SKILLEDTRADES BC

PROGRAM OUTLINE

Boilermaker

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BOILERMAKER
PROGRAM OUTLINE

BASED ON RSOS 2021

Developed by
SkilledTradesBC
Province of British Columbia

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Section 1

INTRODUCTION

Boilermaker

Foreword

This revised Boilermaker Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies, and provincial and federal governments. It reflects updated standards based on the 2025 Red Seal Occupational Standard (RSOS). It was developed by British Columbia industry and instructor subject matter experts.

Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship.

This Boilermaker Program Outline includes a list of recommended reference textbooks that are available to support the learning objectives and the minimum shop requirements needed to support instruction.

Competencies are to be evaluated through written exams and practical assessments. A passing grade is achieved by getting an overall mark of 70%. See the Assessment Guidelines in Section 4 for more details.

Achievement Criteria are included for those competencies that require a practical assessment. The intent of including Achievement Criteria in the Program Outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measurable and that they reflect the skills spelled out in the competency. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

SAFETY ADVISORY

Be advised that references to the WorkSafe BC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: http://www.worksafebc.com). Please note that it is always the responsibility of any person using these materials to inform themselves about the Occupational Health and Safety Regulation pertaining to their work.

Acknowledgements

Industry and Instructor Subject Matter Experts retained to assist in the development and review of this Program Outline:

- Sat Chatta — Boilermakers Lodge 359
- Collin Robertson — Boilermakers Lodge 359
- Russel Osborne — British Columbia Institute of Technology

SkilledTradesBC would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Boilermaker occupation.

Previous Contributors

Industry and Instructor Subject Matter Experts retained to assist in the development and review of the 2017 Program Outline:

- Paul Hucal
- John Cole
- Russell Osborne
- Gord Weel
- David French
- Matthew Hudson-Gray

How to Use this Document

This Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Program Credentialing Model	Communicates program length and structure, and all pathways to completion	Illustrates the length and structure of the program	Illustrates the length and structure of the program, and pathway to completion	Illustrates the challenger pathway to Certificate of Qualification
OAC	Communicates the competencies that industry has defined as representing the scope of the occupation	Displays the competencies that an apprentice is expected to demonstrate in order to achieve certification	Displays the competencies apprentices will achieve as a result of program completion	Displays the competencies challengers must demonstrate in order to challenge the program
Training Topics and Suggested Time Allocation	Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application	Shows the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Shows the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Shows the relative weightings of various competencies of the occupation on which assessment is based
Program Content	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measurable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice	Provides detailed information on program content and performance expectations for demonstrating competency	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels
Assessment Guidelines	Shows the general areas of competency covered in each level of technical training, the theory and practical grading weight, and the calculation method for final percentage marks	Shows the general areas of competency covered in the technical training, the grading weight for each GAC, and the percentage of that time spent on theory versus practical application	Shows the general areas of competency covered in each level of technical training, the theory and practical grading weight, and the calculation method for final percentage marks	Shows the relative weightings of various general areas of competency within the occupation on which assessment is based

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Training Provider Standards	Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program	Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own	Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors	Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment
Appendix A – Glossary of Acronyms			Defines program specific acronyms	
Appendix B – Summary of Achievement Criteria	Summarizes and organizes expected practical assessments by level		Summarizes and organizes expected practical assessments by level	

Section 2

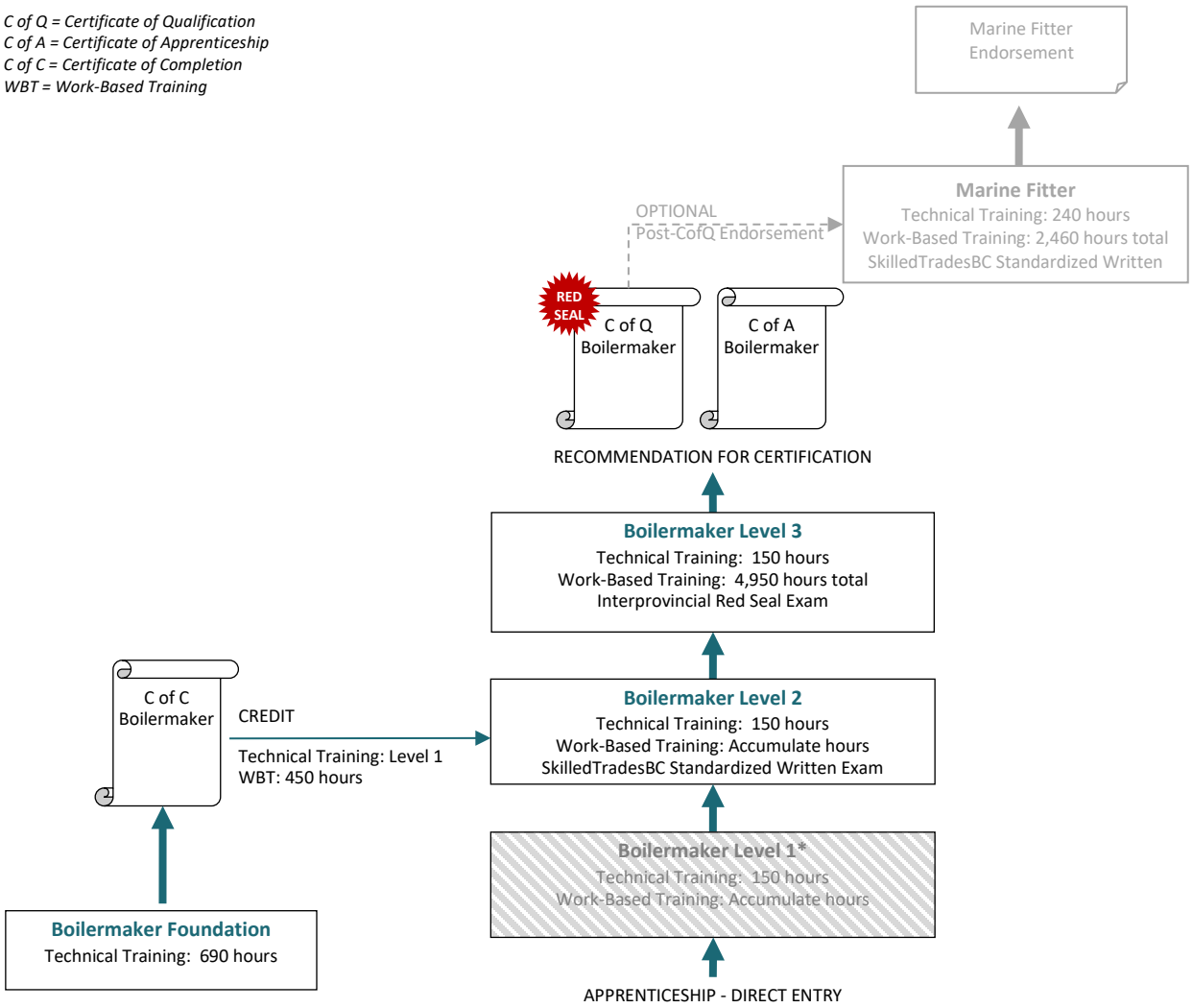
PROGRAM OVERVIEW

Boilermaker

Program Credentialing Model

Apprenticeship Pathway

C of Q = Certificate of Qualification
C of A = Certificate of Apprenticeship
C of C = Certificate of Completion
WBT = Work-Based Training



**Level 1 is not offered. Apprentices must complete Foundation Program*

CROSS-PROGRAM CREDITS
Individuals who hold the credentials listed below are entitled to receive partial credit toward the completion requirements of this program

None

Occupational Analysis Chart

BOILERMAKER

Occupation Description: "Boilermaker" is a tradesperson who must possess the full range of knowledge, abilities and skills required to fabricate, construct, install, assemble, erect, demolish, repair and maintain a wide variety of vessels, tanks, towers, boilers, hoists and other structures, ancillary equipment and fixtures made of steel, other metals, fibreglass, and other materials. The broad scope of the boilermaker trade includes the construction and maintenance activities performed in the field and in industrial and commercial plants such as: cement plants, fertilizer plants, water treatment facilities, breweries, sawmills, iron and steel production facilities, steam generation plants, electric power generation (thermal, nuclear, hydro) plants, gas turbines, refineries (oil, chemical), shipbuilding and repair docks, pulp and paper mills, wind and fusion sites, and many other industrial and commercial facilities.

F = Foundation

Line (GAC)	Competency	Code	Levels
PRACTICE SAFE WORK PRACTICES (A)	Use personal protective equipment	A1	F
	Use fall protection systems	A2	F
	Use fire safety procedures	A3	F
	Control workplace hazards	A4	F
	Interpret OHS regulations and WorkSafeBC standards	A5	F
	Monitor confined spaces	A6	F
USE TOOLS AND EQUIPMENT (B)	Use hand tools	B1	F
	Use power tools and shop fabrication tools	B2	F, 2, 3
	Use cutting tools and equipment	B3	F, 2, 3
	Use work platforms and access equipment	B4	F, 2, 3
USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS (C)	Perform trade math	C1	F
	Use drawings and specifications	C2	F, 2, 3
	Handle materials and components	C3	F, 2, 3
	Use communication and mentoring techniques	C4	F, 3
	Organize project tasks and procedures	C5	F
PERFORM CUTTING AND WELDING ACTIVITIES (D)	Cut material	D1	F, 2, 3
	Perform welding	D2	F, 2, 3

USE RIGGING, HOISTING AND LIFTING EQUIPMENT **E**	Plan lifts E1	Rig loads E2	Hoist loads E3	Fabricate rigging equipment E4	
	F 2 3	F 2 3	F 2 3	3	
PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS **F**	Perform fabrication F1	Align and fit vessels and components F2	Fasten components F3		
	F 2 3	F 2 3	F 2 3		
PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS **G**	Inspect and test vessels and components G1	Service vessels and components G2	Remove and dismantle vessels and components G3		
	F 2 3	F 2 3	F 2 3		

Training Topics and Suggested Time Allocation

BOILERMAKER – FOUNDATION

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line A	**PRACTICE SAFE WORK PRACTICES**	**4%**	**90%**	**10%**	**100%**
A1	Use personal protective equipment		✓	✓	
A2	Use fall protection systems		✓	✓	
A3	Use fire safety procedures		✓		
A4	Control workplace hazards		✓		
A5	Interpret OHS regulations and WorkSafeBC standards		✓		
A6	Monitor confined space		✓		
Line B	**USE TOOLS AND EQUIPMENT**	**5%**	**20%**	**80%**	**100%**
B1	Use hand tools		✓	✓	
B2	Use power tools and shop fabrication tools		✓	✓	
B3	Use cutting tools and equipment		✓	✓	
B4	Use work platforms and access equipment		✓	✓	
Line C	**USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS**	**11%**	**90%**	**10%**	**100%**
C1	Perform trade math		✓		
C2	Use drawings and specifications		✓	✓	
C3	Handle materials and components		✓	✓	
C4	Use communication and mentoring techniques		✓		
C5	Organize project tasks and procedures		✓		
Line D	**PERFORM CUTTING AND WELDING ACTIVITIES**	**27%**	**35%**	**65%**	**100%**
D1	Cut material		✓	✓	
D2	Perform welding		✓	✓	
Line E	**USE RIGGING, HOISTING AND LIFTING EQUIPMENT**	**22%**	**50%**	**50%**	**100%**
E1	Plan lifts		✓		
E2	Rig loads		✓	✓	
E3	Hoist loads			✓	
Line F	**PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS**	**27%**	**30%**	**70%**	**100%**
F1	Perform fabrication		✓	✓	
F2	Align and fit vessels and components		✓	✓	
F3	Fasten components		✓	✓	
Line G	**PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS**	**4%**	**60%**	**40%**	**100%**
G1	Inspect and test vessels and components		✓		
G2	Service vessels and components		✓		
G3	Remove and dismantle vessels and components		✓	✓	
	Total Percentage for Boilermaker Level 1	**100%**			

