



**Skilled
Trades**
Ontario

**Métiers
spécialisés**
Ontario

Apprenticeship
Curriculum Standard

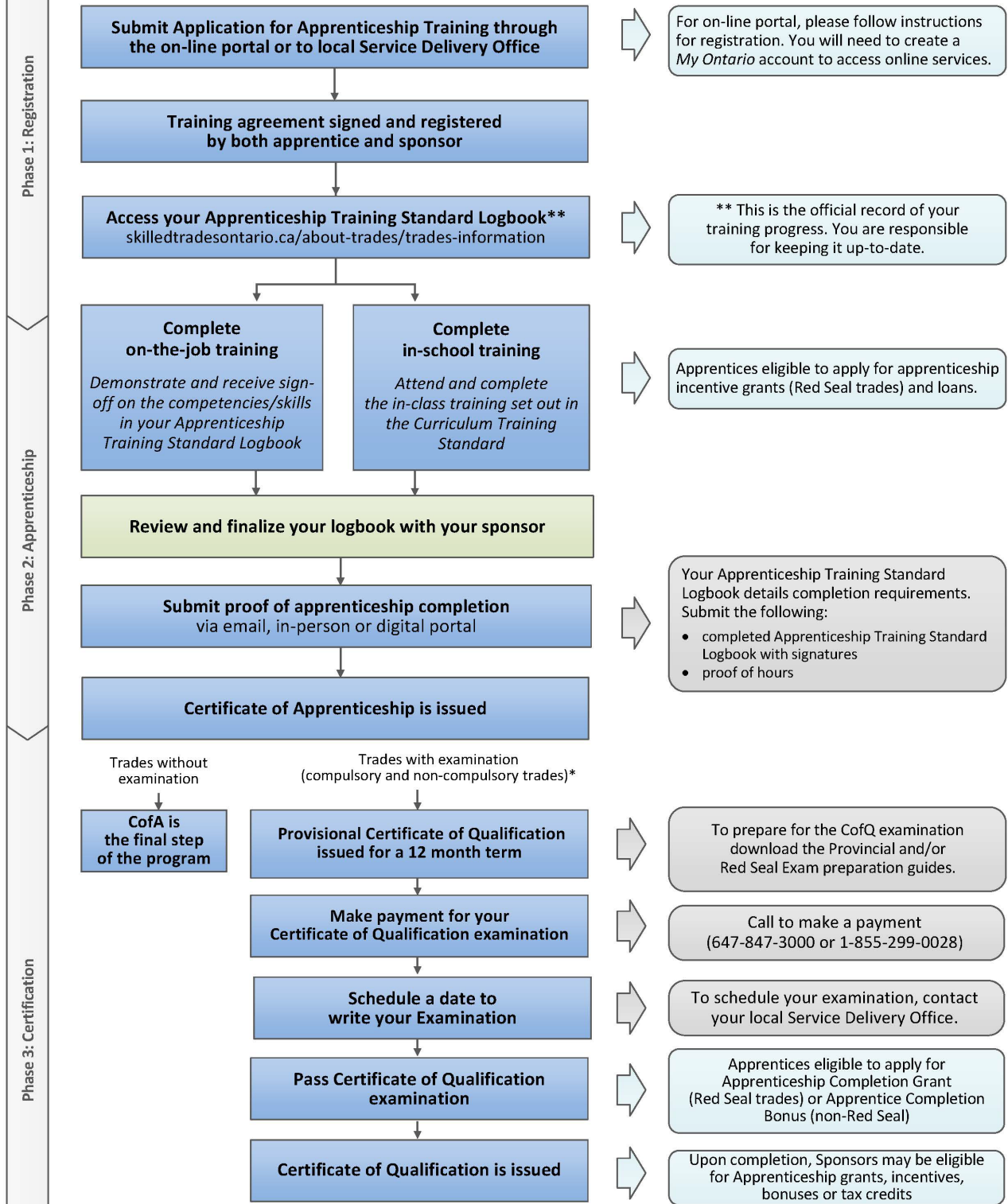
Steamfitter

Level 1

307A

2009

Apprenticeship Pathway to a Certificate of Qualification



* For a list of trades subject to a certification examination, visit: skilledtradesontario.ca

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Please Note: This Standard has been revised to reflect the visual identity of Skilled Trades Ontario (STO) which replaced the Ontario College of Trades on January 1, 2022. The content of this Standard may refer to the former organization; however, all trade specific information or content remains relevant and accurate based on the original date of publishing.

Please refer to STO's website: skilledtradesontario.ca for the most accurate and up to date information. For information about BOSTA and its regulations, please visit [Building Opportunities in the Skilled Trades Act, 2021 \(BOSTA\)](#).

Any updates to this publication are available on-line; to download this document in PDF format, please follow the link: Skilled Trades Ontario.ca.

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Maintained with transfer to Skilled Trades Ontario 2009 (V100)

Preface

This curriculum standard for the Steamfitter trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 3 levels of training. The Reportable Subjects Summary chart (located on page 3) summarizes the training hours for each reportable subject.

The curriculum identifies the learning that takes place in-school. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship Training Standards.

Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on a work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to verify that all apprentices have achieved the learning outcomes identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

Please refer to Skilled Trades Ontario website (www.skilledtradesontario.ca) for the most accurate and up-to-date information about Skilled Trades Ontario. For information on *Building Opportunities in the Skilled Trades Act, 2021 (BOSTA)* and its regulations, please visit [Building Opportunities in the Skilled Trades Act, 2021, S.O. 2021, c. 28 - Bill 288 \(ontario.ca\)](http://www.skilledtradesontario.ca/building-opportunities-in-the-skilled-trades-act-2021-s.o.-2021-c.-28-bill-288-ontario.ca)

Hours Disclaimer (if applicable)

It is agreed that Training Delivery Agents (TDAs) may need to make slight adjustments (with cause) according to particular apprentice needs and may deviate from the unit sequencing and the prescribed practical and theoretical hours shown within the standard. However, all TDAs will comply with the hours at the reportable subject level.

Level 1

Reportable Subject Summary – Level 1

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1	Workplace Safety, Rigging and Hoisting I	24	18	6
2	Piping Materials and Joining Techniques I	72	24	48
3	Steamfitting Systems I	72	48	24
4	Applied Trade Calculations I	24	16	8
5	Trade Documentation I	24	9	15
6	Welding I	24	4	20
	Total	240	119	121

Number:	S0921.0		
Title:	Workplace Safety, Rigging & Hoisting 1		
Duration:	Total Hours: 24	Theory: 18	Practical: 6
Prerequisites:	None		
Content:	S0921.1 Occupational Health and Safety S0921.2 Personal Protective Equipment S0921.3 Recognize and Assess Hazardous Conditions S0921.4 Control Hazards S0921.5 Work Platforms S0921.6 Lock Out and Tagging Procedures S0921.7 Operate and Maintain Tools S0921.8 Perform Housekeeping Duties S0921.9 Rigging & Hoisting S0921.10 Plan the Hoist S0921.11 Inspect the Job Site S0921.13 Determine the Required Equipment S0921.14 Schedule the Lift S0921.15 Connect the Equipment to the Rigging S0921.16 Inspect the Rigging S0921.17 Secure the Hoist Area S0921.18 Plan to Perform the Lift S0921.19 Communicate Throughout the Lift S0921.20 Position, Secure and Disconnect the Load		

Evaluation & Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the 8-week term.
Final exam at end of term.
Periodic quizzes.

Instructional and Delivery Strategies: Provide material samples and manufacturers' specifications (CDs, manuals, internet)

Reference Materials: PT Crane & Rigging Handbook
Construction Safety Association of Ontario
- Hoisting & Rigging Presentation Package
CD Occupational Health & Safety Act and Regulations for Construction Projects
Workplace Safety and Insurance Act and Regulations
Workplace Safety and Insurance Board -
Prevention Fact Sheets
Alberta Steamfitting Modules

Steamfitter – Level 1

recommended equipment list:

handouts for international hand signals
30 pieces of 6 feet x ½-inch nylon braided rope
safety belts and lanyards
safety glasses
chain falls, ½ ton, 1 ton
comalongs, ¾ ton, 1 ½ ton
shackles of different sizes
eye bolts, shoulder and non-shoulder type
crosby clips
wire rope including short piece of wire rope for demonstration
slings (nylon web, chain and wire rope)
lock out tags
two sections of scaffold including safety rails, planks, cross braces
multimeters
carbon monoxide detector
oxygen sensor
flammable gas detector

Number:	S0921.1		
Title:	Occupational Health and Safety		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to interpret Codes, Acts and Regulations.

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 1.1 Identify the most recent applicable health and safety acts, codes and regulations including the Occupational Health and Safety Act and Regulations and the Workplace Safety and Insurance Act and Regulations
- 1.2 Explain the difference between the “Act” and the “Regulation”
- 1.3 Identify the sections of OHS Act which deal with the construction industry
- 1.4 Interpret applicable health and safety regulations
- 1.5 Identify the group responsible for enforcement of the construction safety and health found in the OHS Act
- 1.6 State the responsibilities of the employer, worker and an inspector
- 1.7 Explain when a worker may refuse work
- 1.8 Define a supervisor and a competent worker
- 1.9 Explain when a supervisor, safety officer and/or committee must be appointed
- 1.10 Apply sections of applicable acts, codes and regulations dealing with:
 - personal protective clothing
 - hand and power tools
 - flammable substances
 - housekeeping practices
- 1.11 State the cause of most construction accidents

- 1.12 As set out in the health and safety legislation, state the major responsibilities of:
- employers
 - workers
 - supervisors
 - inspectors
- 1.13 Identify the most important regulations pertaining to hazards that may be encountered by the trade
- 1.14 Explain the procedure for submitting a notification of an infraction
- 1.15 Explain when a worker is, and is not covered by the Workplace Safety and Insurance Act
- 1.16 Explain the procedure when reporting an accident to comply with the Workplace Safety and Insurance Act
- 1.17 State the purpose of the Workplace Safety and Insurance Board (WSIB)

Number:	S0921.2		
Title:	Occupational Health and Safety		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to protect self and others through the use of appropriate work dress and personal protective equipment in accordance with applicable safety standards and regulations

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 2.1 Identify and interpret sections of the Ontario Occupational Health and Safety Act, Construction Safety Association of Ontario and company/customer standards related to personal protection
- 2.2 Determine the requirements for acceptable work dress and personal protective equipment including:
 - protective head wear, foot wear and eye wear
 - hearing protection and face mask
- 2.3 Select, adjust, wear and maintain work dress and personal protective equipment for maximum protection and suitable to the given task including:
 - protective work clothing
 - protective head wear, foot wear and eye wear

Number:	S0921.3		
Title:	Recognize and Assess Hazardous Conditions		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to recognize and assess hazards, hazardous conditions and potential damage and/or injury with equipment and/or materials that are not in compliance with OHSA, WHMIS, company/employer standards and applicable codes and regulations

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 3.1 Identify codes, standards, and regulations which may be violated, including:
 - OHSA
 - client and/or company safety regulations
- 3.2 Identify conditions, material or equipment that may be a safety hazard, including:
 - personal protective equipment
 - hand and power tools
 - rigging equipment
 - wire and fibre rope
 - scaffolds, guardrails, ladders and lifts
 - trenching and shoring
 - unprotected openings
- 3.3 Assess the hazardous condition, material or equipment, determining how quickly action must be taken
- 3.4 Identify the potential damage and/or personal injury that may occur including:
 - falls causing cuts, bruises, abrasions, burns and damage to eyes, back, hands, knees, feet and hearing to self and others
 - damaged hand and power tools, equipment and fixtures
 - damages to the work site
- 3.5 Note violation of codes and regulations by:
 - identifying causes and responsibility
 - determining possible consequences

Number:	S0921.4		
Title:	Occupational Health and Safety		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to control hazardous conditions, equipment and material in compliance with OHSA, WHMIS, company/employer standards and applicable codes and regulations

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 4.1 Identify appropriate actions to correct and make safe the hazardous condition, material or equipment
- 4.2 Identify relevant safety acts or company/customer standards
- 4.3 Identify steps to take to prevent further hazards
- 4.4 Report hazards to appropriate personnel

Number:	S0921.5		
Title:	Occupational Health and Safety		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to safely plan the erection, use and dismantling of platforms and scaffolding in compliance with OHSA, WHMIS, company/employer standards and applicable codes and regulations.

