbing
 - domestic hot and cold water lines
 - roof drains
 - heating
 - boiler
 - piping
 - vessels
 - chilled water lines
 - ducts
 - emergency generators
 - ii) industrial
 - process piping systems
 - large and small vessels
 - boilers
 - breaching
 - stacks

- precipitators
- tanks

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit.
Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify insulation materials and accessories and describe procedures for their usage.

Objectives and Content:

1. Identify insulation materials and their characteristics.
 - i) composition
 - fibrous
 - cellular
 - granular
 - ii) configurations
 - iii) characteristics
 - iv) temperature range
 - upper limit
 - lower limit

2. Identify application materials and where they are used.
 - i) wires
 - ii) bands
 - iii) adhesives
 - iv) tape
 - v) screws
 - vi) rivets
 - vii) tacks
 - viii) hog rings

3. Identify coverings, finishes and sealants used in insulating.
 - i) bore coatings
 - ii) adhesives
 - iii) mastics
 - iv) reinforcement materials
 - v) cements
 - vi) jacketing materials
 - vii) protectors

4. Identify the procedures for handling, storing and distributing insulation materials.
 - i) delivery
 - ii) stacking
 - iii) storage
 - iv) moving materials

- v) proper housekeeping procedures

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe basic procedures for insulating at various temperature ranges.

Objectives and Content:

1. Define terminology associated with insulating procedures.
 - i) convection
 - ii) calorie
 - iii) conduction
 - iv) radiation
 - v) heat
 - vi) temperature

2. Describe the basic procedures involved in insulating.
 - i) moderate temperature
 - ii) hot temperature
 - iii) cold - low temperature
 - vapour barrier

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify and describe piping systems that require insulating.

Objectives and Content:

1. Identify the types of pipes and their characteristics.
 - i) types of pipe
 - heat traced piping
 - ii) thermal expansion of pipe for hot systems

2. Identify the components of a piping system.
 - i) straight thermal piping
 - ii) joints
 - iii) irregular surfaces
 - connectors
 - valves
 - fittings
 - iv) hangers
 - clevis hanger
 - pipe shoe on roller support
 - contact hangers

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Identify various piping systems, connectors, tees, valves and hangers.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to demonstrate knowledge required to install pipe insulation.

Objectives and Content:

1. Describe the procedures for installing plain insulation (no jacketing) on a straight run of pipe.
 - i) hot piping systems
 - ii) install with tape, wire or bands
 - iii) establish stagger pattern
2. Describe the procedure used to apply fibreglass insulation with all service jacket (ASJ).
 - i) butt strips
 - ii) staples
 - iii) self sealing lap (SSL)
3. Describe the procedures for trimming insulation.
 - i) pipe welds
 - ii) bevel for flanged fittings
4. Describe the procedures for insulating at hangers.
 - i) contact hangers
 - ii) clevis hangers
 - iii) pipe shoe on roller supports
 - iv) anchors
5. Describe the procedures for insulating pipefittings, valves and flanges.
 - i) factory moulded or machined
 - PVC (polyvinyl chloride)
 - ii) mitered segments
 - long and short radius elbows
 - determine size and number of miters
 - methods of measuring and cutting miter
 - methods of attaching miter sections
 - iii) built up insulation covers
 - blanket
 - cement
 - iv) insulating at Tees @ 90°
 - equal
 - unequal

- v) insulating laterals
 - equal
 - unequal
 - vi) in-line flanges
 - vii) insulating valves
 - body
 - bonnet
 - viii) insulating reducer
6. Describe the procedures to finish insulated pipe.
- i)unjacketed
 - ii) cloth jacketing or reinforced mastic (canvas)
 - iii) plastic jacketing
 - iv) metal jacketing

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit.
Suggested practical projects include:

1. Insulate various size pipes; apply canvas finish to pipe coverings; apply vapour barrier to various pipe insulation and PVC finish.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify hot work and describe procedures to work safely in hot work environments.

Objectives and Content:

1. Define “hot work” and its relation to the insulator occupation.
2. Describe the health effects that can result when working in hot work environments.
 - i) body’s ability to cool itself
 - blood circulation
 - sweating
 - ii) effect of hot work on the body’s cooling system
 - metabolic heat
 - iii) heat disorders
 - symptoms
 - treatments
3. Describe the procedures to prevent heat disorders when working in hot work environments.
 - i) workplace prevention
 - hot work supervisor
 - schedules
 - worker’s records
 - ii) monitoring hot work areas
 - wet bulb globe thermometer
 - determine stay times
 - acclimatization
 - iii) personal prevention
 - knowledge of personal medical/work history
 - knowledge of personal limits

Practical Projects:

Practical skills enhance the apprentice’s ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify asbestos types and describe procedures to work safely with asbestos.