Training Topics and Suggested Time Allocation

BOILERMAKER – LEVEL 2

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line B	**USE TOOLS AND EQUIPMENT**	**10%**	**20%**	**80%**	**100%**
B2	Use power tools and shop fabrication tools		✓	✓	
B3	Use cutting tools and equipment		✓	✓	
B4	Use work platforms and access equipment		✓		
Line C	**USE DOCUMENTATION AND PRACTICE ORGANIZATION SKILLS**	**12%**	**90%**	**10%**	**100%**
C2	Use drawings and specifications		✓	✓	
C3	Handle materials and components		✓	✓	
Line D	**PERFORM CUTTING AND WELDING ACTIVITIES**	**10%**	**10%**	**90%**	**100%**
D1	Cut material		✓		
D2	Perform welding		✓	✓	
Line E	**USE RIGGING, HOISTING AND LIFTING EQUIPMENT**	**34%**	**50%**	**50%**	**100%**
E1	Plan lifts			✓	
E2	Rig loads		✓		
E3	Hoist loads		✓	✓	
Line F	**PERFORM LAYOUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS**	**25%**	**50%**	**50%**	**100%**
F1	Perform fabrication		✓		
F2	Align and fit vessels and components		✓	✓	
F3	Fasten components			✓	
Line G	**PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS**	**9%**	**50%**	**50%**	**100%**
G1	Inspect and test vessels and components		✓		
G2	Service vessels and components		✓	✓	
G3	Remove and dismantle vessels and components			✓	
	Total Percentage for Boilermaker Level 2	**100%**			

Training Topics and Suggested Time Allocation

BOILERMAKER – LEVEL 3

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line B	**USE TOOLS AND EQUIPMENT**	**5%**	**20%**	**80%**	**100%**
B2	Use power tools and shop fabrication tools		✓	✓	
B3	Use cutting tools and equipment		✓	✓	
B4	Use work platforms and access equipment		✓		
Line C	**USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS**	**10%**	**50%**	**50%**	**100%**
C2	Use drawings and specifications		✓	✓	
C3	Handle materials and components		✓	✓	
C4	Use communication and mentoring techniques		✓	✓	
Line D	**PERFORM CUTTING AND WELDING ACTIVITIES**	**5%**	**30%**	**70%**	**100%**
D1	Cut material		✓	✓	
D2	Perform welding			✓	
Line E	**USE RIGGING, HOISTING AND LIFTING EQUIPMENT**	**35%**	**50%**	**50%**	**100%**
E1	Plan lifts		✓	✓	
E2	Rig loads		✓	✓	
E3	Hoist loads		✓	✓	
E4	Fabricate rigging equipment		✓		
Line F	**PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS**	**35%**	**50%**	**50%**	**100%**
F1	Perform fabrication		✓	✓	
F2	Align and fit vessels and components		✓	✓	
F3	Fasten components			✓	
Line G	**PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS**	**10%**	**50%**	**50%**	**100%**
G1	Inspect and test vessels and components		✓	✓	
G2	Service vessels and components		✓	✓	
G3	Remove and dismantle vessels and components		✓	✓	
	Total Percentage for Boilermaker Level 3	**100%**			

Section 3

PROGRAM CONTENT

Boilermaker

Foundation

Boilermaker

Line (GAC): A PRACTICE SAFE WORK PRACTICES

Competency: A1 Use personal protective equipment

Objectives

To be competent in this area, the individual must be able to:

- Use personal protective equipment (PPE)

LEARNING TASKS	CONTENT

1. Describe personal protective equipment requirements	• Safety footwear
	• Eye protection
	• Ear protection
	• Head protection
	• Gloves
	• Hi-visibility vests
	• Respiratory protection
	• Self-contained breathing apparatus (SCBA)
	• Supplied air breathing apparatus (SABA)
	• Respirator
	  ○ Fit test
	  ○ Fit check
	• Clothing
	  ○ Welding leathers
	  ○ Coveralls
	• Barrier cream
	• Fall protection
	• Atmospheric testing and monitoring
	• Hazmat suits

2. Use personal protective equipment	• Usage • Inspection • Maintenance • Storage

Achievement Criteria

Performance	The learner will be able to perform a respirator fit check.
Conditions	The learner will be given • Respirator
Criteria	The learner will be evaluated on • Correct inspection of the mask prior to use • Proper tensioning sequence • Appropriate size • Snugness of fit • Accuracy of positioning

Line (GAC): A PRACTICE SAFE WORK PRACTICES

Competency: A2 Use fall protection systems

Objectives

To be competent in this area, the individual must be able to:

- Use fall protection equipment and systems as per job requirements

LEARNING TASKS	CONTENT

1. Describe fall protection equipment	• Fall arrest/restraint/work positioning equipment
	  ○ Harnesses
	  – Hardware
	  – Rolling tie-off
	  – Lanyard
	  – Carabiner
	  – Shock-absorbing devices
	  – Retractable devices
	  – Vertical line grab (fibre and wire)
	  – Connectors
	  – Work positioning systems
	• Inspection and maintenance
	• Worksite awareness
	• Occupation Health and Safety (OHS) Regulations Part 11
	• Standards
	  ○ Canadian Standards Association (CSA)

2. Describe fall protection systems	• Railings/scaffolds • Nets • Hardware • Anchor points • Assembly • Ladder systems • Vertical and horizontal systems

3. Use fall protection equipment and systems	• OHS Regulations Part 11
	• Daily inspection
	• Assembly/disassembly
	• Fall protection plan
	  ○ Identification of work area and risks
	  ○ Equipment selection
	  ○ Rescue procedures
	• Harness fit test (practical demonstration)

Achievement Criteria

Performance	The learner will be able to perform a safety harness fit test.
Conditions	The learner will be given • Safety harness • D-ring
Criteria	The learner will be evaluated on • D-ring position (between shoulders) • Snugness of fit

Line (GAC): A PRACTICE SAFE WORK PRACTICES

Competency: A3 Use fire safety procedures

Objectives

To be competent in this area, the individual must be able to:

- Identify various classes of fires
- Apply preventative fire safety precautions
- Select appropriate fire extinguishers for the class of fire and environmental condition
- Use equipment to prevent various classes of fires

LEARNING TASKS	CONTENT
1. Describe the conditions necessary to support a fire	• Air • Fuel • Heat • Flashpoint
2. Describe the classes of fires according to the materials being burned	• Class A • Class B • Class C • Class D • Symbols and colours
3. Identify combustible hazards	• Diesel • Gasoline • Propane • Natural gas • Lubricants • Oily rags • Aerosols • Mill fines
4. Apply preventative fire safety precautions when working near, handling, or storing, flammable liquids or gases, combustible materials and electrical apparatus	• Ventilation • Purging • Fire blanketing • Spark control • Spark watch • Fire hoses • Awareness of surroundings
5. Describe the considerations and steps to be taken prior to fighting a fire	• Warning others and fire department • Evacuation of others

LEARNING TASKS	CONTENT
	• Fire containment • Personal method of egress • Training

6. Use fire extinguishers	• Extinguisher selection
	• P.A.S.S
	  ○ Pull
	  ○ Aim
	  ○ Squeeze
	  ○ Sweep

Line (GAC): A PRACTICE SAFE WORK PRACTICES

Competency: A4 Control workplace hazards

Objectives

To be competent in this area, the individual must be able to:

- Apply Level 1 First Aid certification principles
- Identify workplace hazards
- Apply worksite safety policies

LEARNING TASKS

1. Describe short term hazards

CONTENT

- Hazards
  - Overhead
  - Slip
  - Fall
  - Swing
- Pinch points and bites
- Sharp objects
- Ladders
- Work platforms
- Electrical
- Lockout procedures
- Compressed gas
- Explosive material (dust)
- Lifting/ergonomics
- Personal apparel
  - Clothing
  - Hair and beards
  - Jewelry
- Housekeeping
- Respect for others' safety
  - Workplace conduct
  - Workplace violence
- Constant awareness of surroundings
- Safe attitude
- Identification of local hazards
- Reporting procedures
- Noise
- Cell phone usage
- Environmental
  - Water
  - Wildlife
  - Heat stroke

LEARNING TASKS	CONTENT
	○ Fatigue ○ Dehydration ○ Cold weather
2. Describe long term hazards	• Respiratory disease • Asbestos and silica • Noise • Repetitive strain injuries
3. Describe safety precautions when working at elevations	• Floor openings • Guard rails • Safety lines • Weather • Access and egress • Barricades • Communication • Emergency evacuation
4. Describe control zone procedures	• Barricades • Flag off • Information tags • Permits
5. Demonstrate emergency procedures	• Emergency shutoffs • Fire control systems • Eye wash facilities • Emergency exits • Emergency contact/phone numbers • Muster areas
6. Describe non-emergency injury reporting procedures	• First aid facilities • Reports and investigations
7. Apply worksite safety policies	• Process ○ Risk assessment ○ Risk management ○ Meeting requirements ○ Immediate reporting of hazards and incidents ○ Committees

LEARNING TASKS	CONTENT
	○ Employee orientation ○ Level 1 First-aid Certification ○ Hearing ○ Records and statistics ○ Lock-out ○ Non-compliance procedures • Minimum standards • Fall protection plan • Acts and regulations • Hierarchy of safety policies • Safe work procedures as per task requirements • Site specific policies
8. Describe WHMIS 2015 requirements	• As per Workplace Hazardous Materials Information System (WHMIS) 2015 documentations

Line (GAC): A PRACTICE SAFE WORK PRACTICES

Competency: A5 Interpret OHS regulations and WorkSafeBC standards

Objectives

To be competent in this area, the individual must be able to:

- Locate the relevant parts of the OHS Regulation
- Apply the relevant parts of the OHS Regulation

LEARNING TASKS	CONTENT
1. Locate terms used in the OHS Regulation	• Definitions
2. Locate the general duties of employers, employees and others in the OHS Regulation	• As per current regulation
3. Locate the OHS Regulation requirements for the reporting of accidents	• As per current regulation

4. Locate the "Core Requirements" of the OHS Regulation	• Application
	• Rights and responsibilities
	  ○ Health and safety programs
	  – Toolbox talks
	  – Safety committee meetings
	  ○ Investigations and reports
	  ○ Workplace inspections
	  ○ Right to refuse work
	• General conditions
	  ○ Building and equipment safety
	  ○ Emergency preparedness
	  ○ Preventing violence
	  ○ Working alone
	  ○ Ergonomics
	  ○ Illumination
	  ○ Indoor air quality
	  ○ Smoking
	  ○ Lunchrooms

5. Locate the "General Hazard Requirements" of the OHS Regulation	• Chemical and biological substances • Substance specific requirements • Noise, vibration, radiation and temperature • Personal protective clothing and equipment • Confined spaces • De-energization and lockout • Fall protection • Tools, machinery and equipment • Ladders, scaffolds and temporary work platforms

LEARNING TASKS	CONTENT
	• Cranes and hoists • Rigging • Mobile transport • Transportation of workers • Traffic control • Electrical safety
6. Apply OHS information	• As per documentation