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 5.1 Identify approved scaffold parts
- 5.2 Determine safe condition of scaffolding prior to use
- 5.3 Describe safety procedures to follow to ensure safe use of platforms and scaffolds
- 5.4 Explain the procedure to follow to erect and to dismantle scaffolds
- 5.5 Identify any structural deficiencies
- 5.6 Recommend replacement of damaged, unsafe or worn scaffold components
- 5.7 Plan how to secure all scaffold attachments to ensure the protection of self and others
- 5.8 Identify personnel lifting devices, swing stages and bosun's chairs
- 5.9 Identify various approved power lifts and hoists

Number:	S0921.6		
Title:	Lock Out and Tagging Procedures		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to lock out and tag mechanical and electrical equipment according to applicable codes and company/customer standards.

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 6.1 Determine which conditions would cause mechanical and electrical equipment to be tagged and locked out
- 6.2 Describe how to lock out mechanical and electrical equipment according to all applicable codes and customer/company standards
- 6.3 Describe tagging procedures of defective mechanical and electrical equipment according to all applicable codes and customer/company standards
- 6.4 Describe how to remove locked out mechanical and electrical equipment according to all applicable codes and customer/company standards

Number:	S0921.7		
Title:	Operate and Maintain Tools and Equipment		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to use, inspect and maintain tools and equipment to ensure safe operation in accordance with CSA standards and manufacturers' operating instructions

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 7.1 Recognize various hand and power tools
- 7.2 Recognize the applications of various tools and material handling equipment
- 7.3 Select the appropriate tools and/or material handling equipment for a given job
- 7.4 Operate the various tools and/or material handling equipment according to CSA standards and manufacturer client/customer standards
- 7.5 Determine the inspection points of hand and power tools and equipment according to the manufacturers' operating instructions
- 7.6 Determine the frequency of inspections required for hand, power tools and equipment according to the manufacturers' operating instructions
- 7.7 Identify routine maintenance schedules
- 7.8 Perform routine maintenance according to the manufacturer and/or client/company schedules
- 7.9 Ensure hand tools, power tools and equipment are free from defects and are in proper working condition before use
- 7.10 Remove defective hand tools, power tools and equipment from service
- 7.11 Use hand and power tools and equipment

Number:	S0921.8		
Title:	Perform Housekeeping Duties		
Duration:	Total Hours: 1	Theory: 0.5	Practical: 0.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to maintain a clean and safe work area

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 8.1 Identify and comply with all applicable codes and company/customer standards
- 8.2 Identify the location of first aid equipment and supplies
- 8.3 Identify the location of fire extinguishers
- 8.4 Identify job conditions which require heating, ventilation and lighting
- 8.5 Store material and equipment in designated areas
- 8.6 Erect protective barriers as required
- 8.7 Remove debris to designated locations at intervals that will keep the work area clean and safe
- 8.8 Recycle materials as required and where possible

Number:	S0921.9		
Title:	Plan the Hoist		
Duration:	Total Hours: 1	Theory: 1	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to determine the weight, size and any special rigging requirements from drawings to rig and hoist material and equipment in compliance with Occupational Health and Safety Act and company/customer safety precautions

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 9.1 Recognize and use common rigging terms and abbreviations
- 9.2 Demonstrate the use of standard weight tables to determine the weight of a given load
- 9.3 Identify the weight, size and center of gravity of a given object
- 9.4 Determine whether there are any special rigging and/or hoisting requirements for given materials or pieces of equipment

Number:	S0921.10		
Title:	Inspect the Job Site		
Duration:	Total Hours: 1	Theory: 1	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to assess a site to determine if rigging and hoisting operations may be carried out in accordance with Occupational Health and Safety Act and company/customer safety procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 10.1 Identify conditions which should be assessed before hoisting and rigging operations begin including:
 - soil conditions
 - power lines
 - overhead clearance
 - underground services
 - space requirements
 - special conditions
 - visibility of operator and signaler
 - barricade areas in which personnel could be trapped or crushed
 - working near transmitters (microwave)

- 10.2 Identify what step must be taken if rigging conditions do not meet requirements

Number:	S0921.11		
Title:	Determine the Required Equipment		
Duration:	Total Hours: 1	Theory: 1	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to assess a site to determine the capacity of the hoisting equipment required in accordance with Occupational Health and Safety Act and company/customer procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 11.1 Establish the weight of the load to be lifted by using:
 - bills of lading
 - technical drawings and data
 - estimation tables
 - equipment catalogues
 - weight scales
 - weighing device on crane

- 11.2 Assist in the selection of the lifting or hoisting equipment by:
 - determining the boom angle of the hoist equipment
 - determining the lift height of the equipment hoisting the load
 - determining site conditions

Number:	S0921.12		
Title:	Schedule the Lift		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to recommend a schedule for hoisting and off loading tasks in compliance with Occupational Health and Safety Act and company/customer policy

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 12.1 Plan a schedule for the arrival of material and equipment to be hoisted
- 12.2 Prepare a schedule for hoisting equipment
- 12.3 Plan to assign duties to the hoisting crews
- 12.4 Plan to monitor hoisting crews

Number:	S0921.13		
Title:	Connect the Equipment to the Rigging		
Duration:	Total Hours: 5	Theory: 3	Practical: 2
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to describe required rigging operations as they conform to CSA standards, Occupational Health and Safety Act and company/customer safety procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 13.1 Describe the use and purpose of rigging hardware
- 13.2 Explain the use and purpose of rigging tools and devices
- 13.3 Explain the use and purpose of standard types of fibre rope used when rigging
- 13.4 Tie five different types of knots using various types of fibre rope
- 13.5 Identify the use and purpose of standard types of wire rope used when rigging
- 13.6 Estimate the safe working load of slings at different sling angles

Number:	S0921.14		
Title:	Inspect the Rigging		
Duration:	Total Hours: 4	Theory: 3	Practical: 3
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to inspect rigging and hoisting equipment to ensure it complies with OSHA, the Hoisting Engineers Act and company and customer safety procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 14.1 Identify the rigging and hoisting equipment that requires inspection
- 14.2 Describe the inspection procedures for rigging and hoisting equipment
- 14.3 Perform inspection procedures for a variety of rigging and hoisting equipment
- 14.4 Calculate the safe working load and breaking strength for fibre rope
- 14.5 Calculate the safe working load and breaking strength for wire rope

Number:	S0921.15		
Title:	Secure the Hoisting Area		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to plan how to secure an area where rigging and hoisting operations are to take place in accordance with CSA standards, Occupational Health and Safety Act and company/customer safety procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 15.1 Plan to secure the area(s) where rigging and hoisting operations may take place

- 15.2 Explain how to coordinate with other trades when preparing for a hoisting and rigging operation to take place

- 15.3 Explain how to barricade an area where rigging and hoisting activities will be taking place

Number:	S0921.16		
Title:	Plan to Perform the Lift		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to plan a lift conforming to CSA standards, Occupational Health and Safety Act and company/client safety procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 16.1 Plan to secure the area where the lift will be performed
- 16.2 Plan how to connect the rigging equipment to the load
- 16.3 Explain how and where to connect a tag line
- 16.4 Plan the landing area

Number:	S0921.17		
Title:	Communicate Throughout the Lift		
Duration:	Total Hours: 1	Theory: 0.5	Practical: 0.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to use signals in compliance with Occupational Health and Safety Act and company/customer safety procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 17.1 Determine when a signaller is required
- 17.2 Demonstrate the use of International Hand Signals
- 17.3 Identify situations when voice communications are best used

Number:	S0921.18		
Title:	Position, Secure and Disconnect the Load		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to describe a process to position, secure and releasing hoisting equipment from the load in compliance with the Occupational Health and Safety Act and company/customer safety procedures

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 18.1 Plan to position the load in the landing area
- 18.2 Plan to secure the load in a safe manner
- 18.3 Plan to release the hoisting equipment used
- 18.4 Describe how to remove the lifting devices from the load

Number:	S0921.19		
Title:	Remove and Store the Rigging Equipment		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to plan the removal and storage of lifting devices to comply with company or customer standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

19.1 Identify a designated storage area for the rigging and hoisting equipment

19.2 Explain how and where to store the rigging and hoisting equipment

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
60%	10%	30%

Number:	S0922.0		
Title:	Piping Materials And Joining Techniques		
Duration:	Total Hours: 72	Theory: 24	Practical: 48
Prerequisites:	None		
Content:	S0922.1	Steel and Related Metal Piping, Tubing and Fittings	
	S0922.2	Copper Tubing and Fittings	
	S0922.3	Fibreglass Pipe and Fittings	
	S0922.4	ABS Plastic Pipe and Fittings	
	S0922.5	PVC Plastic Pipe and Fittings	
	S0922.6	CPVC Plastic Tubing and Fittings	
	S0922.7	Polyethylene Plastic Tubing and Fittings	
	S0922.8	Cross Linked Polyethylene (PEX) Plastic Tubing	
	S0922.9	Polyolefin Plastic Tubing and Fittings	
	S0922.10	Cross Linked Polyethylene (PEX/AL/PEX) Composite pipe	
	S0922.11	Polyethylene/Aluminum/Polyethylene (PE/AL/PE) Composite pipe	
	S0922.12	Pipe Joining Techniques	
	S0922.13	Pipe Supports, Anchors, Hangers and Linear Expansion	
	S0922.14	Pipe Assembly Calculations	

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the 8-week term
Final exam at end of term
Periodic quizzes

Instructional and Delivery Strategies: Use of material samples and manufacturers' specifications (CDs, manuals, internet)

Reference Materials: Use of material samples and manufacturers' specifications (CDs, manuals, Internet)
IPT Pipe Trades Handbook
Pipe Fitters & Pipe Welders Handbook

Recommended Equipment List:

threading machines

- 300 complete with accessories
- 535 complete with accessories
- 700 complete with accessories
- 775 support arm
- 774 square drive

adaptor universal drive shaft
victaulic groover, #916 and #918
geared threader
pipe stands,
adjustable pipe
horses
roller stands
hand dies
enclosed ratchet die heads set - 1/8" - 2"
chop saws 12" / 14"
65R dies
oilers #418
spiral
reamers tri
stands
power pipe cutter #258
direct tap machine
MLT3401 copper cutters
flaring tools of different sizes and
manufacturers
tube reamers
nipple chuck rigging #819
prestolite torches / turbo torch
oxyacetylene torches with cutting and head
welding tips
cutting goggles
reciprocating saw 5228
grinders
face shields
porta-band saws 932
US pipe hole saw & kit
press fit tool
plastic fusion welder
hot air weld gun

ipex kits tool
wirsbro tool kit
set hole saws
dry cut saw
#614
pipe wrenches, 14", 18", 24", and 36"
adjustable wrenches
combination wrenches from 1/4" to