Objectives and Content:

1. Identify the types of asbestos and their characteristics.
 - i) dangers of asbestos
 - why asbestos is dangerous
 - when asbestos is dangerous
 - ii) possible locations of asbestos
 - iii) safe identification of asbestos
 - bulk samples
 - lab reports
 - iv) other safety issues relating to asbestos removal
 - heat
 - chemicals
 - electric shock
 - fire
 - tight places
 - scaffolds and ladders
 - slipping and tripping

2. Describe personal health and medical issues relating to asbestos.
 - i) symptoms and effects of asbestos on the body
 - latency period (how long it takes to get sick from exposure)
 - amount of asbestos that can cause illness
 - ii) functions of the human respiratory system
 - iii) effects of smoking in relation to asbestos exposure
 - iv) medical exams for workers exposed to asbestos
 - timing and frequency of exams
 - what should be included in the medical exam
 - keeping records of medical exams
 - employee
 - employer
 - physician

3. Identify types of personal protective equipment used in asbestos work.
 - i) respirators
 - ii) disposable suits
 - iii) boots (rubber)

- iv) specialty PPE for hot work
4. Identify the types of respirators used on asbestos abatement.
 - i) Air Purifying Respirator (APR)
 - ii) Supplied Air Respirator (SAR)
 5. Describe the procedures used to ensure use of a respirator is possible.
 - i) tests to ensure proper fit
 - qualitative test
 - quantitative test
 - negative pressure and positive pressure test
 6. Describe the procedures used to determine which respirator is suitable for the job.
 - i) protection factor of respirator
 - ii) maximum use level (MUL)
 7. Describe the procedures used to inspect, care for and maintain respirators.
 8. Identify equipment used in asbestos abatement.
 - i) negative air machine
 - purpose
 - function
 - determining volume of air required
 - calculating number of machines required
 - ii) HEPA Vacs
 - HEPA filters on power tools
 - HEPA filters in vacuum cleaners
 9. Describe the procedures used to control asbestos.
 - i) enclosure
 - ii) encapsulation
 - iii) repair
 - iv) removal
 - v) operations and maintenance program

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Visual aids.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe procedures used to remove asbestos.

Objectives and Content:

1. Describe the procedures to set-up for asbestos abatement.
 - i) air sampling before set-up
 - ii) PPE required
 - iii) pre-cleaning work area
 - iv) posting of signs
 - v) electrical and ventilation shut-down
 - vi) moving in large equipment
 - vii) set-up of De-con Unit
 - viii) containing work area
 - critical barriers
 - ix) entering and exiting work area
 - pre-planned escape route
 - x) placement and hook-up of negative air machines
 - xi) identification of possible changes required for set-up in hot work area
 - fire and heat resistant material
 - increased number of negative air machines

2. Describe methods used for removing asbestos.
 - i) air sampling during removal
 - area sampling
 - personal air monitoring
 - ii) removing asbestos from walls, ceilings and pipes
 - keeping out of the air
 - keeping asbestos wet
 - iii) variations to normal procedures for hot work removal
 - dry removal
 - special tools
 - vacuum loaders
 - bagging of asbestos waste

3. Describe the procedures for clean-up and disposal of asbestos.
 - i) bagging of asbestos waste
 - type of bag
 - proper loading
 - ii) cleaning work area

- spray lock down
 - take down poly
 - dispose with other asbestos containing materials
 - waste load out
 - iii) disposal of asbestos waste once it leaves the job site
 - air-tight containers
 - properly labeled
 - approved sanitary land fill
 - iv) air sampling upon job completion
 - aggressive air sampling
 - clearance air test
4. Describe removal procedures for maintenance related (small) jobs.
- i) mini enclosure
 - ii) glove bags

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Set up a temporary asbestos enclosure and demonstrate proper asbestos removal procedures.

LEVEL 2

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to calculate quantities and solve problems relating to the application of insulation materials and accessories.