Line (GAC): A PRACTICE SAFE WORK PRACTICES

Competency: A6 Monitor confined spaces

Objectives

To be competent in this area, the individual must be able to:

- Apply confined space awareness principles
- Recognize a confined space
- Monitor confined spaces

LEARNING TASKS	CONTENT

1. Describe a confined space	• Current section of OHS
	• Responsibilities of worker and employer
	• Procedures
	  ○ Access/egress
	  ○ Hole watch
	  ○ Air quality testing
	  ○ Explosive environments
	  ○ Lock out and isolation
	  ○ Ventilation
	  ○ Cleaning/purging/venting/inerting
	  ○ Rescue procedures
	• Entry permits
	  ○ Authorized signatures
	  ○ Posted hazard assessment
	  ○ Posted air quality tests

2. Identify equipment used when working in a confined space	• Respirators
	• Ladders
	• Tripod
	• Harnesses
	• Air quality monitor
	• Ventilation
	• Fresh air equipment
	  ○ SCBA
	  ○ SABA
	• Tools as per conditions
	  ○ Non-sparking
	  ○ Explosion proof
	  ○ Proper lighting

3. Monitor confined spaces	• Location requiring monitoring • Hazards ○ Gases and surrounding conditions

LEARNING TASKS

CONTENT

- Properties and types of gases
  - Chlorine
  - Carbon dioxide
  - Hydrogen sulphide
  - Mercaptan
- Site-specific requirements
  - Monitoring
  - Securement of confined space during inactivity
  - Training
- Communication with emergency personnel
- Recognition and respondent to emergency situations
- Direction of evacuation
- Documentation of personnel entering and exiting confined spaces
- Monitoring and documentation of atmospheric conditions of confined spaces
- Maintenance of contact with personnel in confined spaces as per OHS regulations
  - Visual
  - Radio
  - Lifeline

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B1 Use hand tools

Objectives

To be competent in this area, the individual must be able to:

- Use hand tools appropriate to the task
- Inspect and maintain tools

LEARNING TASKS	CONTENT
1. Describe hand tools	• Wrenches • Hammers • Clamps • Pliers • Screwdrivers • Files • Punches and scribers • Chisels • Plumb bob • Combination squares • Hacksaw • Threading tools • See Tools & Equipment for a complete list of tools
2. Use hand tools	• Purpose/use • Procedures/operations • Safety • Adjustment
3. Inspect and maintain hand tools	• Inspection • Maintenance • Storage • As per job requirements

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B2 Use power tools and shop fabrication tools

Objectives

To be competent in this area, the individual must be able to:

- Use power tools
- Use shop fabrication tools
- Inspect power tools
- Inspect fabrication tools

LEARNING TASKS	CONTENT
1. Select power tools	• Drill • Grinder/grinding tools • Impact wrench • Chop saw • Circular saw • Reciprocating saw • Gasoline-powered tools • Hydraulic tools • Pneumatic tools • See Tools & Equipment for complete list of tools
2. Select shop fabrication tools	• Band saws • Cutoff saws • Drill presses • Bender • Ironworker • Hydraulic presses • Shears • Brakes • Power plate rolls • Turning rolls • Automatic burning equipment • See Tools & Equipment for complete list of tools
3. Use power tools and shop fabrication tools	• Types • Parts • Purpose/uses • Procedures/order of operations • Safe use

LEARNING TASKS	CONTENT
	• Lubricants and fluids • Adjustment • Assured grounding
4. Inspect power tools and shop fabrication tools	• Inspection • Storage • As per job requirement and manufacturer specifications
5. Shape and check components	• Forming methods • Dimensions • Tolerances
6. Finish fabricated material	• Buffing • Cleaning • Grinding

Achievement Criteria

Performance	The learner will be able to demonstrate the proper selection, set-up and use of shop equipment for shaping and forming.
Conditions	The learner will be given • Equipment • Materials • Task instructions
Criteria	The learner will be evaluated on • Safety • Appearance • Inspection of equipment • Tolerances • Adherence to the checklist of tasks

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B3 Use cutting tools and equipment

Objectives

To be competent in this area, the individual must be able to:

- Perform various methods of cutting

LEARNING TASKS

1. Describe different methods of cutting

CONTENT

- Oxy fuel torch
  - Purpose/use
  - Limitations
  - Equipment
    - Torch head
    - Rose bud
    - Combination torch
    - Standards hand torch
    - Lance
    - Striker
    - Tip cleaner
  - Materials to be cut
  - Consumables
  - Safety
- Plasma
  - Purpose/Use
  - Limitations
  - Equipment
  - Materials to be cut
  - Consumables
  - Safety
- Abrasive disk
  - Purpose/Use
  - Limitations
  - Equipment
  - Materials to be cut
  - Consumables
  - Safety
- Carbon arc
  - Purpose/Use
  - Limitations
  - Equipment
  - Materials to be cut
  - Consumables
  - Safety

LEARNING TASKS

CONTENT

- High pressure water cutting system
  - Purpose/Use
  - Limitations
  - Equipment
  - Materials to be cut
    - Consumables
  - Safety

Achievement Criteria

Performance	The learner will be able to set-up an oxy-acetylene burning outfit.
Conditions	The learner will be given • Materials • Equipment • Specifications
Criteria	The learner will be evaluated on • Safety • Pressure leak test

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B4 Use work platforms and access equipment

Objectives

To be competent in this area, the individual must be able to:

- Use ladders and platforms
- Use access equipment
- Apply aerial work platform certification principles

LEARNING TASKS	CONTENT

1. Describe ladders and elevated platforms	• Types
	  ○ Scaffolds
	  – Manufactured
	  – Layer systems
	  – Tube and clamp
	  – Tank
	  – Springboard
	  ○ Aerial work platforms
	  ○ Aluminum and wooden planks
	  ○ Extension ladders
	  ○ Swing stages
	  ○ Tank buggy
	  ○ Step ladders
	  ○ Personnel basket
	  ○ Boatswain's chair
	• Uses
	• Safety
	  ○ Hazard recognition
	  ○ OHS
	  ○ Daily inspections and tagging

2. Use ladders and elevated platforms	• Selection • Set up • Moving ladders • Limitations • Securing • Inspection • Maintenance • Storage
3. Use aerial access equipment	• Types • Anchor points

LEARNING TASKS	CONTENT
	○ Safety Harness • Location considerations • Swing stage failure ○ Rescue plan • Equipment ○ Jurisdictional certification • Aerial access equipment ○ Selection ○ Inspection • Aerial access equipment ○ Assembly

Note: *Re-certification requirements for aerial lifts and forklifts are employee and/or employer's responsibility.*

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C1 Perform trade math

Objectives

To be competent in this area, the individual must be able to:

- Apply mathematical principles to solve problems

LEARNING TASKS	CONTENT
1. Use fractions to solve problems	• Add, subtract, multiply, divide • Express in higher terms • Simplify fractions
2. Use decimal fractions to solve problems	• Add, subtract, multiply, divide • Convert between decimals and fractions • Decimal notation
3. Solve problems of ratio and proportion	• Ratio ○ Equivalent • Proportion • Unknown quantities • Similar triangles

4. Describe metric and imperial measurements	• Units of measurement
	  ○ Metric
	  ○ Imperial

5. Solve geometric problems	• Area
	• Chord length
	• Circumference
	• Volume
	• Angles
	• Arc
	• Radius and diameter
	• Formulas for area of:
	  ○ Square and rectangles
	  ○ Triangles
	  ○ Circle
	  ○ Sector
	  ○ Segment

6. Calculate load weights	• Area • Volume • Material types

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C2 Use drawings and specifications

Objectives

To be competent in this area, the individual must be able to:

- Analyse a drawing
- Sketch structural shapes

LEARNING TASKS	CONTENT

1. Describe types of drawings	• Hierarchy of drawings
	• Types
	  ○ Assembly
	  ○ Shop
	  ○ Erection
	  ○ General arrangement
	  ○ Engineered lift
	  ○ Orthographic
	  – Auxiliary
	  – Sectional
	  – Exploded
	  ○ Pictorial
	  – Isometric
	  – Oblique

2. Identify elements on drawings	• Basic format
	  ○ Lines
	  ○ Symbols/welding
	  ○ General notes
	  ○ Legends
	  ○ Title block
	  ○ Abbreviations
	  ○ Material list
	  ○ Tolerance and fitting requirements
	  ○ Direction marks and placement marks
	  ○ Centres and work points
	  ○ Scale
	  ○ Rise and run
	  ○ Revisions
	• Details

3. Identify views on drawings	• Orthographic projections • Pictorial

LEARNING TASKS	CONTENT
	• Isometric • Oblique • Plan • Elevation • Sections
4. Analyse a drawing	• Common structural shapes and symbols ○ Identification • Reference dimension point (running dimensions) • Working point • Orientations • Elevations • Rise and run • Cut out size • Codes and standards

Achievement Criteria

Performance	The learner will be able to produce a sketch.
Conditions	The learner will be given • Materials • Instructions
Criteria	The learner will be evaluated on • Accuracy

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C3 Handle materials and components

Objectives

To be competent in this area, the individual must be able to:

- Apply forklift certification principles
- Describe considerations when handling, ordering and coordinating materials
- Handle materials according to job requirements

LEARNING TASKS	CONTENT

1. Describe considerations and responsibilities when handling, ordering and coordinating materials	• Safety/Occupation Health and Safety
	• Ergonomics
	• Storage
	• Contamination
	• Timing
	• Transportation
	  ○ Method
	• Off-loading/loading
	  ○ Crane type
	  ○ Forklift
	  ○ Tools
	  ○ Equipment
	  ○ Excess materials
	• Cribbing and blocking
	• Use of plate clamps and plate racks
	• Product protection
	• Disposal
	• Recycling
	• Identification of materials
	  ○ Weights
	  ○ Tubes
	  ○ Plates
	  ○ Studs
	  ○ Fibreglass
	  ○ Nuts and bolts
	  ○ Gas cylinders
	  ○ Inventory

2. Describe procedures for handling materials	• Safety • Loading/unloading procedures • Securing • Packaging/shipping

LEARNING TASKS	CONTENT
	• Pallets • Shipping containers • Equipment

3. Handle materials	• According to job/site requirements
	  ○ Moving plate
	  ○ Moving exchanger bundle
	  ○ Moving water wall tubes
	• Safety procedures
	• Shipping and storage considerations

4. Demobilize site	• Tools and equipment
	  ○ Inventory
	  ○ Return
	• Restore work area

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C4 Use communication and mentoring techniques

Objectives

To be competent in this area, the individual must be able to:

- Describe methods of communication
- Communicate with others

LEARNING TASKS	CONTENT

1. Describe methods of communication	• Listening
	• Verbal
	• Written
	• Drawings
	• Trade terminology
	• Use of
	  ○ Two-way radios
	  – Etiquette
	  ○ Computers
	  ○ Toolbox talk
	  ○ Emergency communication
	  ○ Worker proximity
	• Interpersonal skills
	  ○ Active listening
	  ○ Provide feedback
	• Ethics/responsibilities
	  ○ Cell phone usage
	  ○ Bullying
	• Harassment

2. Communicate with others	• Other trades • Co-workers • Industry people • Apprentices ○ Mentorship • Public

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C5 Organize project tasks and procedures

Objectives

To be competent in this area, the individual must be able to:

- Organize project tasks and procedures

LEARNING TASKS	CONTENT
1. Describe procedure of work	• Tools and equipment • Safety and regulations • Time management • Permits • Job requirements • Drawings • Materials • Procedures
2. Organize project tasks and procedures	• Tools and equipment • Safety and regulations • Time management • Permits • Job requirements • Drawings • Materials • Procedures

Line (GAC): D PERFORM CUTTING AND WELDING ACTIVITIES

Competency: D1 Cut material

Objectives

To be competent in this area, the individual must be able to:

- Perform various methods of cutting carbon steel plate

LEARNING TASKS	CONTENT

1. Cut carbon steel using various tools	• Basic procedures/operations
	• Set-up
	• Adjustment
	• Take down
	• Inspection
	• Maintenance
	• Storage
	• Cutting tools
	• Oxy-fuel torch
	• Adjustment
	  ○ Working pressures
	  ○ Flame types
	• Transport
	• Plasma
	• Abrasive disk
	• Carbon arc

Achievement Criteria

Performance	The learner will be able to layout and cut carbon steel.
Conditions	The learner will be given • Materials • Equipment • Specifications
Criteria	The learner will be evaluated on • Safety • Appearance of layout and cut • Accuracy

Line (GAC): D PERFORM CUTTING AND WELDING ACTIVITIES

Competency: D2 Perform welding

Objectives

To be competent in this area, the individual must be able to:

- Identify standard weld and joint symbols
- Describe welding joints and weld types
- Perform basic welding
- Use distortion control
- Describe weld testing procedures

LEARNING TASKS	CONTENT

1. Identify welding joint symbols	• Types of welding joints
	  ○ Butt
	  ○ Lap
	  ○ Corner
	  ○ Tee
	  ○ Edge
	• Types of welds
	  ○ Groove
	  ○ Fillet
	  ○ Plug
	• Standard welding symbols
	  ○ Type of weld
	  ○ Type of joint
	  ○ Size of weld
	  ○ Dimensions of the joint
	  ○ Finish of the weld
	• Welding joint symbols
	  ○ Reference line
	  ○ Basic welding symbols
	  ○ Typical welding symbols

2. Identify arc welding equipment	• Safety • Types of processes • Types of welding machines • Cables • Ground clamp • Electrode holder • Remote controls • Hydraulic test piece bender • PPE

LEARNING TASKS	CONTENT
3. Identify arc welding consumables	• Electrodes • Filler wire • Flux • Tungsten • Shielding gases • Anti-spatter
4. Apply welding procedures	• Safety • Procedures • Material to be welded • Process used • Consumables • Pre-heats • Post-heats • Inter-pass temperatures • Techniques
5. Use distortion controls	• Jigs • Bracing • Tacking • Pre-offset • Heat • Welding • Back stepping • Sequential

6. Describe weld testing procedures	• Non-destructive
	• Inspection
	  ○ Visual
	  ○ Liquid penetrant
	  ○ Magnetic particle
	  ○ Ultrasonic
	  ○ Gamma ray
	• Hardness test
	• Destructive test
	  ○ Bend test
	  ○ Tensile test
	  ○ Weld analysis

7. Prepare joints for fitting	• Tool and equipment selection

LEARNING TASKS	CONTENT
	• Joint set up • Material preparation • Dam and purge components • Joint cleaning
8. Fit joints	• Tool and equipment selection • Alignment tolerances • Set gap • Set offset • Fit-up joints

9. Perform tack welds	• Tool and equipment selection
	• Consumables required
	• Pre- and post-heat materials
	• Tack weld
	  ○ Placement
	  ○ Removal
	• Welding symbol interpretation

Achievement Criteria 1

Performance The learner will be able to prepare joints for fittings.

Conditions The learner will be given

- Materials
- Equipment
- Specifications

Criteria The learner will be evaluated on

- Safety
- Accuracy
- Appearance

Achievement Criteria 2

Performance The learner will be able to fit joints.

Conditions The learner will be given

- Materials
- Equipment
- Specifications

Criteria The learner will be evaluated on

- Safety
- Accuracy
- Appearance

Achievement Criteria 3

Performance	The learner will be able to perform tack welds.
Conditions	The learner will be given • Materials • Equipment • Specifications
Criteria	The learner will be evaluated on • Safety • Accuracy • Appearance

Achievement Criteria 4

Performance	The learner will be able to perform basic welding.
Conditions	The learner will be given • Materials • Equipment • Specifications
Criteria	The learner will be evaluated on • Safety • Penetration • Accuracy • Appearance • Bend test

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E1 Plan lifts

Objectives

To be competent in this area, the individual must be able to:

- Describe rigging and hoisting equipment
- Perform a pre-lift analysis
- Plan a lift

LEARNING TASKS	CONTENT

1. Describe rigging and hoisting equipment	• Rigging equipment and uses
	  ○ Slings
	  ○ Shackles
	  ○ Hardware below the hook lifting devices
	  ○ Spreader bar
	• Hoisting equipment and uses
	  ○ Blocks
	  ○ Grip hoist
	  ○ Tuggers
	  ○ Chain falls
	  ○ Come-alongs
	• Cranes
	  ○ Truck-mounted
	  ○ Conventional
	  ○ Rough terrain
	  ○ Hydraulic
	• Limitations and capacities
	• Current WorkSafeBC Regulations

2. Identify auxiliary hoisting equipment	• Types of hoists
	  ○ Fixed boom
	  ○ Material hoisting lifts
	  ○ Overhead cranes
	  ○ Forklifts
	• Types and applications of hoists and tuggers
	• Tuggers
	• Chain hoists and come-a-longs
	• Grip hoist

3. Determine load	• Rigging formulas and Working Load Limit (WLL) • Reading prints • Check load

LEARNING TASKS	CONTENT
	○ Material integrity • Load dimensions measurement • Calculation of weights of loads • Verification weight of load • Centre of gravity of loads
4 Perform pre-lift analysis	• Load properties ○ Dimensions ○ Shape ○ Weight • Lift type ○ Regular ○ Tandem ○ Critical • Area surrounding lift • Signaling methods ○ Two-way radios ○ Hand signals • Load securing methods • Delegate responsibilities ○ Operator ○ Signaler ○ Tag line person • Dry run procedures • Recognize hazards ○ Overhead wires ○ Load drift ○ Wind speed ○ Unstable ground conditions ○ Obstructions ○ Weather conditions • Interpret engineered lift drawings • Interpret load charts • Perform load calculations • Walk-through inspection • Permit requirements • Equipment required for rigging removal ○ Personnel lifts ○ Scissor lifts ○ Personnel baskets ○ Scaffolding

LEARNING TASKS	CONTENT
5. Select rigging and hoisting equipment for a given application	• Determination of rigging and hoisting capacity • Mechanical advantage • Meeting parameters of WLL • Protection of rigging and hoisting equipment
6. Secure a lift area	• Swing zone and swing clearance • Setting up barricades and barriers • Conducting pre-lift safety checks
7. Demonstrate knowledge of regulatory requirements pertaining to rigging hoisting/lifting	• WorkSafeBC • Site specific

Achievement Criteria 1

Performance: The learner will be able to inspect rigging gear prior to use.

Conditions: The learner will be given
- Materials
- Equipment
- Instructions

Criteria: The learner will be evaluated on
- Accuracy of written inspection report

Achievement Criteria 2

Performance: The learner will be able to write a lift plan.

Conditions: The learner will be given
- Materials
- Equipment
- Instructions

Criteria: The learner will be evaluated on
- Accuracy of written inspection report

Achievement Criteria 3

Performance: The learner will be able to make a lift using a spreader bar.

Conditions: The learner will be given
- Materials
- Equipment
- Instructions

Criteria: The learner will be evaluated on
- Safety
- Below the hook lifting devices set-up
- Proper choice of rigging gear
- Effective communication for signaling

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E2 Rig loads

Objectives

To be competent in this area, the individual must be able to:

- Rig loads
- Tie knots, bends and hitches
- Maintain rigging equipment

LEARNING TASKS

1. Select ropes, slings and hitches

CONTENT

- Strength
- Wear resistance
- Fibre rope
  - Types
  - Properties
  - Efficiencies
    - Knots
    - Bends
    - Hitches
    - Splices
- WLL
- Calculation using rigger's rule of thumb
- Wire rope
  - Types
    - Cores and lays
  - Properties
    - Fatigue
    - Abrasion
    - Corrosion
    - Bending
    - Crushing
    - Strength
    - Flexibility
  - Efficiencies
    - Clipped eye
    - Flemish eye
    - Flemish eye with one wire rope clip
    - Mechanical eye
    - Wedge socket
  - WLL
    - Calculation using rigger's rule of thumb
    - Use of charts

LEARNING TASKS	CONTENT

	• Slings
	  ○ Compositions
	  – Wire rope
	  – Synthetics
	  – Chain
	  – Fibre
	  – Metal/chain mesh
	  ○ Sling configurations
	  – Load control
	  – Vertical
	  – Baskets
	  – Choker hitches
	  – Bridle hitches
	  – Efficiencies
	  ○ WLL
	  – Calculation using rigger's rule of thumb
	  – Use of charts

2. Inspect rigging equipment	• Storage • Handling • Safety considerations ○ OHS regulations

3. Tie knots, bends, hitches and splices	• Sheet bend, double sheet bend
	• Hitches
	  ○ Clove
	  ○ Rolling
	  ○ Timber
	  ○ Hammer
	• Snubber
	• Knots
	  ○ Figure 8
	  – Single
	  – Double
	  ○ Bowline
	  – Standard
	  – Running
	  ○ Clove hitch
	  ○ Reef knot
	  ○ Sheet bend

LEARNING TASKS	CONTENT

4. Attach rigging equipment to the load	• Rigging plan requirements
	• Rigging equipment practices
	  ○ Usage of softeners
	  ○ Shackles positioning
	  ○ Setting of spreaders
	• Selection of lifting location or pick point
	  ○ Lifting lug location
	  ○ Sling arrangements
	  ○ Function
	  ○ Advantages and limitations of various sling arrangements
	• Determination the centre of gravity of load
	• Accessing rigging points using various equipment
	  ○ Scissor lifts
	  ○ Manual lifts
	  ○ Ladders
	• Adjustment or adding of rigging equipment
	• Anchorage and hold back
	• Safety
	• Securing loads
	  ○ Tag line
	  ○ Lashing

5. Maintain rigging equipment	• Cleaning and lubricating of rigging equipment • Inspection • Recognition of damaged and defective rigging equipment

Achievement Criteria 1

Performance	The learner will be able to tie a prescribed set of knots in a working manner.
Conditions	The learner will be given • Equipment • Instructions
Criteria	The learner will be evaluated on • Accuracy • Shaping

Achievement Criteria 2

Performance The learner will be able to construct a Flemish eye to a specified size.

Conditions The learner will be given

- Equipment
- Instructions

Criteria The learner will be evaluated on

- Accuracy
- Measured eye size
- Marriage
- Tail length

Achievement Criteria 3

Performance The learner will be able to apply minimum size choker(s) required for a given task.

Conditions The learner will be given

- Materials
- Equipment
- Instructions

Criteria The learner will be evaluated on

- Configuration
- Mass
- Physical condition

Achievement Criteria 4

Performance The learner will be able to perform a multi-part reeve-up.