1¼" tube wrenches #124
hammers of different types including ball pein,
claw and rubber
files
wire brushes
levels and
squares
centre punches and chisels chalk lines and plumb
bobs try squares steel
screw drivers (robertson, philips, flat)
plastic saws
plastic cutter #493
laser level with rotary base RB90
laser level with gradient base
6B390 micrometer
depth
gauge
feeler
gauge
electric
drills
battery (cordless) drill
rotary hammer drill
power band saw

Number:	S0922.1		
Title:	Steel and Related Metal Pipe, Tubing and Fittings		
Duration:	Total Hours: 4	Theory: 4	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to composition, design, manufacture, terminology, available lengths and diameters, as well as previous and current approved applications of steel and related metal pipes and fittings

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 1.1 Explain the fundamentals of the steel and wrought iron manufacturing process
- 1.2 List the three main methods of pipe manufacture
- 1.3 State the purpose and limitations for pipe manufactured by each of the above three methods
- 1.4 State the range of nominal pipe sizes produced by each of the three methods of manufacture
- 1.5 State three identifying features of wrought iron pipe
- 1.6 State the purpose of iron silicate in wrought iron
- 1.7 State the four types of steel or wrought iron pipe end finishes
- 1.8 Name types of protective coatings applied to the outside surface of black pipe
- 1.9 Describe the steps in zinc coating black pipe to produce galvanized pipe
- 1.10 State the identifying features of monel pipe
- 1.11 State the purpose of monel pipe
- 1.12 State the identifying features of chromalloy (stainless) pipe
- 1.13 State the purpose of chromalloy (stainless) pipe
- 1.14 State the identifying features of Inconel pipe

- 1.15 State the purpose of Inconel pipe
- 1.16 State the main advantage of using aluminum tubing
- 1.17 State the purpose of a plastic liner installed inside aluminum pipe
- 1.18 List different weights of pipe based on wall thickness
- 1.19 State range of sizes through which pipe is known by its inside or outside diameter
- 1.20 Define the term “random lengths” of steel pipe
- 1.21 Provide the full name of the testing agency known as “ASTM”
- 1.22 List three tests conducted on standard schedules of pipe.
- 1.23 Describe the tests involved in determining the mechanical characteristics of a pipe
- 1.24 Name the five generally accepted methods of joining iron or steel pipe
- 1.25 Name five types of piping systems that use screwed joints
- 1.26 Interpret the service designations usually indicated on the side of fittings
- 1.27 List factors to be considered when selecting steel pipe including:
 - type of systems
 - premature pipe wall failures
 - cost of material
 - installation time
 - availability

Number:	S0922.2		
Title:	Copper Tubing and Fittings		
Duration:	Total Hours: 3.5	Theory: 3.5	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to distinguish characteristics of copper tubing and fittings including wall thickness, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 2.1 Identify the four standard wall thicknesses for copper pipe
- 2.2 Identify the colour designation assigned to each wall thickness
- 2.3 Identify the advantages and disadvantages of copper pipe and fittings
- 2.4 Explain the term degreased copper
- 2.5 State the standard diameters for copper pipe and fittings
- 2.6 State the standard lengths for hard drawn and coiled copper pipe
- 2.7 Identify which wall thickness may be purchased as hard drawn lengths, coils or both
- 2.8 State where soft copper pipe may be installed
- 2.9 Explain why restrictions are placed on soft copper coils
- 2.10 State where hard drawn copper pipe may be installed
- 2.11 Explain why restrictions are placed on hard drawn lengths
- 2.12 State the common joining methods for copper pipe and tubing
- 2.13 Identify the approval agency for copper pipe
- 2.14 Explain the difference between a “drainage” and “pressure” copper fitting

- 2.15 State the support requirements for various diameters of copper pipe installations
- 2.16 Identify the precaution that must be taken if supports for copper pipe and fittings are not copper
- 2.17 Explain the purpose of dielectric unions
- 2.18 Explain where dielectric unions should be installed
- 2.19 List factors to be considered when selecting copper pipe including:
 - type of system
 - corrosion
 - cost of material
 - installation time
 - availability
- 2.20 State the main components of brass and bronze
- 2.21 State the type of lubricant used to thread brass pipe

Number:	S0922.3		
Title:	Fibreglass Pipe and Fittings		
Duration:	Total Hours: 0.5	Theory: 0.5	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to distinguish characteristics of fibreglass pipe and fittings including selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 3.1 State the size range for fibreglass pipe
- 3.2 Identify the uses for fibreglass pipe
- 3.3 Explain the type of fittings that are installed with fibreglass pipe
- 3.4 Explain the joining method that is used with fibreglass pipe
- 3.5 State the precautions that must be taken when cutting fibreglass pipe
- 3.6 State the approval agency for fibreglass pipe installations

Number:	S0922.4		
Title:	ABS Plastic Pipe and Fittings		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5478.0, 5479.0, 5482.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to identify ABS plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 4.1 Upon successful completion, the apprentice is able to:
- 4.2 State the full name for the common abbreviation for ABS pipe
- 4.3 Identify the joining methods of ABS pipe and fittings
- 4.4 Identify the joining methods of ABS pipe and fittings to other plastics
- 4.5 Identify the joining method of ABS pipe and fittings to non-plastic pipe and fittings
- 4.6 State the standard colour for ABS pipe and fittings
- 4.7 State the approvals ABS pipe and fittings require
- 4.8 Explain the support requirements for ABS pipe and fittings
- 4.9 List the standard pipe diameters for ABS pipe and fittings
- 4.10 List the wall thicknesses available for ABS pipe and fittings
- 4.11 State how ABS pipe is sold
- 4.12 State the standard length for ABS pipe
- 4.13 List the approved piping system uses for ABS pipe and fittings
- 4.14 State restrictions placed on the use of ABS pipe and fittings

Number:	S0922.5		
Title:	PVC Plastic Pipe and Fittings		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards: : 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to identify PVC plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 5.1 State the full name for the common abbreviation for PVC pipe
- 5.2 Identify the joining methods of PVC pipe and fittings
- 5.3 Identify the joining methods of PVC pipe and fittings to other plastics
- 5.4 Identify the joining method of PVC pipe and fittings to non-plastic pipe and fittings
- 5.5 State the approvals PVC pipe and fittings require
- 5.6 Explain the support requirements for PVC pipe and fittings
- 5.7 List the standard pipe diameters for PVC pipe and fittings
- 5.8 List the wall thicknesses available for PVC pipe and fittings
- 5.9 State how PVC pipe is sold
- 5.10 State the standard length(s) for PVC pipe
- 5.11 List the approved piping system uses for PVC pipe and fittings
- 5.12 State restrictions placed on the use of PVC pipe and fittings

Number:	S0922.6		
Title:	CPVC Plastic Tubing and Fittings		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to identify CPVC plastic pipe and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 6.1 State the full name for the common abbreviation for CPVC tubing
- 6.2 Identify the joining methods of CPVC tubing and fittings
- 6.3 Identify the joining methods of CPVC tubing and fittings to other plastics
- 6.4 Identify the joining method of CPVC tubing and fittings to non-plastic pipe & fittings
- 6.5 State the approvals CPVC tubing and fittings require
- 6.6 Explain the support requirements for CPVC tubing and fittings
- 6.7 List the standard diameter sizes for CPVC tubing and fittings
- 6.8 List the wall thicknesses available for CPVC tubing and fittings
- 6.9 State how CPVC tubing is sold
- 6.10 State the standard length for CPVC tubing
- 6.11 List the approved piping system uses for CPVC tubing and fittings
- 6.12 State restrictions placed on the use of CPVC tubing and fittings

Number:	S0922.7		
Title:	Polyethylene Plastic Tubing and Fittings		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to identify polyethylene plastic tubing and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 7.1 State the full name for the common abbreviation for PE tubing
- 7.2 Identify the joining methods of polyethylene tubing and fittings
- 7.3 Identify the joining methods of polyethylene tubing and fittings to other plastics
- 7.4 Identify the joining method of polyethylene tubing and fittings to non-plastic pipe and fittings
- 7.5 State the standard colour for polyethylene tubing and fittings
- 7.6 State the approvals polyethylene tubing and fittings require
- 7.7 State the maximum pressure restrictions for polyethylene tubing
- 7.8 Explain the support requirements for polyethylene tubing and fittings
- 7.9 List the standard diameter sizes for polyethylene tubing and fittings
- 7.10 List the wall thicknesses available for polyethylene tubing and fittings
- 7.11 State how polyethylene tubing is sold
- 7.12 State the standard lengths for polyethylene tubing
- 7.13 List the approved piping system uses for polyethylene tubing and fittings
- 7.14 State restrictions placed on the use of polyethylene tubing and fittings

Number:	S0922.8		
Title:	Cross Linked Polyethylene (PEX) Plastic Tubing		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to identify PEX plastic tubing and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 8.1 State the full name for the common abbreviation for PEX
- 8.2 Identify the joining methods of PEX tubing and fittings
- 8.3 Identify the joining methods of PEX tubing and fittings to other plastics
- 8.4 Identify the joining method of PEX tubing and fittings to non-plastic pipe and fittings
- 8.5 State the standard colour for PEX tubing and fittings
- 8.6 State the approvals PEX tubing and fittings require
- 8.7 Explain the support requirements for PEX tubing and fittings
- 8.8 List the standard diameter sizes for PEX tubing and fittings
- 8.9 List the wall thicknesses available for PEX tubing and fittings
- 8.10 State how PEX tubing is sold
- 8.11 State the standard lengths for PEX tubing
- 8.12 List the approved piping system uses for PEX tubing and fittings
- 8.13 State restrictions placed on the use of PEX tubing and fittings

Number:	S0922.9		
Title:	Polyolefin Plastic Tubing and Fittings		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to identify polyolefin plastic tubing and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 9.1 Identify the joining methods of polyolefin tubing and fittings
- 9.2 Identify the joining methods of polyolefin tubing and fittings to other plastics
- 9.3 Identify the joining method of polyolefin tubing and fittings to non-plastic pipe and fittings
- 9.4 State the standard colour for polyolefin tubing and fittings
- 9.5 State the approvals polyolefin tubing and fittings require
- 9.6 Explain the support requirements for polyolefin tubing and fittings
- 9.7 List the standard diameter sizes for polyolefin tubing and fittings
- 9.8 List the wall thicknesses available for polyolefin tubing and fittings
- 9.9 State how polyolefin tubing is sold
- 9.10 State the standard lengths for polyolefin tubing
- 9.11 List the approved piping system uses for polyolefin tubing and fittings
- 9.12 State restrictions placed on the use of polyolefin tubing and fittings