Objectives and Content:

1. Describe the procedures used to calculate insulation quantities for rectangular shapes.
 - i) exterior of duct
 - ii) interior of duct
 - excluding ends
 - including ends
 - bends in duct

2. Describe the procedures used to calculate insulation quantities for circular shapes.
 - i) exterior of duct
 - ii) interior of duct
 - excluding ends
 - including ends
 - bends in duct

3. Describe the procedures used to calculate insulation quantities using board foot measurements.
 - i) total board feet required
 - ii) number of cartons required

4. Describe the procedures used to solve problems involving band spacing.
 - i) length of bands
 - ii) number of bands

5. Describe the procedures used to calculate the length of jacketing required to finish rectangular shapes.
 - i) canvass
 - shrinkage
 - ii) metal jacketing
 - iii) plastic jacketing

6. Describe the procedures used to calculate the length of jacketing required to finish cylindrical shapes.

- i) canvass
 - shrinkage
 - overlap
 - ii) metal jacketing
 - hem
 - overlap
 - iii) plastic jacketing
 - overlap
7. Describe the procedures used to calculate the number of pieces of jacketing required to finish cylindrical or rectangular shapes.
- i) canvass
 - ii) metal jacketing
 - iii) plastic jacketing
8. Describe the procedures used to calculate the total area of finish covering required.
- i) canvass
 - width of canvass
 - shrinkage
 - overlap
 - ii) metal jacketing
 - hem
 - overlap
 - iii) plastic jacketing
 - overlap

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Perform calculations.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify and describe applications and characteristics of foam insulation.

Objectives and Content:

1. Identify the characteristics and applications of elastomeric foam insulation.
2. Identify and describe the forms of foam insulation.
 - i) pipe
 - ii) sheet
 - iii) rolls
3. Identify types and characteristics of adhesives used on flexible foam insulation.
 - i) contact type
 - ii) safe use
 - flammable when wet

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe procedures used to install flexible foam insulation and its accessories.

Objectives and Content:

1. Describe the procedures used to install flexible foam insulation using the slip on insulation method.
 - i) insulating pipe fittings
 - tees
 - ells
2. Describe the procedures used to insulate screwed fittings.
3. Describe the procedures used to apply slit tubes.
4. Describe the procedures used to create fitting covers from pipe insulation.
 - i) single miter (stove pipe) fitting covers.
 - sweated joints
 - screwed joints
 - ii) sleeve types fitting covers
 - 90° ells
 - cross fittings
 - 45° ells
 - laterals
 - tees and valves
5. Describe the procedures used to create and apply sheet fabricated fitting covers.
 - i) lay-out short of long radius ells
 - use manufacturer's templates (available for most common fittings)
 - use charts for measurements
 - take measurements from pipe
 - ii) apply fitting cover to short or long radius ells
 - before or after adjacent pipe insulation
 - iii) fabricate flanged valve covers
 - donuts
 - build out valve body
 - measure flange circumference
 - measure and cut insulation to fit valve body
 - measure and cut insulation to fit bonnet

6. Describe the procedures used to install flexible foam insulation at hangers.
 - i) high density inserts
 - ii) metal shields
 - iii) vapor barrier

7. Describe the procedures used to install flexible foam sheets to ductwork and equipment.
 - i) determine cut sizes
 - ii) apply adhesive to both surfaces
 - iii) use compression joints for butt joints
 - iv) standing seams
 - v) apply protective coatings

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Install flexible foam insulation to copper pipes and various pieces of equipment.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify and describe air handling systems and components related to the Insulator occupation.

Objectives and Content:

1. Identify the various types of air handling systems and their applications.
2. Identify and describe components of an air handling system (HVAC).
 - i) fresh air intake
 - ii) supply air
 - iii) return air
 - iv) relief air
 - v) exhaust air
 - vi) main (trunk)
 - vii) riser
 - viii) branch
 - ix) branch
 - x) run-out
 - xi) diffuser

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe the procedures for installing blanket insulation.

Objectives and Content:

1. Describe the procedures for measuring and cutting fibrous blanket.
 - i) calculate perimeter or circumference of duct
 - ii) make allowances for insulation thickness
 - iii) add for overlap

2. Describe the procedures used to apply blanket duct insulation.
 - i) application methods
 - straight duct
 - duct bends
 - elbow on round duct
 - miter segments (gores)
 - reducers
 - ii) fastening methods

3. Describe the procedures of sealing to provide vapour barrier.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Apply blanket insulation to straight ducts, duct bends, elbows, reducers and transitions.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe the procedures for installing fibrous board insulation.