Conditions The learner will be given

- Materials
- Equipment
- Instructions

Criteria The learner will be evaluated on

- Block position
- Reeving of rope
- Proper alignment of reeving
- Starting and finishing point
- Installation of becket

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E3 Hoist loads

Objectives

To be competent in this area, the individual must be able to:

- Hoist loads with cranes
- Hoist loads with tuggers
- Hoist loads with manually operated hoisting equipment

LEARNING TASKS	CONTENT
1. Use manually operated hoisting equipment	• Come-alongs • Chain falls • Grip hoist

2. Prepare cranes for hoisting	• Knowledge of crane components
	• Set up
	• Blocks
	• Reeving sequences
	• Crane procedures
	  ○ Load charts
	  ○ Outriggers
	  ○ Walk-around inspection

3. Prepare tuggers for hoisting	• Tuggers
	• Operation specifications
	• Set up
	  ○ Structural integrity of tugger and anchor points
	  ○ Installation of wire rope on tugger drum
	  ○ Air compressor to tugger
	  ▪ Connection
	  ○ Lead blocks (fleet angles)
	• Compressed air requirements for operation of tuggers

4. Hoist loads with cranes, tuggers and manually operated equipment	• Operation of hoisting equipment
	  ○ Procedures
	  ○ Participate in pre-lift meeting
	• Hoisting operations
	  ○ Pulling
	  ○ Pushing
	  ○ Transferring rigging
	• Hoisting communication methods

LEARNING TASKS	CONTENT
	○ Hand signals ○ Two-way radios • Performing tandem lifts • Recognizing and correcting lift irregularities
5. Secure load before rigging removal	• Securing loads ○ Guy wires ○ Come-alongs ○ Lashing ○ Welding – Grounding procedures • Potential dangers during rigging removal • Cribbing • Ensuring load stability • Determining requirements for securing load • Securing materials ○ Selection • Loads for subsequent placement ○ Suspension • Tying knots
6. Perform post-lift activities	• Post-lift inspection • Hoisting equipment disassembly • Maintain rigging equipment

Achievement Criteria

Performance: The learner will be able to lift a given object.

Conditions: The learner will be given
- Tools
- Equipment
- Instructions

Criteria: The learner will be evaluated on
- Lift plan
- Safety
- Set-up
- Hand signals/communication
- Lift load
- Securing load

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F1 Perform fabrication

Objectives

To be competent in this area, the individual must be able to:

- Use measurement and layout tools
- Use parallel and radial line development techniques
- Inspect and maintain measurement and layout tools
- Apply layout techniques

LEARNING TASKS	CONTENT
1. Describe layout tools	• Tape measure • Levels • Water level • Lasers • Distance finder • Squares • Dividers • Trammel points • Straight edge • Scribe • Soapstone • Plumb bob • Chalk line • Centre punch • Hammer • Piano wire • See Tools & Equipment for complete list of tools

2. Use measurement and layout tools	• Purpose/use
	  ○ Lines
	  ○ Circles
	  ○ Rectangles
	  ○ Triangles
	  ○ Flanges
	  ○ Bolt holes
	• Proper use
	• Procedures/operations
	• Set-up
	• Safe use and storage

LEARNING TASKS	CONTENT
	• Adjustment
3. Inspect and maintain measurement and layout tools	• Inspection • Maintenance • Storage

4. Apply layout techniques	• Applying layout methods
	  ○ Parallel-line
	  ○ Triangulation
	  ○ Radial-line development
	• Layout and measuring tools and equipment
	  ○ Selection
	• Mathematical calculations
	• Transferring measurements and elevations
	• Measurements verification

5. Make jigs and templates	• Task at hand • Specifications

Achievement Criteria 1

Performance	The learner will be able to demonstrate the proper set up, use, care and handling of a Builder's Level.
Conditions	The learner will be given • Level • Task instructions
Criteria	The learner will be evaluated on • Adherence to the checklist of tasks

Achievement Criteria 2

Performance	The learner will be able to develop layout patterns for assembly.
Conditions	The learner will be given • Tools • Equipment • Dimensions • Instructions
Criteria	The learner will be evaluated on • Accuracy

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F2 Align and fit vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Erect boilers and tanks according to job specifications

LEARNING TASKS	CONTENT
1. Describe types of tanks	• Wet storage • Dry storage • Mixing • Thickening • Gas storage
2. Describe types of roofs	• Conical • Floating • Pan • Self-supporting • Lifter roof
3. Describe types of floor joints	• Lap • Square butt with backing • V-butt with backing
4. Describe types of grades	• Soil • Built-up • Concrete ring • Concrete pad • Grillage and beams
5. Describe the steps involved in erecting a tank	• Establish work point • Chord charts • Staging • Base preparation • Annular ring • Layout of floor plates • Orientation of shell • Layout of first course • Erect first course • Welding of vertical seams

LEARNING TASKS	CONTENT

	• Fit floor to shell
	• Erection of subsequent courses
	• Weld horizontal seams
	• Fittings
	  ○ Ladders
	  ○ Stairs
	  ○ Platforms
	  ○ Nozzles
	  ○ Access hatches
	• Rim angle
	• Roof
	  ○ Centre column
	  ○ Roof trusses
	  ○ Roof plates
	• Testing
	• Ensuring fit before fastening
	  ○ Welding on stopper bars
	  ○ Dogs and wedges
	• Checking for fit and function
	  ○ Temporary fastening
	• Modifying components

6. Select tools	• Shims • Dogs and wedges • Key plates and blank nuts • U-bars • Bull pins • Pry bars • Hickey bar • Leaf springs • Sweep
7. Erect tanks	• As per job requirements
8. Describe boiler types	• Fire tube • Water tube • Radiant • Convection • Power • Chemical recovery

LEARNING TASKS	CONTENT
	• Waste heat • Package
9. Describe boiler components	• Hanger rods • Drums/headers • Generating section • Wall platens • Super heater elements • Reheaters • Economizer bundles • Buck stays • Air heater • Tube sheets • Ducting • Wind boxes • Doors and ports • Scoot blowers • Burner boxes • Casing • Stack • Multi cones • Induced and Forced Draft fans • Screen tubes
10. Describe boiler tubing	• Sizes • Shapes • Materials • Hardness • Tube wall configurations
11. Describe the boiler tube installation process	• Expanding (rolling) • Calculation of optimum expansion • Tack tubes • Stabbing • Setting stock • Peening • First roll • Second roll • Belling

LEARNING TASKS	CONTENT
	• Over roll • Under roll • Setting retractors • Rolling blind nipples • Reroll • Testing • Welding • Tube bending • Milling • Beading • Annealing • Codes • Purging
12. Describe process equipment	• Digesters • Evaporator train • Tanks and vessels • Electrostatic precipitator

13. Select specialty tools and equipment for boiler erection	• Tube expanders
	  ○ Rolls
	  – Self-feed
	  – Retractive
	  – Modified retractor
	  – Ball drift expander
	  ○ Expanding (rolling)
	  – Lubrication
	  – Mandrel selection
	  – Peening tool
	  – Ball drift expanders
	  – Hydraulic/water
	• Portable milling equipment
	• Welding equipment
	• Tuggers
	• See Tools & Equipment for complete list of tools

14. Describe the steps involved in erecting (dismantling) boilers	• Erecting (dismantling) sequence • Hangar rods • Drums/headers

LEARNING TASKS	CONTENT
	• Generating section • Wall platens • Super heater elements • Economizer bundles • Buck stays • Air heater/tube sheets • Ducting • Wind boxes • Doors and ports • Soot blowers • Burner boxes • Casing
15. Erect/dismantle boilers	• As per job requirements

Achievement Criteria 1

Performance: The learner will be able to erect annular ring floor and tank.

Conditions: The learner will be given
- Tools
- Equipment
- Drawings

Criteria: The learner will be evaluated on
- Accuracy with specified tolerances
- Rigging practices
- Communication
- Fit-up of vertical seams

Achievement Criteria 2

Performance: The learner will be able to dismantle a mock-up boiler.

Conditions: The learner will be given
- Tools
- Equipment
- Boiler
- Instructions

Criteria: The learner will be evaluated on
- Site work procedures
- Rigging plan
- Equipment setup
- Proper communication
- Proper sequence
- Material handling
- Secure equipment

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F3 Fasten components

Objectives

To be competent in this area, the individual must be able to:

- Install fittings
- Expand tubes
- Describe bolt components

LEARNING TASKS	CONTENT

1. Install fittings	• Types
	  ○ Nozzles
	  ○ Access hatches
	  ○ Ports
	  ○ Instrument connections
	  – Level indicator
	  – Temperature probes
	  – Draft connections
	• Accessories
	  ○ Reinforcing plates (Doublers)
	  ○ Flanges
	  ○ Connections
	• Aligning vessel or component with existing component

2. Expand tubes	• Expansion theory and techniques • Tools and equipment • Measuring devices • Tube expansion calculations

3. Describe bolt components	• Preparing components prior to fastening
	  ○ Cleaning
	  ○ Buffing
	  ○ Lubricating
	• Ensuring proper fit before tightening
	  ○ Connections
	  – Types
	  – Flanges
	  – Structure
	  – Access hatches
	• Bolt tensioning equipment/tools
	• Hardware

LEARNING TASKS	CONTENT
	○ Grades ○ Size ○ Locking mechanisms • Gaskets • Sequence of installation • Techniques ○ Alignment of components ○ Gaskets ○ Initial bolt installation ○ Tightening sequence ○ Torque and tensioning sequence

Achievement Criteria

Performance	The learner will be able to expand water wall tubes.
Conditions	The learner will be given • Material • Instructions • Equipment • Specifications
Criteria	The learner will be evaluated on • Preparation of tube sheet and tube • Expansion of tube • Final inside diameter (ID)

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G1 Inspect and test vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Perform destructive and non-destructive testing procedures
- Inspect vessels and components for defects

LEARNING TASKS	CONTENT
1. Describe testing procedures	• Non-destructive • Destructive

2. Identify bodies that determine test requirements	• Customer
	• Contractors
	• Design Engineer
	• Inspection of Power Engineer Boiler
	• Technical Safety BC (TSBC)
	• Contractor Quality Assurance/Quality Control (QA/QC)
	• Supplier QA/QC
	• Design documents
	  ○ Specifications
	  ○ Drawings
	• American Petroleum Institute (API)
	• American National Standards Institute (ANSI)
	• American Society of Mechanical Engineers (ASME)
	• Canadian Welding Bureau (CWB)
	• CSA

3. Perform destructive and non-destructive tests	• Preparation of components for testing
	• Non-destructive
	  ○ Visual inspection
	  ○ Hydrostatic test
	  ○ Air test
	• Destructive
	  ○ Bend test
	• Interpret test results
	• Venting systems as required
	• Recognition of leaks

LEARNING TASKS

4. Inspect vessels and components for defects

CONTENT

- Cleaning welded surfaces for inspection
- Recognition of common defects
- Identification of weld deficiencies
- Visual inspection
- Tubes
  - Purge
- Alignment
  - Inspection
- Reporting deficiencies and defects
- Permit requirements as needed

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G2 Service vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Describe upgrades to vessels and components
- Describe preventative maintenance on vessels and components

LEARNING TASKS	CONTENT

1. Describe upgrades to vessels and components	• Site conditions
	• Permit requirements
	  ○ Gas tests
	  ○ Hot and cold work
	  ○ Confined space
	• Fasteners
	• Permit requirements
	• Isolating
	• Blinding
	• Blanking
	• Locking and tagging
	• Site modification requirements
	  ○ Demolition
	  ○ Component removal
	  ○ Adjustments
	• Access to work area
	• Materials
	  ○ Transport
	  ○ Disposal
	• Fitting and fastening components to existing systems
	• Recognition of hazards
	  ○ Removal and addition of components
	• Replacement of material
	• Re-using materials and components