Number:	S0922.10		
Title:	Cross Linked Polyethylene/Aluminum/Cross Linked Polyethylene (PEX/AL/PEX) Composite Tubing		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to identify PEX/AL/PEX plastic tubing and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 10.1 State the full name for the common abbreviation for PEX/AL/PEX tubing
- 10.2 Identify the joining methods of PEX/AL/PEX tubing and fittings
- 10.3 Identify the joining methods of PEX/AL/PEX tubing and fittings to other plastics
- 10.4 Identify the joining method of PEX/AL/PEX tubing and fittings to non-plastic pipe and fittings
- 10.5 Identify the fitting used with PEX/AL/PEX tubing
- 10.6 State the standard colour for PEX/AL/PEX tubing and fittings
- 10.7 State the approvals PEX/AL/PEX tubing and fittings require
- 10.8 Explain the support requirements for PEX/AL/PEX tubing
- 10.9 List the standard diameter sizes for PEX/AL/PEX tubing
- 10.10 List the wall thicknesses available for PEX/AL/PEX tubing and fittings
- 10.11 State how PEX/AL/PEX tubing is sold
- 10.12 State the standard lengths for PEX/AL/PEX tubing
- 10.13 List the approved piping system uses for PEX/AL/PEX tubing
- 10.14 State restrictions placed on the use of PEX/AL/PEX tubing

Number:	S0922.11		
Title:	Polyethylene/Aluminum/Polyethylene (PE/AL/PE) Composite Tubing		
Duration:	Total Hours: 0.25	Theory: 0.25	Practical: 0
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to identify PE/AL/PE plastic tubing and fittings, distinguishing characteristics, selection factors, applications, joining methods and support requirements

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 11.1 State the full name for the common abbreviation for PE/AL/PE tubing
- 11.2 Identify the joining methods of PE/AL/PE tubing and fittings
- 11.3 Identify the joining methods of PE/AL/PE tubing and fittings to other plastics
- 11.4 Identify the joining method of PE/AL/PE tubing and fittings to non-plastic pipe and fittings
- 11.5 Identify the fitting used with PE/AL/PE tubing
- 11.6 State the standard colour for PE/AL/PE tubing and fittings
- 11.7 State the approvals PE/AL/PE tubing and fittings require
- 11.8 Explain the support requirements for PE/AL/PE tubing
- 11.9 List the standard diameter sizes for PE/AL/PE tubing
- 11.10 List the wall thicknesses available for PE/AL/PE tubing and fittings
- 11.11 State how PE/AL/PE tubing is sold
- 11.12 State the standard lengths for PE/AL/PE tubing
- 11.13 List the approved piping system uses for PE/AL/PE tubing
- 11.14 State restrictions placed on the use of PE/AL/PE tubing

Number:	S0922.12		
Title:	Pipe Joining Techniques		
Duration:	Total Hours: 12	Theory: 4	Practical: 8
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to describe and perform pipe joining methods in accordance with government safety regulations, manufacturers' recommendations and accepted industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 12.1 List 5 different pipe thread standards used in North America and elsewhere
- 12.2 State when dry seal pipe threads are required
- 12.3 Explain the precautions that must be taken when borrowing another trade's pipe threading machine on the job, especially electrician's machines when they are threading conduit
- 12.4 Explain the difference between running threads and tapered threads
- 12.5 Define the fundamentals of pipe threads including:
 - American Standard technical terms
 - advantages of standardizing pipe threads
 - threads per inch (or metric equivalent) for nominal pipe sizes
 - thread engagement
 - nominal pipe diameters that may be threaded with the same die chasers
 - importance of ensuring the correct thread engagement
- 12.6 Describe pipe joining methods for:
 - Victaulic joints
 - press fitting
 - compression fitting
 - flaring, soldering and brazing
 - hot air welding
 - butt welding
 - plastic butt fusion
- 12.7 List, draw and label five methods of edge preparation for welded joints

12.8 Describe methods of preparing pipe for the following joining methods:

- Victaulic joints
- press fitting
- compression fitting
- flaring, soldering and brazing
- emersion element fitting
- hot air welding
- butt welding
- plastic butt fusion

12.9 Perform the recommended pipe joining methods for:

- cut threads
- tightening bolts of flanged connections with a single-line drawing
- Victaulic joints
- press fitting
- compression fitting
- flaring, soldering and brazing
- emersion element fitting
- hot air welding
- plastic butt fusion

Number:	S0922.13		
Title:	Pipe Supports, Anchors, Hangers and Linear Expansion		
Duration:	Total Hours: 5	Theory: 2	Practical: 3
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to describe construction features and perform installation procedures for pipe supports, anchors, hangers, as well as explain linear expansion, selection and installation factors in accordance with government safety regulations, manufacturers' recommendations and accepted industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 13.1 Explain the purpose of pipe supports, hangers and anchors
- 13.2 State the maximum horizontal distances between supports for various pipe
- 13.3 Identify the largest size of pipe that may be supported by solid or perforated metal strap hangers
- 13.4 Identify the smallest threaded rod that may be installed to support the hanger
- 13.5 State the minimum pipe size that must be supported by metal rods
- 13.6 Explain the type of fastener that may be used when attaching hangers to concrete or masonry
- 13.7 List the factors to be considered when selecting a hanger or support
- 13.8 List the factors to be considered when using anchors and guides to support an expansion joint
- 13.9 List the factors to be considered when supporting underground piping systems
- 13.10 Identify types of hangers and supports and describe how they are installed including:
 - strap hangers; ring hangers; clevis hangers; spring hangers; trapeze hangers; MJ pipe hangers and roller hangers
 - beam clamps; riser clamps; pipe clamps; and U bolts
 - threaded rod and threaded rod couplings

- pipe clips; pipe racks; concrete inserts; wall pipe supports; expansion plugs; and support anchors and threaded studs

13.11 List factors to be considered when selecting pipe supports including:

- type of system
- installation time
- cost of material
- availability
- capacity

13.12 Describe the factors involving linear expansion of pipe assemblies including:

- expansion of various materials when heated
- coefficients of expansion for various piping materials
- expansion as linear, superficial and volumetric
- the effects caused by expansion of a material when provisions were not implemented during installation
- expansion controls in piping systems

13.13 Calculate expansion loops given appropriate parameters

13.14 Calculate the increase in length (expansion) when the type of material, length of piping in feet and the temperature change in degrees Fahrenheit and/or Celsius are given

13.15 Build pipe supports, anchors and hangers to specifications

Number:	S0922.14		
Title:	Pipe Assembly Calculations		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to identify and use fitting tables to determine pipe lengths and allowances in accordance with manufacturers' recommendations and accepted industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

14.1 Describe how end-to-end piping measurements are calculated from piping diagrams showing centre-to-centre measurements

14.2 State what must be known to convert centre-to-centre measurements to actual pipe lengths

Explain the terms:

- fitting allowance
- thread engagement

Explain the terms:

- offset
- advance
- travel
- rolled offset
- spread
- spread allowance
- even parallel offset
- uneven parallel offset

14.3 Calculate the end-to-end measurements of a variety of pipe materials and sizes given the centre-to-centre measurements required, using standard pipefitting charts to determine fitting allowances and thread engagements

Number:	S0922.15		
Title:	Measuring Tools and Instruments		
Duration:	Total Hours: 3	Theory: 1	Practical: 2
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to select and use measuring tools and instruments in accordance with manufacturers' recommendations and accepted industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 15.1 Identify the various types and applications of measuring tools and instruments
- 15.2 Select the measuring tool or instrument based on:
 - application
 - the instrument's limitations including:
 - range
 - scale values
 - tolerance
- 15.3 Set up and adjust measuring instruments for operation
- 15.4 Measure, level, align, test, check and weigh depending on measuring instruments to be used
- 15.5 Interpret reading by giving correct value and unit of measurement
- 15.6 Describe how to maintain and store the measurement instrument

Number:	S0922.16		
Title:	Hand Tools		
Duration:	Total Hours: 5	Theory: 3	Practical: 2
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to select and use hand tools in accordance with government safety regulations, manufacturers' recommendations and accepted industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 16.1 Identify the types of hand tools in terms of their:
 - size and design
 - application to specific materials
 - capacity
 - operation
 - pipe related
 - measure and layout
 - Interpret manufacturer's instructions for various hand tools

- 16.2 Determine the methods of assembling and adjusting various hand tools Use hand tools for:
 - safe operation
 - restricted operations
 - the most efficient use to perform the following operations:
 - threading
 - holding
 - fastening
 - cutting and filing
 - material removal

Number:	S0922.17		
Title:	Power Tools		
Duration:	Total Hours: 10	Theory: 2	Practical: 8
Cross Reference to Training Standards: 5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to select and use power tools in accordance with government safety regulations, manufacturers' recommendations and accepted industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 17.1 Select the appropriate tool for the application.
- 17.2 Identify specified power tools based upon:
 - types and sizes
 - application
 - operating range
- 17.3 Select accessories based upon:
 - specified types, sizes, applications and tolerances
 - materials to be worked upon
- 17.4 Determine the correct electrical requirements by:
 - voltage
 - amperage
 - grounding requirements
- 17.5 Select the accessories based upon:
 - specified types, sizes, applications and tolerances
 - materials to be worked upon
- 17.6 Identify common hazards related to the use of power tools
- 17.7 Handle, maintain, adjust and store:
 - accessories
 - power tools
- 17.8 Describe the methods to operate power tools for:
 - safe operation
 - restricted operations based on:
 - type of operation

- type of material
- operating rate

17.9 Describe the procedures for using explosive actuated tools including:

- instructions and safe handling
- selection of charges
- selection of fasteners
- handling of charges including loading
- misfires, firing and clearing
- safety features of equipment

Number:	S0922.18		
Title:	Pipe and Tubing Installation Practices		
Duration:	Total Hours: 24	Theory: 0	Practical: 24
Cross Reference to Training Standards:	5470.0, 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5480.0, 5483.0		

General Learning Outcomes

Upon successful completion the apprentice is able to install pipe and tubing in accordance with government safety regulations, manufacturers’ recommendations and accepted industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 18.1 Measure, cut, ream, clean, assemble and solder copper piping to complete a specified project
- 18.2 Measure, cut and assemble non-metallic piping to complete a specified project
- 18.3 Measure, cut, ream, thread and assemble steel piping to complete a specified project involving multiple pipe lines and double 45° offsets
- 18.4 Measure, cut, ream, groove and assemble steel piping to complete a specified project

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
30%	40%	30%

Steamfitter – Level 1

Number:	S0923.0		
Title:	Steamfitting Systems I		
Duration:	Total Hours: 72	Theory: 48	Practical: 24
Prerequisites:	None		
Content:	S0923.1	Hydronic Heating System Principles	
	S0923.2	Gravity Hot Water Systems	
	S0923.3	Forced Circulation Hot Water Systems	
	S0923.4	Hot Water System Designs	
	S0923.5	Hot Water Boilers	
	S0923.6	Hot Water Boiler Piping	
	S0923.7	Hot Water Boiler Controls	
	S0923.8	Valves	

Evaluation & Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the 8-week term.
Final exam at end of term.
Periodic quizzes

Instructional and Delivery Strategies: Use of material samples and manufacturers' specifications (CDs, manuals, internet)

Reference Materials: IPEX Radiant Design Software
Radiant Basic Radiant Panel Association