Objectives and Content:

1. Describe the procedures for measuring and cutting fibrous board.
 - i) measure duct and make allowances for thickness of insulation
 - ii) cut to leave little waste
 - iii) kerfing or v-groove tool
2. Describe the procedures used to install board insulation on rectangular duct.
 - i) fastening procedures
 - ii) applying insulation to elbows
 - iii) applying insulation to standing ribs and stiffeners
3. Describe the procedures used to install board insulation on round or oval duct.
 - i) placement and cutting of v-grooves
 - ii) calculating circumference of insulated duct
 - iii) cutting mitre segments for elbows
4. Describe the procedures used to seal fiberglass board.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Insulate fibrous board insulation on duct work and demonstrate techniques for elbows, transitions, hangers, ribs and standoffs.

INS-195 Insulating Breeching, Flues and Precipitators

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe the procedures used to insulate breechings and the use of associated equipment.

Objectives and Content:

1. Describe the procedures used to provide air space.
 - i) rectangular surface
 - ii) cylindrical surface

2. Describe the procedures to insulate round breechings.
 - i) apply blanket or rigid-wrap
 - using bands
 - using metal mesh blanket

3. Describe the procedures used to insulate rectangular breechings.
 - i) applying block insulation
 - ii) fastening methods
 - stand-offs

4. Describe the procedures for pin welding.
 - i) types of pin welders
 - Capacitor Discharge (CD)
 - Stud Weld
 - ii) types of pins and studs
 - iii) placement of pins

5. Describe the procedures used to finish ducts and breechings.
 - i) applying canvass
 - ii) applying PVC
 - iii) applying metal jacketing

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

INS-200 Insulating Methods (Cylinders and Heads)

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe the procedures used to insulate tank heads and cylinders with rigid and flexible insulation.

Objectives and Content:

1. Describe the procedures used to insulate cylinders with rigid insulation.
 - i) measure and cut lags
 - calculate lag size
 - given diameter
 - given circumference
 - calculate bevel on lag
 - ii) score or kerf board insulation
 - iii) create expansion joints for hot work
 - iv) fastening insulation to substrate surface
 - v) temporary holding of materials
 - vi) cylinder legs or supports
 - vii) use of chokers

2. Describe the procedures used to insulate tank heads with rigid insulation.
 - i) types (shapes) of tank heads
 - ii) top heads
 - application of insulation to large and small heads
 - iii) bottom heads
 - chokers and pigtail wires
 - iv) on hot work
 - v) on cold work

3. Describe the procedures used to insulate cylinders with flexible fibrous insulation.
 - i) proper installation methods
 - ii) use of support bars on large diameter vessels
 - iii) insulating tank head with flexible fibrous insulation

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit.

Suggested practical projects include:

1. Calculate insulation requirements for tank mock-up; insulate body of tank; apply flexible and rigid insulation to tank heads.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe the procedures used to apply finishes to tank heads and cylinders.

Objectives and Content:

1. Describe the procedures used to finish tank heads.
 - i) apply canvass
 - ii) apply mastic
 - iii) apply metal gores

2. Describe the procedures used to finish bodies of cylinders.
 - i) apply canvass
 - ii) apply metal jacketing
 - iii) apply plastic jacketing

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Apply canvass, mastic, metal gores, metal jacketing and plastic jacketing.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to understand and describe the properties of cryogenic work and identify the types of insulation material used in cryogenic work.

Objectives and Content:

1. Define cryogenic work
2. Explain the importance vapour pressure plays in cryogenic insulation work.
3. Identify the types of insulation material used in cryogenic temperature ranges.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe the procedures used to insulate cryogenic systems.

Objectives and Content:

1. Describe the procedures used to install cellular glass or rigid foam to pipes and equipment for cryogenic service.
 - i) all joints staggered
 - ii) applied in several layers
 - iii) sealing joints
 - iv) vapour stops
 - v) expansion/contraction joints
 - vi) at pipe supports and hangers
 - vii) external vapour barrier required

2. Describe the procedures used to insulate pipe connectors between prefabricated insulated pipe sections.
 - i) foam in place
 - calculate volume required
 - factor expansion rate of foam
 - snap time of foam product
 - forms required
 - methods to deliver foam

3. Describe the procedures to insulate pipe by foaming in place.
 - i) setting of forms
 - ii) delivery of foam product

4. Describe the procedures used to insulate a tank shell using particulate insulation.
 - i) application of particulate
 - ii) sealing the vessel once insulation is in place

5. Describe the procedures used to insulate pipes or equipment by packing in mineral wool.
 - i) equipment or pipes encased in metal box
 - mineral wool packed to desired density

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Apply cellular glass and rigid foam to piping systems.