2. Describe the preparation of vessels and components for maintenance and repair	• Company and worksite policies and procedures
	• Safety requirements
	  ○ Ensuring proper ventilation
	  ○ Installing bulkheads
	  ○ Performing lock out procedures
	• Setting up work area

LEARNING TASKS	CONTENT
	• Accessing/creating opening to work area • Connecting to service and utilities • Identifying material to be repaired • Selecting the repair material • Preparing parent material • Preparing repair pieces
3. Describe preventative maintenance on vessels and components	• Inspection methods and procedures • Company policies and procedures • Overlay and thermal spray procedures • Scraping and cleaning components • Performing of hydro tests • Visual inspections • Plugging of tubes to isolate them from the system • Recognition of worn, damaged, and defective vessels and components • Informing appropriate authority of possible defects • Removal, maintenance and replacement of components

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G3 Remove and dismantle vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Describe vessels and components
- Describe how to demolish vessels and components
- Remove materials from vessels and components

LEARNING TASKS	CONTENT
1. Dismantle vessels and components	• Dismantling methods and procedures • Safety coordination and planning • Planning the dismantling of components • Tools and equipment • Coordination with other trades • Numbering and match marking components to organize dismantled pieces • Salvaging materials
2. Describe how to demolish vessels and components	• Demolition methods and procedures • Safety coordination and planning • Identifying re-usable material • Identifying components and vessels for demolition • Planning the demolition • Coordination with other trades • Securing the work area • Salvaging materials
3. Remove materials from vessels	• Lifting, hoisting, handling and storage methods • Safety coordination and planning • Proper disposal of waste material • Material and scrap removal procedures • Coordination with other workers • Securing the work area • Identify material for re-use or scrap
4. Reinstall materials into vessels	• Materials • Tools and equipment • Reassemble procedure • Safety considerations • Securing work area • Coordination with other workers

Achievement Criteria 1

Performance	The learner will be able to remove and replace a tube bundle in a heat exchanger.
Conditions	The learner will be given • Equipment • Material • Instructions
Criteria	The learner will be evaluated on • Organization • Safety • Procedures • Piece marking/tagging • Final assembly • Communication

Achievement Criteria 2

Performance	The learner will be able to open towers and replace defective components.
Conditions	The learner will be given • Material • Equipment • Instructions
Criteria	The learner will be evaluated on • Material handling • Installation procedures • Communication

Level 2

Boilermaker

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B2 Use power tools and shop fabrication tools

Objectives

To be competent in this area, the individual must be able to:

- Select power tools and shop fabrication equipment
- Use power tools
- Use shop fabrication tools
- Inspect power tools and accessories
- Inspect fabrication tools

LEARNING TASKS	CONTENT
1. Select power tools	• Drill • Grinder/grinding tools • Impact wrench • Chop saw • Circular saw • Reciprocating saw • Gasoline-powered tools • Hydraulic tools • Pneumatic tools • See Tools & Equipment for complete list of tools
2. Select shop fabrication tools	• Band saws • Cutoff saws • Drill presses • Bender • Ironworker • Hydraulic presses • Shears • Brakes • Power plate rolls • Turning rolls • Automatic burning equipment • See Tools & Equipment for complete list of tools
3. Use power tools and shop fabrication tools	• Types • Parts • Purpose/use • Procedures/order of operations • Safe use • Adjustment

LEARNING TASKS	CONTENT
	• Assured grounding
4. Inspect power tools and shop fabrication tools	• Inspection • Storage • As per job requirement and manufacturer specifications
5. Describe tube removal/ expansion tools	• Tube rolls • Mandrel • Rolling gun • Milling machine • Micrometers • See Tool list, section 4
6. Describe bolt tensioning and torqueing equipment	• Hydraulic pumps • Torqueing and tensioning equipment
7. Inspect tube tools and tensioning and torqueing equipment	• Visual • Operational

Achievement Criteria 1

Performance: The learner will be able to demonstrate the proper set up and use of given tools.

Conditions: The learner will be given

- Tools
- Equipment
- Specifications

Criteria: The learner will be evaluated on

- Accuracy of finished product
- Fit-up
- Operation

Achievement Criteria 2

Performance: The learner will be able to demonstrate the proper set-up and use of shop equipment.

Conditions: The learner will be given

- Equipment
- Materials
- Task instructions

Criteria: The learner will be evaluated on

- Safety
- Appearance
- Tolerances
- Adherence to the checklist of tasks

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B3 Use cutting tools and equipment

Objectives

To be competent in this area, the individual must be able to:

- Perform various methods of cutting and welding plate

LEARNING TASKS	CONTENT

1. Cut plate using various tools	• Basic procedures/operations
	• Set-up
	• Adjustment
	• Take down
	• Inspection
	• Maintenance
	• Storage
	• Cutting tools
	• Oxy-fuel torch
	  ○ Adjustment
	  – Working pressures
	  – Flame types
	  ○ Transport
	• Plasma
	• Abrasive disk
	• Carbon arc

2. Identify arc welding equipment	• Safety • Types of processes • Types of welding machines • Cables • Ground clamp • Electrode holder • Remote controls • Hydraulic test piece bender • PPE
3. Identify arc welding consumables	• Electrodes • Filler wire • Flux • Tungsten • Shielding gases • Anti-spatter
4. Apply welding procedures	• Safety • Procedures • Interpret procedures

LEARNING TASKS	CONTENT
	• Material to be welded • Process used • Consumables • Pre-heats • Post-heats • Inter-pass temperatures • Techniques
5. Use distortion controls	• Jigs • Bracing • Tacking • Pre-offset • Heat • Welding • Back stepping • Sequential • Procedures

6. Describe weld testing procedures	• Non-destructive
	• Visual inspection
	• Liquid penetrant inspection
	• Magnetic particle inspection
	• Ultrasonic inspection
	• Gamma ray inspection
	• Hardness test
	• Destructive test
	  ○ Bend test
	  ○ Tensile test
	• Weld analysis
	• Metallurgical analysis

Achievement Criteria

Performance	The learner will be able to perform cutting and basic welding.
Conditions	The learner will be given • Materials • Equipment • Specifications
Criteria	The learner will be evaluated on • Safety • Penetration • Accuracy • Appearance • Bend test

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B4 Use work platforms and access equipment

Objectives

To be competent in this area, the individual must be able to:

- Perform a rigging removal analysis
- Plan access for rigging removal

LEARNING TASKS	CONTENT
1. Determine appropriate access for rigging removal	• Mobile • Mechanical • Stationary

2. Determine appropriate considerations for rigging removal	• Methods
	• Area surrounding lift
	  ○ Impact on others
	• Dry run procedures
	• Recognize hazards
	  ○ Overhead wires
	  ○ Load drift
	  ○ Wind speed
	  ○ Ground conditions
	• Interpret engineered lift drawings
	• Interpret load charts

3. Determine mobile equipment required for rigging removal	• Personnel lifts
	  ○ Size
	  ○ Boom styles
	  ○ Capability
	• Scissor lifts
	• Personnel baskets
	  ○ Communication methods
	  – Two-way radios
	  – Hand signals
	  ○ Delegate responsibilities
	  – Operator
	  – Signal person
	  – Tag line person

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C2 Use drawings and specifications

Objectives

To be competent in this area, the individual must be able to:

- Analyse a drawing in detail

LEARNING TASKS	CONTENT

1. Identify elements on advanced drawings	• Basic format
	  ○ Symbols/welding
	  ○ Abbreviations
	  ○ Material list
	  ○ Tolerance and fitting requirements
	  ○ Direction marks and placement marks
	  ○ Centres and work points
	  ○ Revisions
	  ○ Details

2. Analyse a drawing in detail	• Reference dimension point (running dimensions) • Working point • Orientations • Elevations • Rise and run • Cut out size • Discuss relevant codes and standards

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C3 Handle materials and components

Objectives

To be competent in this area, the individual must be able to:

- Describe considerations when handling materials and relevant components
- Handle materials and relevant components according to job requirements

LEARNING TASKS	CONTENT

1. Describe considerations and responsibilities when handling plates, tubes and fasteners	• Safety/OHS
	• Ergonomics
	• Storage
	• Transportation
	  ○ Method of transportation
	• Off-loading
	  ○ Crane
	  ○ Forklift
	  ○ Manual
	• Cribbing and blocking
	• Use of plate clamps and plate racks
	• Product protection
	• Disposal
	• Recycling
	• Identification of materials

2. Describe procedures for handling materials	• Safety • Loading/unloading procedures • Securing • Packaging/shipping • Pallets • Shipping containers • Equipment

3. Handle materials	• According to job/site requirements
	  ○ Moving plate
	  ○ Moving tubes
	  ○ Moving fasteners
	• Safety procedures
	• Shipping and storage considerations

Line (GAC): D PERFORM CUTTING AND WELDING ACTIVITIES

Competency: D1 Cut material

Objectives

To be competent in this area, the individual must be able to:

- Perform various methods of cutting on plate and tubes

LEARNING TASKS

1. Cut plate and tubes using various tools

CONTENT

- Basic procedures/operations
- Set-up
- Adjustment
- Take down
- Inspection
- Maintenance
- Storage
- Cutting tools
  - Reciprocating saw
  - Abrasive disk
  - Plasma
  - Oxy-fuel torch
  - Gouging
- Adjustment (working pressures and flame types)
- Transport

Line (GAC): D PERFORM CUTTING AND WELDING ACTIVITIES

Competency: D2 Perform welding

Objectives

To be competent in this area, the individual must be able to:

- Prepare and fit joints for a hopper
- Perform basic welding for a hopper
- Use distortion control

LEARNING TASKS	CONTENT
1. Prepare joints for fitting	• Tool and equipment selection • Joint set up • Material preparation • Joint cleaning
2. Fit joints	• Tool and equipment selection • Alignment tolerances • Set gap

3. Identify arc welding equipment	• Safety
	• Types of processes
	• Types of welding machines
	  ○ Alternating current (AC)
	  ○ Direct current (DC)
	• Cables
	• Ground clamp
	• Electrode holder
	• PPE

4. Identify arc welding consumables	• Electrodes • Filler wire • Flux • Shielding gases • Anti-spatter
5. Perform tack welds	• Tool and equipment selection • Consumables required • Tack weld placement • Tack weld removal

LEARNING TASKS	CONTENT
6. Apply welding procedures	• Safety • Procedures • Material to be welded • Process used • Consumables • Techniques
7. Use distortion controls	• Jigs • Bracing • Tacking • Heat • Welding • Back stepping • Sequential

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E1 Plan lifts

Objectives

To be competent in this area, the individual must be able to:

- Perform a pre-lift analysis
- Plan a lift

LEARNING TASKS	CONTENT
1. Determine the weight of a load	• Reading prints • Measuring load dimensions • Calculating weights of loads using required formulas • Shipping weights

2. Perform a pre-lift analysis on a given component	• Types of lift
	  ○ Regular
	  ○ Tandem
	  ○ Critical
	• Load properties
	  ○ Dimensions
	  ○ Shape
	  ○ Weight
	  ○ Determining centre of gravity of loads
	• Area surrounding lift
	  ○ Impact on others
	• Signaling methods
	  ○ Two-way radios
	  ○ Hand signals
	• Delegate responsibilities
	  ○ Operator
	  ○ Signal person
	  ○ Tag line person
	• Dry run procedures
	• Recognize hazards
	  ○ Overhead wires
	  ○ Load drift
	  ○ Wind speed
	  ○ Unstable ground conditions
	• Interpret engineered lift drawings
	• Interpret load charts
	• Perform load calculations

LEARNING TASKS	CONTENT

	• Anticipate equipment required for rigging removal
	  ○ Personnel lifts
	  ○ Scissor lifts
	  ○ Personnel baskets
	  ○ Scaffolding

3. Select rigging and hoisting equipment for a given application	• Determine the rigging and hoisting capacity • Mechanical advantage • Ensure rigging and hoisting equipment meets parameters of WLL
4. Secure the lift area	• Swing zone and swing clearance • Setting up barricades • Conducting pre-lift safety checks

Achievement Criteria

Performance: The learner will be able to plan and perform a lift.