Recommended Equipment List: small boilers from several manufacturers and types;
controls for boilers including gauges, low water cut-off, relief valve, expansion tank, airtrol fitting, bladder tank;
small electric pumps from different manufacturers
flexible hoses, control valves, shut off valves, three way mixing valves, check valves, pressure gauges, temperature gauges, ipex tubing;
radiators, convectors, cast iron radiators, unit heaters, thermometers, air vents, mono-flow fittings, radiant panels for ceiling and floor; air separators;
boiler fittings.
four hot water piping systems:

- direct return
- reverse return
- one pipe series return
- diversion fitting system

- primary and secondary loop

Number:	S0923.1		
Title:	Hydronic Heating System Principles		
Duration:	Total Hours: 12	Theory: 8	Practical: 4
Cross Reference to Training Standards:	5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0		

General Learning Outcomes

Upon successful completion the apprentice is able to describe the physics and principles of hot water heating

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 1.1 Define the properties of water
- 1.2 Explain the term “potable water”
- 1.3 State the composition of water
- 1.4 Identify the chemical symbol for water
- 1.5 Explain H₂O
- 1.6 Describe the characteristics of pure water
- 1.7 Identify the different states of water
- 1.8 Define water in a solid state
- 1.9 Define water in a gaseous state
- 1.10 Define hard water
- 1.11 Identify the solution used to determine the amount of hardness in water
- 1.12 Describe two methods of measuring the degree of hardness in water
- 1.13 Identify the types of hardness in water
- 1.14 Describe the effects of iron and magnesium in water
- 1.15 Describe the effects of bacteria in water

- 1.16 State the density of water
- 1.17 State the formula used to find the specific gravity of a substance
- 1.18 State the specific gravity of:
 - water
 - mercury
- 1.19 State the freezing point of water in Fahrenheit and Celsius degrees at atmospheric pressure
- 1.20 State the maximum density of water in Fahrenheit and Celsius degrees at atmospheric pressure
- 1.21 State the boiling point of water in Fahrenheit and Celsius degrees at atmospheric pressure
- 1.22 State the Fahrenheit and Celsius temperature of water when it changes from a liquid to a solid at atmospheric pressure
- 1.23 State the approximate expansion of water when converted to steam at 212° Fahrenheit or 100° Celsius
- 1.24 State the approximate expansion of water when converted to ice at 32° Fahrenheit or 0° Celsius
- 1.25 Identify the term used for the heat involved in the change of state from liquid water to steam
- 1.26 Identify the term used for the heat involved in the change of state from liquid water to ice
- 1.27 Calculate the boiling point of water in Fahrenheit degrees when the water is subjected to a gauge pressure of 50 PSIG
- 1.28 Calculate the boiling point of water in Fahrenheit degrees when the water is subjected to a gauge pressure of 100 PSIG
- 1.29 Calculate the boiling point of water in Fahrenheit degrees when the water is subjected to a gauge pressure of 150 PSIG
- 1.30 Calculate the boiling point of water in Fahrenheit degrees when it is confined in a vacuum
- 1.31 Calculate temperature scale conversions from F to C and vice versa

- 1.32 Define sensible and latent heat
- 1.33 Demonstrate sensible and latent heat
- 1.34 Describe the importance of the difference between sensible and latent heat
- 1.35 Define specific heat
- 1.36 Identify the specific heat of ice, water, steam and air
- 1.37 Define British Thermal Unit (BTU)
- 1.38 Demonstrate how heat energy is measured using the BTU scale
- 1.39 Perform British Thermal Unit calculations
- 1.40 Explain temperature and pressure relationships
- 1.41 Demonstrate temperature and pressure relationships
- 1.42 Describe the difference between pressures, head and total force
- 1.43 Convert static head of water to pressure
- 1.44 Identify the factors that affect dynamic pressure drop
- 1.45 Define flow rate in terms of US gallons and litres per minute
- 1.46 Calculate the total force given pressure and area
- 1.47 Describe heat transfer methods
- 1.48 Name the three methods of heat transfer
- 1.49 Identify an example of:
 - conduction
 - convection
 - radiation
- 1.50 Name three good conductors of heat
- 1.51 Name three poor conductors of heat
- 1.52 Explain thermal conductivity
- 1.53 Identify three factors that affect the speed at which heat will be conducted in an iron bar

Steamfitter – Level 1

- 1.54 Draw a single line drawing of a room in which convection currents are circulating through a convector-type heat transfer unit
- 1.55 Identify two examples of forced convection
- 1.56 Identify the type of surfaces that will readily emit or absorb radiated heat
- 1.57 Describe the reasons for heating systems
- 1.58 Calculate the number of BTU/hr produced internally by a normal active adult
- 1.59 State the number of BTU/hr required by the human body for normal body functions
- 1.60 State the normal internal body temperature for a healthy adult
- 1.61 List the five methods of heat transfer used by the human body to remove surplus heat
- 1.62 Name the method of heat transfer used by the human body
- 1.63 State the normal skin temperature for a healthy adult
- 1.64 Name two factors which will affect the rate of body heat loss by evaporation

Number:	S0923.2		
Title:	Gravity Hot Water Systems		
Duration:	Total Hours: 3	Theory: 1	Practical: 2
Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0			

General Learning Outcomes

Upon successful completion the apprentice is able to describe gravity hot water system operation

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 2.1 Describe the operation of gravity hot water systems
- 2.2 State two advantages of gravity hot water systems
- 2.3 State three disadvantages of gravity hot water systems
- 2.4 Identify the basic principle behind the circulation of hot water in a gravity hot water system
- 2.5 Define the meaning of:
 - one-pipe
 - two-pipe
 - up-feed
 - down-feed
 - direct return
 - reverse return
 - open systems
 - closed systems
- 2.6 Define the term “short-circuiting”
- 2.7 Draw a single-line illustration of a hot water system, showing simple gravity circulation
- 2.8 Draw a single-line illustration of a two-pipe, up-feed, direct return gravity hot water system
- 2.9 Draw a single-line illustration of a two-pipe, down-feed, reverse return gravity hot water system

- 2.10 Draw a single-line illustration to show piping connections for heat transfer units
- 2.11 Explain the reason for installing an expansion tank in a gravity hot water system
- 2.12 State the location for the expansion tank in a gravity hot water system
- 2.13 State the level of water in the initial filling of an expansion tank
- 2.14 List the reason for installing a check valve on the vent line from the expansion tank
- 2.15 Describe the precautions taken to prevent freezing of the water in the expansion tank
- 2.16 Explain why the expansion tank should be the first connection taken off the main
- 2.17 Draw a simple illustration of an expansion tank and all related piping connections

Number:	S0923.3		
Title:	Forced Circulation Hot Water Systems		
Duration:	Total Hours: 20	Theory: 14	Practical: 6
Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0			

General Learning Outcomes

Upon successful completion the apprentice is able to describe forced circulation hot water system operation in accordance with government safety regulations, manufacturers' recommendations and approved industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 3.1 Describe the principles of forced circulation hot water systems
- 3.2 Explain the main difference between a gravity hot water system and a forced hot water system
- 3.3 List the advantages of a forced hot water heating system as compared to a gravity hot water heating system
- 3.4 List the disadvantages of a forced hot water heating system as compared to a gravity hot water heating system
- 3.5 Identify two methods used to classify forced hot water systems
- 3.6 List four basic types of forced hot water systems
- 3.7 Identify two important factors to be considered in selecting a circulating pump
- 3.8 State where an "in-line" pump or circulator is generally used
- 3.9 State where a base-mounted high head pump is generally used
- 3.10 Draw a single-line drawing of a boiler, cushion or compression tank, and related piping, with the in-line pump or circulator
- 3.11 Draw a single-line drawing of a boiler, cushion or compression tank, and related piping, with a base-mounted high head pump correctly located
- 3.12 Explain why the reverse return system is preferred over a direct return system

- 3.13 Describe the fundamentals of forced hot water pumps
- 3.14 State a simple definition of a pump
- 3.15 State the factors to be considered when selecting a pump
- 3.16 Identify the two basic classifications of pumps
- 3.17 Describe the two basic kinds of positive displacement pumps
- 3.18 List the advantages of rotary pumps
- 3.19 List the disadvantages of rotary pumps
- 3.20 Draw a single-line drawing of a rotary gear pump, indicating the direction of flow through the pump
- 3.21 Draw a single-line drawing of a lobe-type pump, indicating the direction of flow through the pump
- 3.22 Identify the driving force for power piston pumps
- 3.23 List the advantages of centrifugal pumps
- 3.24 List the disadvantages of centrifugal pumps
- 3.25 Describe the two kinds of casing arrangements of centrifugal pumps
- 3.26 Draw a single-line drawing of a volute centrifugal pump indicating the direction of flow
- 3.27 Draw a single-line drawing of a diffuser centrifugal pump, indicating the direction of flow
- 3.28 Describe the fundamentals of circulation pumps
- 3.29 State the grade of oil recommended to lubricate a circulating pump
- 3.30 List two considerations for the location of circulating pumps
- 3.31 Explain why the centrifugal pump is frequently referred to as the “heart” of the system
- 3.32 Identify two reasons for using a centrifugal pump to circulate water in a hot water heating system
- 3.33 List the two basic types of circulating pumps used in hot water systems

- 3.34 List two factors to be considered when selecting a circulating pump
- 3.35 List two disadvantages of over-sizing a circulating pump
- 3.36 State the maximum recommended flow rate for a hot water heating system
- 3.37 Identify the correct location of an in-line circulator in a hot water heating system, and indicate the direction of flow
- 3.38 Explain why the pump body and motor must be correctly aligned
- 3.39 Draw a single-line drawing of a base-mounted pump, indicating the minimum distances for the location of valves and other restricting fittings
- 3.40 Explain one method used to overcome undesirable noise levels within a building
Define the term “cavitation”
- 3.41 Explain the cause of cavitation
- 3.42 Describe the fundamentals of cushion or compression tanks
- 3.43 Explain the different types of compression or cushion tanks
- 3.44 Illustrate the location and piping for a typical cushion and compression tank installation
- 3.45 State the minimum size of pipe connecting the cushion or compression tank to the boiler
- 3.46 List four basic functions of the cushion or compression tank located in a closed hot water system
- 3.47 Explain why the system can operate above 212° F (100° C)
- 3.48 Illustrate and explain the accessories and piping required for a cushion or compression tank
- 3.49 Define the term “waterlogged”
- 3.50 Draw a single line drawing to illustrate a cushion or compression tank connected to a hot water boiler
- 3.51 Describe the fundamentals of cast iron radiators
- 3.52 Describe the construction features of cast-iron radiators
- 3.53 Explain the operating principles of cast-iron radiators

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- 3.54 State the methods and corresponding approximate percentages of heat transfer for a freestanding cast-iron radiator
- 3.55 Identify two reasons for replacing the cast-iron radiator with more modern types of heat transfer units
- 3.56 Identify two factors that could change the percentages of heat transfer for a cast-iron radiator
- 3.57 Identify the type of surface that will radiate the greatest amount of heat
- 3.58 State the two basic types of design for cast-iron radiators
- 3.59 State the two methods of joining cast-iron sections
- 3.60 Explain why radiators should be located beneath windows
- 3.61 Calculate the equivalent square feet of radiation (E.D.R.) required for a particular room or area for a hot water system
- 3.62 Calculate the equivalent square feet of radiation (E.D.R.) required for a particular room or area for a steam heating system
- 3.63 Draw a single-line drawing of a cast-iron radiator in a room, and indicate heat being transferred to the surrounding atmosphere
- 3.64 Describe the fundamentals of convectors
- 3.65 Identify the principal method of heat transfer used by the convector-type heat transfer unit
- 3.66 Identify the type of metals used in the construction of the convector heating element
- 3.67 Explain why the front cover on the convector cabinet or casing is removable
- 3.68 Identify the two types of damper controls used on convector cabinets or casings
- 3.69 Identify the three basic types of convector cabinets or casings
- 3.70 Explain how the height of the unit affects the heat output from the convector
- 3.71 Explain why copper and aluminum are most commonly used in heating element construction
- 3.72 List four considerations when selecting a convector for a particular room or area
- 3.73 Identify three factors which determine the BTU output from the convector-type heat transfer unit