INS-220

Insulate Underground Piping

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe the procedures used to insulate, seal, and finish underground piping.

Objectives and Content:

1. Describe the procedures used to insulate underground piping using pipe covering.
 - i) application procedures
 - ii) insulating connectors

2. Describe the procedures used to seal and finish underground piping.
 - i) lines
 - reinforced laminated asphalt based jacket
 - primer and membrane
 - polyethylene film
 - ii) connectors

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

LEVEL 3

MENT-1802

Workplace Mentoring II (Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for teaching workplace skills.
- Demonstrate strategies to assist in teaching skills in the workplace

Objectives and Content:

1. Describe the impact of your own experiences in teaching skills.
2. Identify the different roles played by a workplace mentor.
3. Describe the six-step approach to teaching skills.
4. Explain the importance of identifying the point of the lesson.
5. Identify how to choose a good time to present a lesson.
6. Explain the importance of linking the lessons.
7. Identify the components of the skill (the context).
8. Describe considerations for demonstrating a skill.
9. Identify types of skill practice.
10. Describe considerations in setting up opportunities for skill practice.
11. Explain the importance of providing feedback.
12. Identify techniques for giving effective feedback.
13. Describe a skill assessment.
14. Identify methods of assessing progress.
15. Explain how to adjust a lesson to different situations.

Resource:

Recommended resource to use in the delivery of this unit:

www.apprenticeship.nsc.ca/mentoring/apprentice.htm

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify and interpret basic information from blueprints or drawings.

Objectives and Content:

1. Identify and describe the components of a blueprint or drawing.
 - i) title block
 - ii) name
 - iii) address
 - iv) date
 - v) material
 - vi) system
 - vii) view
 - viii) measurements
 - ix) orientation
 - x) north
 - xi) elevation orientation

2. Identify and describe basic architectural symbols.
 - i) earth
 - ii) concrete
 - iii) block
 - iv) metal
 - v) structural steel
 - vi) wood
 - vii) gyproc over wood
 - viii) insulation
 - ix) windows, doors

3. Identify and describe different projections and drawings.
 - i) orthographic projections
 - multi-view
 - ii) pictorial drawings
 - perspective drawings
 - oblique drawings
 - isometric drawings
 - iii) general arrangements
 - iv) plot plans

4. Identify and describe different types of elevation views and details.

- i) elevations
 - ii) sections and details
5. Describe the procedures used to determine measurements from scaled drawings.
- i) the alphabet of lines
 - center line
 - hidden line
 - cutting plane line
 - break line
 - dimension line
 - extension line
 - object line
 - leader line
 - ii) scaling a dimension
 - scales
 - ratios
 - imperial/metric scales
 - using a scale

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Identify and interpret information found on drawings; scale footages for insulation purposes.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to demonstrate knowledge required to read and interpret information from related construction drawings.

Objectives and Content:

1. Read architectural drawings.
 - i) architectural sheets
 - eight items of information
 - ii) architectural drawings
 - know way around
 - quickly find out general information about building new to them

2. Read structural drawings.
 - i) use structural drawings
 - proper manner
 - find information
 - correctly interpret elevation markings
 - identify steel beams by codes
 - marked on structural drawings

3. Read plumbing drawings.
 - i) use plumbing drawings
 - ii) find necessary information
 - domestic water system
 - hot water
 - cold water
 - drainage
 - sewer connections
 - iii) read plumbing drawings to determine
 - lines need to be insulated
 - line not to be insulated

4. Read electrical drawings.
 - i) read electrical drawings to
 - find where the heat tracing is being used
 - ii) exhaust pipe on emergency generator to be insulated
 - carrying out asbestos abatement work
 - electrical drawings are used to
 - determine fixtures to be removed

- power outlets to be located
5. Read mechanical drawings.
 - i) use mechanical drawings to find information on
 - insulation requirements of various sections of the HVAC system
 - what parts of that system require insulation to be installed
 6. Read ductwork drawings.
 - i) read drawings to find information regarding ductwork
 7. Read pipe drawings.
 - i) read drawings to find information regarding piping

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Identify and interpret information found on drawings.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to demonstrate knowledge of parallel line development, identify types of applicable layouts, and describe procedures used to perform parallel line development.