Conditions: The learner will be given

- Materials
- Equipment
- Instructions

Criteria: The learner will be evaluated on

- Safety
- Accuracy of lift plan
- Proper choice of rigging gear
- Rigging gear inspection
- Transferring and securing the load
- Cooperation/communication among group

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E2 Rig loads

Objectives

To be competent in this area, the individual must be able to:

- Apply formulas for rigging loads
- Rig and secure loads

LEARNING TASKS	CONTENT

1. Apply formulas for rigging loads	• WLL
	  ○ Calculate using rigger's rule of thumb
	  ○ Use of charts
	  ○ Using appropriate formulas
	• Slings
	  ○ Sling configurations
	  – Load control
	  – Vertical
	  – Baskets
	  – Choker hitches
	  – Bridle hitches
	  – Efficiencies

2. Rig loads	• Rigging equipment practices
	  ○ Using softeners
	  ○ Positioning shackles
	• Inspection of rigging equipment
	• Selection of lifting attachment location or pick point
	  ○ Lifting lug location
	  ○ Sling arrangements
	  ○ Advantages and limitations of various sling arrangements
	• Determining the centre of gravity of load
	• Securing of loads
	  ○ Tag line
	  ○ Knots
	  – Bowline
	  – Clove hitch
	  – Reef knot
	  – Sheet bend
	• According to job requirements

Achievement Criteria 1

Performance The learner will be able to determine sling stress at a given angle.

Conditions The learner will be given

- Equipment
- Instructions

Criteria The learner will be evaluated on

- Accuracy of calculations
- Proper sling configuration
- Correct choice of rigging

Achievement Criteria 2

Performance The learner will be able to apply slings to exercise maximum load control.

Conditions The learner will be given

- Materials
- Equipment
- Instructions

Criteria The learner will be evaluated on

- Correct sling configuration
- Correct sling size
- Proper load control

Achievement Criteria 3

Performance The learner will be able to choose and tie appropriate knots for given applications.

Conditions The learner will be given

- Equipment
- Instructions

Criteria The learner will be evaluated on

- Accuracy
- Proper knot choice
- Proper rope

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E3 Hoist loads

Objectives

To be competent in this area, the individual must be able to:

- Hoist loads with cranes
- Assemble and disassemble jib

LEARNING TASKS	CONTENT

1. Prepare crane for hoisting	• Set up
	  ○ Jib
	  ○ Headache ball
	• Crane procedures
	  ○ Load charts
	  ○ Outriggers
	  ○ Walk-around inspection

2. Hoist loads with cranes	• Inspect rigging equipment
	• Hoisting communication methods
	  ○ Hand signals
	  ○ Two-way radios
	• Recognition and correction of lift irregularities
	• Establishing of lift plan
	• Securing of required lift area
	• Load control

3. Secure the load before rigging removal	• Securing of loads • Ensuring of load stability

Achievement Criteria

Performance	The learner will be able to attach and stow a jib.
Conditions	The learner will be given • Tools • Equipment • Instructions
Criteria	The learner will be evaluated on • Safety • Proper procedures • Removal and re-attachment of headache ball • Confirm proper attachment and stowing of jib

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F1 Perform fabrication

Objectives

To be competent in this area, the individual must be able to:

- Use measurement and layout tools to lay out a hopper
- Construct a metal hopper

LEARNING TASKS	CONTENT
1. Develop a hopper pattern	• Specifications • Measurement and layout tools

2. Use measurement and layout tools to lay out a hopper	• Purpose/use
	  ○ Lines
	  ○ Rectangles
	  ○ Triangles
	• Proper use
	• Procedures/operations
	• Template set-up
	• Material utilization
	• True line length

3. Construct cardboard model	• Measurement and layout accuracy • Assembly
4. Apply fabrication patterns	• Layout and nesting
5. Cut out components	• Oxy fuel • Plasma

6. Assemble a hopper	• Fitting methods and procedures
	• Pre-assembly requirements
	• Tolerances for conditions
	  ○ Out of level
	  ○ Out of plumb
	  ○ High/low
	  ○ Squareness
	• Tools and equipment
	  ○ Select
	  ○ Use
	• Ensure proper fit:

LEARNING TASKS	CONTENT
	○ Welding on stopper bars ○ Dogs and wedges ○ Jigs ○ Plate fitting techniques ○ Distortion controls ○ Clamping ○ Welding

Achievement Criteria 1

Performance: The learner will be able to lay out and construct a cardboard hopper.

Conditions: The learner will be given

- Tools
- Equipment
- Specifications
- Materials

Criteria: The learner will be evaluated on

- Accuracy of finished product and layout
- Fit-up

Achievement Criteria 2

Performance: The learner will be able to layout, fabricate and construct a metal hopper.

Conditions: The learner will be given

- Material
- Equipment
- Specifications

Criteria: The learner will be evaluated on

- Accuracy of template
- Fit-up
- Burning
- Welding
- Adherence to specifications

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F2 Align and fit vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Describe performing hand lay-ups of fibreglass

LEARNING TASKS

1. Describe fibre-reinforced components

CONTENT

- Methyl ethyl ketone peroxide
- Styrene
- Dimethylaniline
- Cobalt naphthenate
- Acetone
- Resins
- Glass reinforcements
- Cure systems
- Catalysts
- Uses
- Applications
- Storage
- Installation techniques
  - Preparation of joints
  - Fabrication techniques
  - Laminate design and inspection
  - Lay up joints

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F3 Fasten components

Objectives

To be competent in this area, the individual must be able to:

- Bolt components using bolt torquing and tensioning equipment
- Remove and replace exchanger tubes

LEARNING TASKS	CONTENT

1. Set up equipment	• Selection of appropriate tools
	• Handling of equipment
	• Fasteners
	  ○ Grades
	  ○ Size
	  ○ Locking mechanisms
	• Gaskets

2. Fasten components	• Prepare components and fasteners prior to fastening
	  ○ Cleaning
	  ○ Buffing
	  ○ Lubricating
	• Sequence of installation
	  ○ Adherence to specialized procedure
	  ○ Installation of components and fasteners
	• Ensure proper fit before tightening
	• Techniques
	  ○ Alignment of components
	  ○ Gaskets
	  ○ Initial bolt installation
	  ○ Tightening sequence
	  ○ Torqueing and tensioning sequence
	• Use charts

3. Install a tube in a fire tube boiler	• Annealing of tube • Preparation of tube sheet and tube • Expansion • Set stock • Beading

LEARNING TASKS	CONTENT

4. Describe the process of installing a fire tube in a fire tube boiler	• Theory of fire tubes and installation
	  ○ Annealing
	  ○ Use of rolling equipment
	  ○ Technique of beading the tube
	• Tube sheet preparation

5. Remove and replace exchanger tubes	• Removal and replacement procedures • Removal and replacement tools

Achievement Criteria 1

Performance: The learner will be able to bolt components.

Conditions: The learner will be given

- Material
- Instructions
- Equipment

Criteria: The learner will be evaluated on

- Hardware preparation
- Installation sequence
- Adherence to proper technique
- Torqueing and tensioning
  - Adherence to torque specifications

Achievement Criteria 2

Performance: The learner will be able to remove and install fire and exchanger tubes.

Conditions: The learner will be given

- Material
- Instructions
- Equipment
- Specifications

Criteria: The learner will be evaluated on

- Preparation of tube sheet and tube
- Expansion of tube
- Final ID

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G1 Inspect and test vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Identify metallurgical properties of vessels and components
- Recognize common vessel and component defects

LEARNING TASKS	CONTENT

1. Identify different properties of metals	• Metallurgy testing theory and applications
	  ○ Types of metals
	  ○ Properties of metals
	  – Mechanical
	  – Physical
	  ○ Methods of steel making
	  ○ Steel products
	  ○ Forging and casting processes
	  ○ Steel classifications
	  ○ Visual identification of metals
	  ○ Testing methods for identifying metals

2. Describe testing methods for vessels and components	• Non-destructive testing
	  ○ Visual
	  ○ Mag particles
	  ○ Dye penetration
	  ○ Ultra-violet lighting
	  ○ Ultra-sound
	  ○ Radiographic
	• Destructive testing

3. Recognize common vessel and component defects	• Loose parts • Metal wastage • Corrosion • Leaks

Achievement Criteria

Performance	The learner will be able to replace tube in tube sheet of vessel.
Conditions	The learner will be given • Material • Instructions • Equipment • Specifications
Criteria	The learner will be evaluated on • Safety • Preparation of tube sheet and tube • Expansion of tube • Accuracy • Final ID

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G2 Service vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Assess vessels and components in preparation for replacement
- Perform preventative maintenance on vessels and components

LEARNING TASKS	CONTENT

1. Assess vessels and components	• Site conditions
	• Fasteners
	• Verification of permit requirements
	• Identification of site modification requirements
	  ○ Demolition
	  ○ Component removal
	  ○ Adjustments
	• Creating access to work area
	• Moving materials to appropriate location
	• Material disposal
	• Recognition of hazards of removing and adding components
	• Replacing material
	• Re-using materials and components

2. Prepare vessels and components for maintenance and repair	• Company and worksite policies and procedures
	• Safety requirements
	  ○ Ensuring proper ventilation
	  ○ Installing bulkheads
	  ○ Performing lock out procedures
	• Setting up work area
	• Accessing/creating opening to work area
	• Identifying material to be repaired
	• Selection of repair material
	• Preparing repair pieces

3. Perform preventative maintenance on vessels and components	• Inspection methods and procedures • Company policies and procedures • Overlay and thermal spray procedures • Scraping and cleaning components • Visual inspections • Recognizing worn damaged and defective vessels and components • Informing appropriate authority of possible defects

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G3 Remove and dismantle vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Dismantle bolted up components

LEARNING TASKS	CONTENT

1. Describe how to dismantle vessels and components	• Sequencing
	  ○ Methods and procedures
	  ○ Safety coordination and planning
	  ○ Positive identification
	  ○ Identifying re-usable material
	  ○ Component integrity
	  ○ Planning the dismantling
	  ○ Coordination with other workers
	  ○ Securing the work area
	  ○ Salvaging materials

2. Dismantle bolted up components	• Dismantling methods and procedures • Safety coordination and planning • Planning the dismantling of components • Tools and equipment • Coordination with other workers • Numbering and match marking components to organize dismantled pieces • Salvaging materials • Unfasten

Achievement Criteria

Performance: The learner will be able to dismantle a bolted up joint.