- 3.74 Identify the units used in tables for calculating convector capacities using hot water
- 3.75 Identify the units used in tables for calculating convector capacities using steam
- 3.76 Calculate the length of convector required for a particular room, using the table for hot water
- 3.77 Calculate the length of convector required for a particular room, using the table for steam
- 3.78 Draw a single-line drawing of a room containing a single convector-type heat transfer unit and indicate the convection currents circulating throughout the room
- 3.79 Describe the fundamentals of baseboard heating
- 3.80 Identify the normal location in the building for baseboard heating units
- 3.81 Explain why baseboard units are located on the outside walls of the building
- 3.82 Identify three advantages of the baseboard heating system as compared to a system using radiators or convectors
- 3.83 List the two basic types of baseboard heat transfer units
- 3.84 List the two kinds of cast-iron baseboard heating units
- 3.85 Define the abbreviation “RC”
- 3.86 State the method used to join sections of cast-iron baseboard units
- 3.87 Identify the size of cast-iron baseboard sections
- 3.88 Identify the two basic parts of a convector-type baseboard
- 3.89 Identify the type of hot water system for which the convector-type baseboard heating unit is particularly suitable
- 3.90 List two disadvantages of cast-iron baseboard heating units
- 3.91 List two advantages of convector-type baseboard heating units as compared to cast-iron baseboard heating units
- 3.92 Identify three factors that affect the sizing of baseboard heat transfer units
- 3.93 Calculate the length of baseboard heating unit required for a room, given the heat loss in BTU/hr, the water temperature from a given chart

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- 3.94 Calculate the length of baseboard heating unit required for a room using a steam heating system, given the heat loss in BTU/hr from a given chart
- 3.95 Describe the purpose of unit heaters
- 3.96 Identify the type of buildings in which unit heaters are usually installed
- 3.97 Identify the three main parts of a unit heater
- 3.98 List five advantages of using unit heaters to heat large areas
- 3.99 Identify the two common types of unit heaters
- 3.100 Explain the difference between a vertical and horizontal unit heater
- 3.101 Explain the method used to direct air from the unit heater to a particular area
- 3.102 Identify the manufacturers' recommendations concerning height limitations for horizontal unit heaters
- 3.103 State the reason for fitting cone-type diffusers to vertical unit heaters
- 3.104 Draw a single-line drawing of horizontal unit heaters installed to ensure the steady circulation of heated air in a building
- 3.105 Draw a single-line drawing of vertical unit heaters correctly located to provide a blanket of warm air over an entire floor area
- 3.106 Explain how fan motors are controlled
- 3.107 State locations where forced flow convector units are installed
- 3.108 State three locations where forced-flow convection units are installed

Number:	S0923.4		
Title:	Hot Water System Designs		
Duration:	Total Hours: 16	Theory: 9	Practical: 7
Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0			

General Learning Outcomes

Upon successful completion the apprentice is able to describe hot water system designs in accordance with government safety regulations, manufacturers' recommendations and approved industry standards

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

One Pipe Series Loop Systems

- 4.1 Describe two factors which make the series loop system suitable for small buildings
- 4.2 Explain why the length limitation of a loop or circuit is important to the operation of the system
- 4.3 State the recommended maximum number of BTUs to be allocated to each loop or circuit
- 4.4 Explain the pipe sizes normally used for series loop system circuits
- 4.5 Describe what causes circulation in a series loop system
- 4.6 Illustrate and explain where air vents and drain points are located in a series loop system
- 4.7 Draw a single-line drawing of a series loop system using one circuit or loop
- 4.8 Draw a single-line drawing of a series loop system using two circuits or loops

One-Pipe Diversion Fitting Systems

- 4.9 Illustrate the difference between the mains in a series loop and a diversion fitting system
- 4.10 Draw a single-line illustration of a one pipe, up-feed, one-circuit diversion fitting system for a small building
- 4.11 Describe the principle on which the function of the diversion tee is based

- 4.12 Describe the hot water heating system that uses diversion tees
- 4.13 Identify the correct location for diversion tees
- 4.14 Identify the minimum distances between connections for heat transfer units
- 4.15 Identify the recommended main size for the one pipe (monoflow) system
- 4.16 State the pitch required on one-pipe (monoflow) systems
- 4.17 Describe the type of heat transfer units that can be installed on a one-pipe (monoflow) system
- 4.18 Illustrate the supply and return connections for up-fed heat transfer units
- 4.19 Draw single main supply heat transfer units above and below the main, and connect the units to the main
- 4.20 Draw a heat transfer unit located above and close to the main, and connect the unit to the main

Two Pipe Systems

- 4.21 Draw a single-line drawing of a two-pipe reverse return system
- 4.22 Draw a single-line drawing of a two-pipe direct return system
- 4.23 Explain why the reverse return system is usually preferred over the direct return system
- 4.24 State the pitch on piping in the two-pipe hot water heating system
- 4.25 Explain why and where eccentric fittings must be used when reductions are made in hot water heating piping
- 4.26 Explain why two-pipe hot water heating systems are not usually used in small residential buildings
- 4.27 Name three high pressure-drop heat transfer units
- 4.28 State where the two-pipe direct return system might be installed
- 4.29 Illustrate how connections to heat transfer units and risers should be taken off the main in two-pipe hot water systems

Radiant Heating

- 4.30 Describe the methods of joining copper pipe, steel pipe and plastic pipe used in panels or grids of radiant hot water heating systems
- 4.31 Identify the sizes of pipe for ceiling installations and floor installations
- 4.32 Explain the effects of spacing between pipes in panels or grids
- 4.33 Name the type of rays emitted by the sun or radiant heat panel
- 4.34 Define the stratification of heated air in a room or building
- 4.35 State why panels or grids should be installed level
- 4.36 Draw a cross-sectional view of a panel ceiling installation, indicating the insulation and other features
- 4.37 Draw a cross-sectional view of a floor panel installation, indicating insulation, vapour barrier and other features
- 4.38 List advantages and disadvantages of copper pipe as compared to steel pipe and plastic pipe in panel or grid construction
- 4.39 Identify the type of copper, steel or wrought iron and plastic pipe used in radiant heating systems
- 4.40 State why steel or copper pipe should not be embedded in concrete
- 4.41 Calculate the percentage of radiant heat emitted by a ceiling panel or grid and a floor panel or grid
- 4.42 State the highest recommended surface temperature for ceiling panels or grids and floor panels or grids
- 4.43 Calculate the water temperatures necessary to maintain the maximum surface temperature for given panel or grid locations

Number:	S0923.5		
Title:	Hot Water Boilers		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0			

General Learning Outcomes

Upon successful completion the apprentice is able to describe the fundamentals and construction features of hot water boilers

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 5.1 Describe the operation of hot water boilers
- 5.2 State the difference between a hot water boiler and a steam boiler
- 5.3 Identify four different ways in which a boiler may be classified
- 5.4 Identify the two classifications of cast-iron boilers
- 5.5 Identify the type of installation in which vertical sectional boilers are frequently used
- 5.6 State the term used for the flue gases when they travel the length of a boiler
- 5.7 Identify the two general classifications of steel boilers
- 5.8 Identify the most common type of fire-tube boilers in use today
- 5.9 Identify four common types of fire-tube boilers
- 5.10 Define the following terms:
 - “package” boiler
 - heating surface
 - piping tax or load
 - gross load
 - Equivalent Direct Radiation (E.D.R.)
 - boiler horsepower
- 5.11 Identify the three main companies and institutions that publish boiler code requirements

- 5.12 Describe the construction features of hot water boilers
- 5.13 State the method commonly used to join sections of vertical cast-iron boilers
- 5.14 Describe where the combustion chamber of the externally fired boiler is located
- 5.15 Identify the number of passes in an HRT boiler
- 5.16 State two advantages of using a Scotch boiler
- 5.17 State the number of passes usually found in a modern package fire-tube boiler

Number:	S0923.6		
Title:	Hot Water Boiler Piping		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross Reference to Training Standards:	5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0		

General Learning Outcomes

Upon successful completion the apprentice is able to describe the fundamentals and construction features of hot water boiler piping.

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 6.1 Describe the flow of hot water boiler piping
- 6.2 Explain the two problems likely to occur when the boiler water is subjected to thermal imbalances
- 6.3 State how modern designs of hot water boilers have overcome the problems of thermal imbalance
- 6.4 Explain the reason for directing cool return water into the upper reaches of the boiler
- 6.5 Explain the two main reasons why the piping connections to the hot water boiler must be correctly installed
- 6.6 Describe the method of heat transfer used when heat is applied to water in a closed boiler
- 6.7 Describe the construction features and installation of hot water boiler piping
- 6.8 Describe the measures used to absorb any undue stresses and strains on the tappings of the boiler
- 6.9 State the preferred location for stop valves that isolate the boiler from the hot water system
- 6.10 Identify the location of the tapping in the boiler that is used to connect the cushion or compression tank
- 6.11 Identify two alternative locations for the low water cut-off device

- 6.12 State the type of fitting used when piping a low water cut off device
- 6.13 State the reason for using brass plugs in the piping system to the low water cut off device
- 6.14 Identify the two possible locations where make-up water may be introduced into the hot water system
- 6.15 State the location of the safety loop connection in the boiler when the boiler operates with a reverse flow
- 6.16 Identify the name of the line that runs from the cushion tank to the boiler when all heat transfer units are located below the level of the top of the boiler
- 6.17 State the nominal pipe size of the safety loop
- 6.18 State where the barometric draft control is installed
- 6.19 Identify three flame sensing devices used in flame failure controls
- 6.20 Explain the procedure commonly performed at the beginning and end of the programming control sequence
- 6.21 Draw an illustration of a typical forced circulation pattern designed to create a fairly even water temperature within a modern fire-tube boiler
- 6.22 Draw an illustration of a single boiler showing the flow and return piping containing swing joints to absorb thermal expansion and contraction
- 6.23 Draw an illustration of a single boiler showing the alternative locations for the low cut-off device, together with appropriate piping connections
- 6.24 Draw a single-line illustration of a boiler indicating the electrical connections between the aquastat and the burner for a system using intermittent circulation
- 6.25 Draw a single-line illustration of a boiler indicating the electrical connections between the thermostat and the burner for a system using continuous circulation

Number:	S0923.7		
Title:	Hot Water Boiler Controls		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0			

General Learning Outcomes

Upon successful completion the apprentice is able to describe the fundamentals and construction features of hot water boiler controls