Objectives and Content:

1. Describe parallel line development.
2. Describe the procedures for parallel line development.
3. Identify the basic geometry skills required for parallel line development.
4. Identify the necessary views of object required for parallel line development.
5. Identify the types of layout that can be produced by parallel line development.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to demonstrate knowledge of radial line development, identify types of applicable layouts, and describe procedures used to perform radial line development.

Objectives and Content:

1. Describe radial line development.
2. Describe the procedures used for radial line development.
 - importance of the apex
3. Identify the basic geometry skills required for radial line development.
4. Identify the necessary views of object required for radial line development.
5. Identify the types of layouts that can be produced by radial line development.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to demonstrate knowledge of triangulation, identify types of applicable layouts, and describe procedures used to perform triangulation.

Objectives and Content:

1. Describe triangulation.
2. Describe the procedures for triangulation.
 - i) true length lines
 - ii) Pythagorean theorem
3. Identify the basic geometry skills required for triangulation.
4. Identify the necessary view of object required for triangulation.
5. Identify the types of layouts that can be produced by triangulation.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe procedures used to develop patterns for tees, valves, and elbows.

Objectives and Content:

1. Describe the procedures used to develop patterns for equal tee or valve.
 - i) layout template
 - ii) layout pattern for main or body
 - iii) layout pattern for branch or bonnet
 - iv) demonstrate how to provide for water-shed

2. Describe the procedures used to develop patterns for unequal tee or valve.
 - i) layout template
 - ii) layout pattern for main or body
 - iii) layout pattern for branch or bonnet
 - iv) demonstrate how to provide for water-shed

3. Describe the procedures used to develop patterns for long radius elbow.
 - i) use of mitre charts
 - ii) basic layout
 - radius of elbow
 - allowances for bead and crimp
 - iii) stretch out for gores
 - identify right and left gores

4. Describe the procedures to develop patterns for segmented (stove pipe) elbow.
 - i) basic layout
 - allowances for bead and crimp
 - ii) stretch out for gores

5. Describe the procedures to develop patterns for short radius elbow
 - i) basic layout
 - radius of elbow
 - allowances for bead and crimp
 - ii) stretch out for gores
 - iii) layout of butterfly throat

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Layout patterns for tees and elbows.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe procedures used to develop patterns for flanges and end-caps.

Objectives and Content:

1. Describe the procedures to develop patterns for flanges.
 - i) three partial patterns
 - ii) flange thickness
 - iii) edge covers
 - iv) adjoining pipe
 - v) demonstrate how to provide for water-shed
 - vi) tools and equipment required to finish and apply finished product to the insulated surface.

2. Describe the procedures to develop patterns for end-caps.
 - i) one piece end-cap
 - ii) two piece end-cap

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Develop patterns for flanges and end-caps.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe procedures used to layout and develop patterns for cones, bevels, and transitions.

Objectives and Content:

1. Describe the procedures used to produce layout for 45° bevel.
 - i) drawn with a series of concentric circles
 - ii) identify measurements required
 - iii) calculation of the size of material required for pattern layout
 - iv) allowances for bead and crimp
 - v) tools and equipment required to finish and apply the finished product to the insulated surface

2. Describe the procedures used to develop pattern for a cylindrical cone (concentric reducer).
 - i) identify measurement required
 - ii) calculation of the size of material required for pattern layout
 - iii) describe how to finish pattern for water-shed and adjoining pieces.
 - iv) tools and equipment required to finish and apply the finished product to the insulated surface.

3. Describe the procedures used to develop pattern for square to square concentric reducer.
 - i) identify measurements required
 - ii) calculation of the size of material required for pattern layout
 - iii) describe how to finish pattern for water-shed and adjoining pieces
 - iv) tools and equipment required to finish and apply the finished product to the insulated surface.

4. Describe the procedures used to layout pattern for square to round or round to square transition.
 - i) using triangulation method of development
 - ii) using radial line development
 - iii) identify which views are required
 - iv) identify measurements required
 - v) calculation of the size of material required for pattern layout
 - vi) describe how to finish pattern for water-shed and adjoining pieces
 - vii) tools and equipment required to finish and apply the finish product to the insulated surface.