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 7.1 Describe the fundamentals of hot water boiler controls
- 7.2 Identify three purposes for which hot water boiler controls are used
- 7.3 Identify two main categories of actuating devices used to control small residential boilers
- 7.4 State the purpose for which thermostats are used
- 7.5 State the purpose for which aquastats are used
- 7.6 Identify the two types of aquastats used on boilers
- 7.7 Identify the two basic control arrangements used for residential hot water boilers
- 7.8 State the purpose of the aquastat in the intermittent circulation system
- 7.9 State the purpose of a reverse acting aquastat
- 7.10 State the purpose of limit controls
- 7.11 State the purpose of a low water cut-off device
- 7.12 Illustrate the two basic designs of low water cut-off devices
- 7.13 Describe how the two basic designs of low water cut-off devices work
- 7.14 State the locations where low water cut-off devices may be installed
- 7.15 Describe the construction features of hot water boiler controls

- 7.16 Identify the piece of equipment that is controlled by the thermostat in the intermittent circulation system
- 7.17 Identify the type of basic control arrangement recommended for small residential buildings
- 7.18 Identify five automatic controls used for large commercial boilers and industrial hot water boilers
- 7.19 State the purpose of a draft control in a fuel gas boiler
- 7.20 Calculate the range of percentage load obtained in the operation of a boiler using modulated control settings
- 7.21 State the name given to the difference between the cut-in and cut-out temperature in a hot water boiler
- 7.22 Identify the two basic types of draft controls used on industrial and commercial boilers
- 7.23 Explain the operating principles of hot water boiler controls
- 7.24 Explain the main reason for using low voltage controls for small residential boilers
- 7.25 Identify the control device that stops and starts the circulation pump in a continuous circulation system and its correct location
- 7.26 Describe what happens to the firing rate of a commercial or industrial burner as the water temperature in the boiler increases
- 7.27 Identify the chemical components used when boiling out a boiler
- 7.28 Draw a single line illustration of a section of a vertical (square) sectional boiler indicating the location of the holes for push nipples
- 7.29 Draw a single line illustration of a three pass fire box boiler indicating the path of the flue gases within the boiler
- 7.30 Explain the operating principles of hot water boilers
- 7.31 Explain how lateral water circulation occurs within a cast-iron boiler
- 7.32 Explain the operation of the two classifications of steel boilers
- 7.33 State where the first pass occurs in a boiler
- 7.34 State the tests conducted on a package boiler before it leaves the factory

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7.35 Calculate the B.T.U/hr equivalent for 25 EDR hot water

7.36 Calculate the boiler horsepower equivalent for 836,800 BTU/hr

Number: S0923.8

Title: Valves

Duration: Total Hours: 9

Theory: 9

Practical: 0

Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5475.0, 5476.0, 5477.0, 5478.0, 5479.0, 5480.0, 5481.0, 5483.0, 5484.0

General Learning Outcomes

Upon successful completion the apprentice is able to describe valve construction and operation

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 8.1 Describe the application, construction features and operation of valves
- 8.2 Describe the primary function of a valve
- 8.3 Describe four ways a valve can control flow
- 8.4 Describe four principal valve types and the function of each
- 8.5 Name five materials used for valve manufacture
- 8.6 Name the component parts of a:
 - gate valve
 - globe valve
 - ball valve
 - swing check valve
 - lift check valve
 - butterfly valve
 - needle valve
- 8.7 Describe the stem operation of a:
 - rising stem with outside screw
 - rising stem with inside screw
 - non-rising stem with inside screw

- 8.8 Describe the function and design of a:
- packing nut with gland
 - bolted gland
 - lantern-type stuffing box
 - screwed bonnet
 - union bonnet
 - bolted bonnet
 - clamp-type bonnet
- 8.9 State the name of the type of valves shown given a cut-away drawing of the following valves:
- solid wedge disc gate valve
 - split wedge disc gate valve
 - double disc gate valve
 - plug disc gate valve
 - conventional disc globe valve
 - composition disc globe valve
 - butterfly valve
- 8.10 Describe the function of:
- solid wedge disc gate valve
 - split wedge disc gate valve
 - double disc gate valve
 - plug disc gate valve
 - conventional disc globe valve
 - composition disc globe valve
 - angle valve
 - ball valve
 - swing check valve
 - lift check valve
 - butterfly valve
- 8.11 Identify the following abbreviations:
- SS
 - FM
 - UA
 - IBBM
 - SW
 - DD
 - RS
 - NRS
 - WSP
 - WOG
- 8.12 Explain valve ratings and selection factors for specific applications

- 8.13 List six factors to be considered in selecting valves for specific applications
- 8.14 Select correct valves for two given applications
- 8.15 Explain the meaning of pressure ratings and letters found on valve bodies
- 8.16 List end connections commonly found on valve bodies
- 8.17 Describe the servicing procedures for the following valve types:
 - globe
 - gate
 - check (lift)
 - plug
 - butterfly
 - ball
 - needle
 - float
 - sediment faucet

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	20%	30%

Number:	S0924.0		
Title:	Applied Trade Calculations I		
Duration:	Total Hours: 24	Theory: 16	Practical: 8
Prerequisites:	None		
Content:	S0924.1	Basic Arithmetic	
	S0924.2	Percentages, Ratio and Proportion	
	S0924.3	Linear Measures	
	S0924.4	Area Calculations	

Evaluation & Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the 8-week term.
Final exam at end of term.
Periodic quizzes

Instructional and Delivery Strategies: Provide applied mathematical examples as much as possible by using steamfitting trade reference materials

Reference Materials: Pipe Trades Handbook
Alberta steamfitting modules

Recommended Equipment List: calculator
imperial & metric ruler

Number:	S0924.1		
Title:	Basic Arithmetic		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards:, 5471.0, 5473.0			

General Learning Outcomes

Upon successful completion the apprentice is able to apply basic mathematical principles and knowledge to solve trade-related problems

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

1.1 Perform the following operation with whole numbers:

- addition
- subtraction
- multiplication
- division
- factoring
- powers/roots

1.2 Solve problems using the aforementioned operation of whole numbers

1.3 Perform the following using $1/16$, $1/8$, $1/4$ & $1/2$ fractions:

- add fractions
- subtract fractions
- multiply fractions
- divide one fraction by another
- simplify a compound fraction
- express a fraction as a decimal
- factor and find lowest common denominator
- change mixed numbers to improper fractions
- multiply a fraction by a mixed number
- raise a fraction to a power

1.4 Evaluate roots of fractions

1.5 Apply all the aforementioned operations of fractions in solving problems

1.6 Use decimal notation

1.7 Perform the following operations:

- add decimal fractions
- subtract decimal fractions
- multiply decimal fractions
- round off decimal fractions
- express a decimal as a fraction
- raise decimals to powers
- extract roots of decimal fractions

1.8 Apply all the aforementioned operations of fractions in solving problems

Number:	S0924.2		
Title:	Percentage, Ratio and Proportion		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standards:, 5471.0, 5473.0			

General Learning Outcomes

Upon successful completion the apprentice is able to calculate percentages and solve ratio and proportional problems

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

2.1 Perform the following operations:

- express a common fraction as a percent
- express a percentage as a common fraction
- express a decimal as a percent
- express a percentage as a decimal

2.2 Solve percentage applications of the aforementioned operations

2.3 Define a “ratio” and a “proportion”

2.4 Explain “direct ratio” and “inverse ratio”

2.5 Solve trade-related problems involving:

- ratio
- proportion
- direct proportion
- inverse proportion

Number:	S0924.3		
Title:	Linear Measure		
Duration:	Total Hours: 9	Theory: 6	Practical: 3
Cross Reference to Training Standards: 5471.0, 5473.0			

General Learning Outcomes

Upon successful completion the apprentice is able to apply Imperial and metric linear measure units to piping system applications

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 3.1 Identify the metric and imperial units used for linear measurement
- 3.2 Convert given linear Imperial unit measurements to metric units
- 3.3 Convert given linear metric unit measurements to Imperial units
- 3.4 Define “square root”
- 3.5 Describe field methods of finding the square root of a number
- 3.6 Calculate square root using a calculator
- 3.7 Explain the Pythagorean Theorem
- 3.8 Calculate a 45° offset from given Imperial and metric measurements using the factor of 1.414
- 3.9 Calculate lengths of pipe for offsets when two measurements are known
- 3.10 Define the term spread and spread allowance
- 3.11 Calculate a 45° even parallel offset
- 3.12 Calculate a 45° uneven parallel offset
- 3.13 Calculate offsets for various angles
- 3.14 Calculate the length of travel for a rolled offset using 45° fittings

Number:	S0924.4		
Title:	Area Calculations		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards: 5471.0, 5473.0			

General Learning Outcomes

Upon successful completion the apprentice is able to apply applicable formulas and calculate areas to piping system applications with the use of a calculator

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 4.1 State the formulas for the area of the following shapes:
 - square
 - rectangle
 - parallelogram
 - triangle
 - circle
 - sector
 - segment
- 4.2 Calculate areas of aforementioned shapes of given dimensions
- 4.3 State the formulas for the surface area of the following shaped tanks:
 - square
 - rectangular
 - cylindrical
 - spherical
 - hemispherical
 - combinations of the above
- 4.4 Calculate the total surface area of closed top rectangular tank of given dimensions given Imperial dimensions
- 4.5 Calculate the total surface area of an open top rectangular tank of given metric dimensions
- 4.6 Calculate the total surface area of a flat-ended cylindrical tank of given Imperial dimensions
- 4.7 Calculate the total surface area of a dished ended cylindrical tank of given metric dimensions

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	20%	30%

Steamfitter – Level 1

Number:	S0925.0		
Title:	Trade Documentation I		
Duration:	Total Hours: 24	Theory: 9	Practical: 15
Prerequisites:	None		
Content:	S0925.1	Drafting Techniques	
	S0925.2	Trade Communications	

Evaluation & Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the 8-week term.
Final exam at end of term.
Periodic quizzes

Instructional and Delivery Strategies: Provide steamfitting appropriate samples of drawing and reports

Reference Materials: Template Development for the Pipe Trades
R.P. Jones
IPT Pipe Trades Handbook
Pipe Fitters and Pipe Welders Handbook

Recommended Equipment List: set of blueprints for architectural and mechanical applications
drafting tables
blueprint texts compass
30°, 60° and 45° set squares
architect scale (metric/imperial)
engineer scale (metric/imperial) protractor
“T” square

Number:	S0925.1		
Title:	Drafting Techniques		
Duration:	Total Hours: 18	Theory: 6	Practical: 12
Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5484.0			

General Learning Outcomes

Upon successful completion the apprentice is able to identify and explain drafting techniques, scales, projections and drawings

Learning Outcomes and Content

Upon successful completion the apprentice is able to

- 1.1 Describe basic drafting techniques
- 1.2 Identify and use the following basic drafting instruments:
 - architect's scale
 - engineer's scale
 - metric scale
 - "T" square
 - set square (30°, 60° and 45°)
 - compass
 - dividers
 - protractor
 - pencils
 - erasers and shields
- 1.3 Print legible upper-case letters
- 1.4 Print legible figures
- 1.5 Identify the purpose of title blocks on drawings containing:
 - drawing number
 - name of company or firm
 - signatures and approvals
 - scales
 - revisions
 - list of materials
- 1.6 Identify and draw the types of lines used in single and multi-view drawings to indicate:
 - object lines
 - centre lines
 - extension lines
 - dimension lines
 - hidden lines
 - cutting plane