5. Describe how to layout pattern for eccentric reducing cones.
 - i) using triangulation method of development
 - ii) using radial line development
 - iii) identify which views are required
 - iv) identify measurements required
 - v) calculation of the size of material required for pattern layout
 - vi) describe how to finish pattern for water-shed and adjoining pieces
 - vii) tools and equipment required to finish and apply the finish product to the insulated surface.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Lay out patterns and calculate their surface areas.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to describe procedures used to layout patterns for tank heads.

Objectives and Content:

1. Describe the procedures used to layout pattern for tank heads.
2. Explain the use of starter piece, center piece and anchor strips.
3. Identify starter gore, closing gore, right and left gores.
4. Explain the steps to do a snap line head gore.
 - i) identify measurements required
 - ii) transfer measurements to layout
 - iii) allowance for bead and crimp
5. Describe layout for flat or conical head gores.

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Make and apply gores to tank heads.

Learning Outcomes:

Upon the successful completion of this unit, the apprentice will be able to identify and explain the characteristics of firestopping materials and describe the procedures to install firestopping.

Objectives and Content:

1. Explain the basics of firestopping.
 - i) introduction to firestopping
 - various definitions
 - process
 - approved
 - installations
 - materials
 - responsibilities of
 - stakeholders involved in the firestopping industry

2. Identify firestopping materials.
 - i) firestopping materials
 - different types
 - intumescent
 - endothermic material
 - silicones
 - grout
 - nonburnable materials
 - firestopping systems

3. Describe how to install firestopping.
 - i) install firestopping
 - methods
 - product information
 - safety concerns during installation
 - ii) installing damming materials
 - iii) installing liquid foams
 - iv) temporary forms
 - v) placing the liquid
 - vi) calculating volume to be filled
 - vii) calculating amount of mix
 - viii) installing intumescent materials
 - ix) installing wrap strip
 - x) installing aluminum tape

- xii) proper way to finish the job
 - xii) composite sheet
4. Describe firestopping systems.
- i) various systems
 - ii) methods to select proper system

Practical Projects:

Practical skills enhance the apprentice's ability to meet the objectives of this unit. Suggested practical projects include:

1. Apply firestop material to various penetrations.

INS-1830

Program Review

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Upon successful completion of this unit, the apprentice will complete a study plan based on the National Occupational Analysis.

Objectives and Content:

1. Identify areas of the program where knowledge of theory is weakest.
2. Identify areas where workplace experience is lacking or weak.
3. Identify resources necessary to address areas of shortfall.
4. Identify timelines to address areas of weakness.

Suggested Learning Activities:

1. Conduct a mock certification exam to be used for diagnostic purposes.
2. Review the National Occupational Analysis.
3. Review the Apprentice Logbook.
4. Review the Exam Preparation information found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
5. Conduct a final mock certification exam.

Resources:

These are the recommended resources to use in the delivery of this unit:

- Exam Preparation information, including videos, occupational analyses, exam counseling sheets, practice exams and sample questions, and other study materials and resources, can be found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
- Apprentice's personal logbook
- Applicable codes and regulations
- Program texts

Evaluation: pass/fail

Formulas

$$C = D \times \pi$$

$$C = 2\pi r$$

$$P = (L \times W)2$$

$$a^2 + b^2 = c^2$$

$$V = L \times W \times H$$

$$LA = (D \times \pi)H$$

$$\frac{(CLR \pm \frac{1}{2} OD) \times 1.57}{\# \text{ of mitres}}$$

$$SA = s\pi r$$

$$SA = 4\pi r^2$$

$$SA = 2\pi r^2$$

$$SA = \pi r^2$$

$$V = \pi r^2 \times h$$

$$SA = \pi dh$$

Nova Scotia Document Evaluation Form

Thank you for your interest in the development and revision of this document. Upon review of the document, please record your feedback in relation to the following items:

- course division and organization
- relevancy of the content
- errors or omissions
- other suggestions for improvement and consideration

Overall comments are to be entered on this evaluation form and specific changes are to be entered directly on the document in the relevant area(s). When making proposed corrections(s) in the document, please use red ink. When all feedback has been recorded, return this evaluation form along with the document to the Apprenticeship Office noted at the bottom of the page.

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