- break
 - projections
 - sections
- 1.7 Draw the standard piping symbols used for trade drawings:
- screwed pipe
 - soldered pipe
 - flanged pipe
 - butt welded pipe
 - socket welded pipe
 - grooved pipe
- 1.8 Identify three principal views in orthographic projection and their orientation
- 1.9 Draw simple objects to scale in orthographic projections and show dimensions
- 1.10 Identify isometric drawing principles
- 1.11 Produce an isometric drawing of a simple object, given the corresponding three views
- 1.12 Identify the standard types and sizes of construction trade drawings and prints
- 1.13 Identify the individual drawings belonging to the following trades:
- architectural
 - structural
 - mechanical
 - electrical
- 1.14 List the trades people that use each of the following drawings and state the reasons for their use:
- architectural
 - structural
 - mechanical
 - electrical
- 1.15 List the important information a steamfitter must obtain from each of the following drawings:
- architectural
 - structural
 - mechanical
 - electrical
- 1.16 List four purposes of shop drawings and equipment roughing-in cuts
- 1.17 Answer five questions based on a given shop drawing and equipment cuts
- 1.18 Interpret construction drawings, given specific steamfitting equipment and piping installation requirements

- 1.19 Answer thirty blueprint reading questions related to steamfitting, given a complete set of drawings

Number:	S0925.2		
Title:	Trade Communications		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standards: 5471.0, 5472.0, 5473.0, 5474.0, 5484.0			

General Learning Outcomes

Upon successful completion the apprentice is able to demonstrate required competency in reading comprehension, writing and use of trade terminology

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 2.1 Complete a unit of trade related study material and answer five related questions based on reading comprehension and interpretation
- 2.2 Complete a written spelling test, given twenty (verbal) trade terms
- 2.3 List six common uses of a dictionary
- 2.4 Locate ten given words in a Canadian English dictionary, write the meanings given and use each word in a written sentence
- 2.5 Identify and correct ten grammatical, spelling and punctuation errors in a given sheet of steamfitting trade related material
- 2.6 Fill out trade forms including “hours worked” report
- 2.7 Complete a daily time sheet, for one week, charging time to hypothetical jobs
- 2.8 Select equipment for three appropriate parameters from a given trade catalogue
- 2.9 Fill out a sample Service Report Form for a hypothetical service call, given an appropriate set of conditions and parameters
- 2.10 Locate, read and report on various trade publications

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
35%	35%	30%

Number:	S0926.0		
Title:	Welding I		
Duration:	Total Hours: 24	Theory: 4	Practical: 20
Prerequisites:	None		
Content:	S0926.1	Oxyacetylene Equipment	
	S0926.2	Oxyacetylene Safety	
	S0926.3	Oxyacetylene Heating	
	S0926.4	Oxyacetylene Cutting	
	S0926.5	Oxyacetylene Silver Soldering	
	S0926.6	Oxyacetylene Brazing	
	S0926.7	Oxyacetylene Welding	

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the 8-week term.
Final exam at end of term
Periodic quizzes

Instructional and Delivery Strategies: Practice oxyacetylene heating, cutting, silver soldering, brazing and welding in a safely laid out, well ventilated and equipped shop

Reference Materials: Oxyacetylene equipment manufacturer's manuals
IPT Pipe Trades Handbook
Pipe Fitters and Pipe Welders Handbook
Alberta steamfitting modules

Recommended Equipment List: oxyacetylene heating, cutting and welding equipment
supply of oxygen and acetylene
welding safety equipment including goggles, hearing and breathing protection
approved ventilated welding areas
shielded welding
booths
grinders files
wire brushes
strikers

Number:	S0926.1		
Title:	Oxyacetylene Equipment		
Duration:	Total Hours: 1	Theory: 0.5	Practical: 0.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5475.0, 5476.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to identify and explain oxyacetylene equipment construction, operation, assembly and disassembly

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 1.1 Identify oxyacetylene welding and cutting equipment and accessories
- 1.2 Describe the construction and operation of:
 - oxygen cylinders
 - acetylene cylinders
 - heating torches
 - cutting torches
 - welding torches
 - gas regulators
 - gas hoses and fittings
- 1.3 Assemble and disassemble oxyacetylene heating, cutting and welding equipment, demonstrating safety precautions
- 1.4 Check equipment for safe operational condition

Number:	S0926.2		
Title:	Oxyacetylene Safety		
Duration:	Total Hours: 1	Theory: 1	Practical: 0
Cross Reference to Training Standards: 5470.0, 5471.0, 5475.0, 5476.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to describe safe use of oxyacetylene cutting and welding equipment

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 2.1 Describe all equipment required for the personal protection of the operator and others
- 2.2 State an acceptable lens shade number for oxyacetylene welding and cutting
- 2.3 List all the necessary equipment and protective measures to prevent fires when using oxyacetylene welding and cutting equipment
- 2.4 List causes of backfire
- 2.5 Describe the results of a backfire
- 2.6 Describe special safety requirements to protect against flashbacks, fire and explosions
- 2.7 List in the proper order the steps to follow in case of a flashback
- 2.8 Describe the site hazards preparation required before starting a cutting or welding operation
- 2.9 Describe the combustibility of oil soaked rags
- 2.10 Describe the hazards of welding or cutting galvanized pipe
- 2.11 Describe ventilation requirements for the welding of materials that give off dangerous fumes or when welding in confined areas

Number:	S0926.3		
Title:	Oxyacetylene Heating		
Duration:	Total Hours: 1	Theory: 0.5	Practical: 0.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5475.0, 5476.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to heat mild steel pipe

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 3.1 Describe the properties of metals related to welding
- 3.2 Describe the effects of heating metals
- 3.3 Describe the effects of annealing metals
- 3.4 Describe the effects of quenching metals
- 3.5 List the reasons for preheating and post heating pipe
- 3.6 List the temperatures required during the process of stress relieving pipe
- 3.7 Describe methods to accurately measure the temperature of pipe while it is being heated
- 3.8 Set up equipment for oxyacetylene heating
- 3.9 Check equipment for safe operating condition
- 3.10 Safely turn on oxyacetylene heating equipment, light, and adjust flame for heating
- 3.11 Heat copper tubing and observe the colour at various temperatures
- 3.12 Heat mild steel pipe and observe the colour at various temperatures
- 3.13 Safely turn off the oxyacetylene heating equipment in the correct sequence

Number:	S0926.4		
Title:	Oxyacetylene Cutting		
Duration:	Total Hours: 9	Theory: 0.5	Practical: 8.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5475.0, 5476.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to safely use oxyacetylene cutting equipment

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 4.1 Describe the theory of oxyacetylene cutting
- 4.2 Identify from a given illustration of eight poor sample cuts the reason for each
- 4.3 Identify the characteristics and uses of fuel gases other than oxygen and acetylene used for cutting metal
- 4.4 Select from a list the proper tip size, acetylene pressure, and oxygen pressure for cutting a given metal thickness
- 4.5 Set up equipment for oxyacetylene cutting
- 4.6 Check equipment for safe operating condition
- 4.7 Safely turn on oxyacetylene cutting equipment, light, adjust to a neutral flame
- 4.8 Adjust oxyacetylene flame to cut material of a given thickness
- 4.9 Cut small holes in mild steel plate and pipe and then cut off small sections of mild steel plate and pipe by restarting in previously cut holes
- 4.10 State the proper angle for pipe butt weld preparation
- 4.11 State the proper landing size for pipe butt weld preparation
- 4.12 Cut two pieces of 2-inch pipe 6 inches long by hand torch-cutting for butt weld joints
- 4.13 Prepare two 2-inch pipe edges for butt welding using the correct angle and landing
- 4.14 Mark and store the two prepared pieces of 2-inch pipe for future use in butt joint welding

Number:	S0926.5		
Title:	Oxyacetylene Silver Soldering		
Duration:	Total Hours: 3	Theory: 0.5	Practical: 2.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5475.0, 5476.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to set up oxyacetylene equipment to silver solder copper pipe

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 5.1 Identify typical applications for silver soldering
- 5.2 Identify the TSSA standards for silver soldering
- 5.3 Sketch an oxyacetylene flame for silver soldering
- 5.4 State the type of material used for silver soldering
- 5.5 Describe the preparation required before silver soldering
- 5.6 List two properties of a properly silver soldered joint
- 5.7 Select from a list the proper tip size, acetylene pressure and oxygen pressure for silver soldering, given metal thickness
- 5.8 Set up oxyacetylene equipment for silver soldering
- 5.9 Turn on oxyacetylene silver soldering equipment, light and adjust the flame for silver soldering
- 5.10 Perform silver soldering procedures in accordance with TSSA standards

Number:	S0926.6		
Title:	Oxyacetylene Brazing		
Duration:	Total Hours: 3	Theory: 0.5	Practical: 2.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5475.0, 5476.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to set up oxyacetylene equipment to braze copper and mild steel

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 6.1 Identify typical applications for brazing
- 6.2 Identify the TSSA standards for brazing
- 6.3 Sketch an oxyacetylene flame for brazing
- 6.4 State the type of rod used for brazing
- 6.5 Describe the preparation required before brazing:
 - copper pipe and fittings
 - mild steel lap joints
- 6.6 List two properties of a properly brazed joint
- 6.7 Select from a list the proper tip size, acetylene pressure and oxygen pressure for brazing, given metal thickness
- 6.8 Set up oxyacetylene equipment for brazing
- 6.9 Turn on oxyacetylene brazing equipment, light and adjust the flame for brazing
- 6.10 Perform brazing procedures in accordance with TSSA standards:
 - copper pipe and fittings
 - mild steel lap joints

Number:	S0926.7		
Title:	Oxyacetylene Welding		
Duration:	Total Hours: 6	Theory: 0.5	Practical: 5.5
Cross Reference to Training Standards: 5470.0, 5471.0, 5475.0, 5476.0, 5483.0			

General Learning Outcomes

Upon successful completion the apprentice is able to explain oxyacetylene welding principles, recognize weld faults and control of distortion as well as weld mild steel pipe

Learning Outcomes and Content

Upon successful completion the apprentice is able to:

- 7.1 Name five factors that determine weld quality
- 7.2 List five properties of a good weld
- 7.3 Identify and draw three types of oxyacetylene welding flames
- 7.4 Name two factors that determine tip size selection in oxyacetylene welding
- 7.5 State the purpose of the filler rod in oxyacetylene welding
- 7.6 List two factors that determine the filler rod selection
- 7.7 State the causes and control of oxyacetylene welding faults
- 7.8 State the causes and control of distortion
- 7.9 Set up equipment for oxyacetylene welding
- 7.10 Select from a list the proper tip size, acetylene pressure and oxygen pressure for oxyacetylene welding a given metal thickness
- 7.11 Turn on oxyacetylene welding equipment, light, and adjust flame for welding
- 7.12 Lay beads on metal plate or pipe with filler rod
- 7.13 Prepare steel plate butt joints for welding
- 7.14 Tack weld steel plate butt joints to maintain alignment
- 7.15 Weld steel plate butt joints with filler rod, in the:
 - flat position
 - horizontal position

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- vertical position
- 7.16 Describe the steps required to weld a 2-inch pipe butt joint
- 7.17 State the proper gap between two 2-inch pipes for proper tacking of pipe butt welds
- 7.18 State the methods used to maintain the proper gap while tack welding two pieces of pipe
- 7.19 Tack weld previously prepared 2-inch pipe butt joint to maintain alignment Butt weld 2-inch pipe joint

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
20%	50%	30%



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