Conditions: The learner will be given

- Equipment
- Material
- Instructions

Criteria: The learner will be evaluated on

- Organization
- Safety
- Procedures
- Piece marking/tagging
- Communication

Level 3

Boilermaker

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B2 Use power tools and shop fabrication tools

Objectives

To be competent in this area, the individual must be able to:

- Select appropriate grinders for pipe and nozzle application
- Use appropriate grinders for pipe and nozzle application
- Inspect power tools

LEARNING TASKS	CONTENT
1. Select appropriate grinders for pipe and nozzle application	• Die grinders • Angle grinders • See Tools & Equipment for complete list of tools
2. Use appropriate grinders for pipe and nozzle application	• Die grinders • Angle grinders • See Tools & Equipment for complete list of tools
3. Inspect power tools	• Operational • Visual

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B3 Use cutting tools and equipment

Objectives

To be competent in this area, the individual must be able to:

- Cut pipe and vessel shells using various methods and tools

LEARNING TASKS

1. Cut pipe and vessel shells using various methods and tools

CONTENT

- Basic procedures/operations
- Set-up
- Adjustment
- Take down
- Inspection
- Maintenance
- Storage
- Cutting tools
- Oxy fuel torch
  - Adjustment
    - Working pressures
    - Flame types
  - Transport
- Plasma
- Abrasive disk
- Carbon arc

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B4 Use work platforms and access equipment

Objectives

To be competent in this area, the individual must be able to:

- Plan access to attachment points for rigging purposes

LEARNING TASKS	CONTENT
1. Determine appropriate access to attachment points	• Stationary • Mobile • Mechanical
2. Determine appropriate considerations for access to attachment points	• Methods • Area surrounding lift ○ Impact on others • Recognize hazards • Interpret engineered drawings

3. Determine stationary equipment required for rigging removal	• Stationary equipment
	  ○ Manufactured
	  ○ Tube clamp
	• Inspection
	  ○ Valid tagging
	• Purpose

4. Determine mechanical equipment required for rigging removal	• Swing staging • Boatswain's chair

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C2 Use drawings and specifications

Objectives

To be competent in this area, the individual must be able to:

- Analyse multiple technical drawings in detail
- Apply information to perform layout for fabrication

LEARNING TASKS	CONTENT

1. Identify elements on technically advanced drawings	• Basic format
	  ○ Symbols/welding
	  ○ Abbreviations
	  ○ Material list
	  ○ Tolerance and fitting requirements
	  ○ Direction marks and placement marks
	  ○ Centres and work points
	  ○ Revisions
	  ○ Details

2. Analyse multiple drawings in detail	• Reference dimension point ○ Running dimensions • Working point • Orientations • Elevations • Rise and run • Discuss relevant codes and standards
3. Use drawings to determine layout for pipe fabrication	• Cut out size • Cutbacks • Angles • Dimensions • Orientation

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C3 Handle materials and components

Objectives

To be competent in this area, the individual must be able to:

- Describe considerations when handling materials and relevant components
- Handle materials and relevant components according to job requirements

LEARNING TASKS	CONTENT

1. Describe considerations and responsibilities when handling piping, nozzles and flanges	• Safety/OHS
	• Ergonomics
	• Storage
	• Transportation
	  ○ Method of transportation
	• Off-loading
	  ○ Crane
	  ○ Forklift
	  ○ Manual
	• Cribbing and blocking
	• Product protection
	• Disposal
	• Recycling
	• Identification of materials

2. Describe procedures for handling materials	• Safety • Loading/unloading procedures • Securing • Packaging/shipping • Pallets • Shipping containers • Equipment

3. Handle materials	• According to job/site requirements
	  ○ Moving pipe
	  ○ Moving nozzles
	  ○ Moving flanges
	• Safety procedures
	• Shipping and storage considerations

Line (GAC): C USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS

Competency: C4 Use communication and mentoring techniques

Objectives

To be competent in this area, the individual must be able to:

- Demonstrate knowledge of learning skills
- Demonstrate knowledge of teaching skills

LEARNING TASKS	CONTENT
1. Demonstrate knowledge of strategies for learning skills in the workplace	• Learning preferences • Skill types • Essential skills • Best practices
2. Demonstrate knowledge of strategies for teaching workplace skills	• Mentor roles • Steps in teaching skills • Providing feedback • Opportunities for improvement • Assessing progress

Line (GAC): D PERFORM CUTTING AND WELDING ACTIVITIES

Competency: D1 Cut material

Objectives

To be competent in this area, the individual must be able to:

- Cut pipe using various methods and tools

LEARNING TASKS

1. Cut pipe using various tools

CONTENT

- Basic procedures/operations
- Set-up
- Adjustment
- Take down
- Inspection
- Maintenance
- Storage
- Cutting tools
  - Oxy fuel torch
    - Adjustment (working pressures and flame types)
    - Transport
  - Plasma
  - Abrasive disk
  - Gouging
  - Band saw

Line (GAC): D PERFORM CUTTING AND WELDING ACTIVITIES

Competency: D2 Perform welding

Objectives

To be competent in this area, the individual must be able to:

- Prepare and fit joints for piping, nozzle installation and patch
- Perform basic welding for piping, nozzle installation and patch
- Use distortion control

LEARNING TASKS	CONTENT
1. Prepare joints for fitting	• Tool and equipment selection • Joint set up • Material preparation • Joint cleaning
2. Fit joints	• Tool and equipment selection • Alignment tolerances • Set gap • Elevation • Orientation • Projection

3. Identify arc welding equipment	• Safety
	• Types of processes
	• Types of welding machines
	  ○ AC
	  ○ DC
	• Cables
	• Ground clamp
	• Electrode holder
	• PPE

4. Identify arc welding consumables	• Electrodes • Filler wire • Flux • Shielding gases • Anti-spatter
5. Perform tack welds	• Tool and equipment selection • Consumables required • Tack weld placement

LEARNING TASKS	CONTENT
	• Tack weld removal
6. Apply welding procedures	• Safety • Material to be welded • Process used • Consumables • Techniques
7. Use distortion controls	• Jigs • Bracing • Tacking • Heat • Welding • Back stepping • Sequential • Procedures

Line (GAC): E USE RIGGING, HOISTING AND LIFITNG EQUIPMENT

Competency: E1 Plan lifts

Objectives

To be competent in this area, the individual must be able to:

- Plan and describe a lift using a bridle hitch

LEARNING TASKS	CONTENT
1. Determine weight of load	• Measuring load dimensions • Calculating weights of loads using required formulas

2. Define lift requirements	• Load properties
	  ○ Dimensions
	  ○ Shape
	  ○ Weight
	  ○ Determining centre of gravity of loads
	• Signaling methods
	  ○ Hand signals
	  ○ Verbal communication
	• Recognizing hazards
	• Interpreting load charts

3. Select rigging and hoisting equipment for a given application	• Bridle sling selection • Ensure rigging and hoisting equipment meets parameters of WLL
4. Secure lift area	• Swing zone and swing clearance • Setting up barricades and barriers • Conducting pre-lift safety checks

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E2 Rig loads

Objectives

To be competent in this area, the individual must be able to:

- Lift and transfer loads through an obstacle course

LEARNING TASKS	CONTENT

1. Apply formulas for rigging loads	• Rigging stress formulas
	  ○ Unequal leg length
	  ○ Efficiencies
	  ○ Stresses/angles
	• WLL
	  ○ Calculate using rigger's rule of thumb
	  ○ Using appropriate formulas

2. Plan a lift	• Pre-lift planning
	  ○ Detailed planning and coordination
	• Types of lift
	  ○ Regular
	  ○ Tandem
	  ○ Critical

3. Rig loads	• Rigging equipment practices
	  ○ Using softeners
	  ○ Positioning of anchor points
	  ○ Inspect equipment
	• Securing of loads
	  ○ Tag line
	  – Knots

4. Transfer loads	• Maintenance of correct elevations • Obstacle avoidance • Communication

Achievement Criteria

Performance	The learner will be able to lift and transfer loads through the rigging structure.
Conditions	The learner will be given • Materials • Equipment • Instructions
Criteria	The learner will be evaluated on • Safety • Detail of lift plan • Transferring of load • Equipment placement • Obstacle avoidance • Calculation of rigging stress

Line (GAC): E USE RIGGING, HOISTING AND LIFITNG EQUIPMENT

Competency: E3 Hoist loads

Objectives

To be competent in this area, the individual must be able to:

- Plan and execute a multiple-component lift
- Plan and execute lifts using tuggers

LEARNING TASKS	CONTENT

1. Plan the lift	• Determination of lift requirements and load path for lifts
	• Inspect rigging equipment
	• Type of lift
	• Calculated mechanical advantages
	• Rigging placement
	  ○ Initial
	  ○ Relocation
	  ○ Location of equipment placement
	  ○ Hold back
	  ○ Block locations
	  ○ Communication/coordination
	  ○ Attachment of rigging
	  ○ Rigging choice

2. Prepare tuggers for hoisting	• Set up • Location • Anchoring • Wire rope inspection • Air requirements

3. Hoist loads	• Hoisting communication methods
	  ○ Hand signals
	  ○ Two-way radios
	  ○ Verbal communication
	• Recognizing and correcting lift irregularities
	• Securing required lift area
	• Load control

4. Secure the load before removing rigging	• Ensuring load stability • Securing loads • Material handling

LEARNING TASKS	CONTENT
5. Disassemble rigging equipment	• Wire rope respooling • Blocks • Inspection • Storage • As per job requirements

Achievement Criteria

Performance	The learner will be able to plan and execute a multiple-component lift.
Conditions	The learner will be given • Materials • Equipment • Instructions
Criteria	The learner will be evaluated on • Safety • Detail of lift plan • Execution and accuracy

Line (GAC): E USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: E4 Fabricate rigging equipment

Objectives

To be competent in this area, the individual must be able to:

- Follow regulations for fabricating rigging equipment

LEARNING TASKS	CONTENT
1. Recognize limitations of fabricating rigging equipment	• Safety branch acceptance • WLL specified
2. Follow regulations for fabricating rigging equipment	• WorkSafeBC OHS ○ Part 15 • Site specific standards • Engineering standards

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F1 Perform fabrication

Objectives

To be competent in this area, the individual must be able to:

- Use measurement and layout tools to layout pipe
- Lay out and fabricate given pipe configurations

LEARNING TASKS	CONTENT
1. Use layout tools	• Pipe centre finder • Wrap-around • Straight edge ○ Angle iron

2. Lay out pipe	• Use of correct formulas for various pipe configurations
	• Laying out and marking on pipe
	• Quartering pipe
	• Pipe off-sets
	  ○ Tangents
	  ○ Ordinates
	  ○ Coordinates

3. Fabricate pipe configurations	• Alignment methods and procedures
	• Orientation
	• Tolerances
	• Aligning component with existing component
	• Assembly and installation using methods such as match-marking
	  ○ Two-piece 90° turn
	  ○ Three-piece 90° turn
	  ○ Full sized T
	  ○ Reducing lateral
	  ○ True-Y

4. Assemble pipe components	• Burning • Fitting methods and procedures • Inspection of fit up • Welding • Final inspection

Achievement Criteria

Performance — The learner will be able to lay out and fabricate various pipe configurations:

- 2 piece 90° from 6-in. pipe
- 3 piece 90° from 3-in. pipe
- 6-in. pipe tee
- Reducing lateral from 4-in. pipe
- True wye from 6-in. pipe

Conditions — The learner will be given

- Tools
- Pipe
- Instructions
- Drawings

Criteria — The learner will be evaluated on

- Accuracy of layout
- Fit-up
- Burning
- Welding

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F2 Align and fit vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Fabricate and install a nozzle in a vessel
- Lay out and install nozzle
- Install flush patch

LEARNING TASKS	CONTENT
1. Lay out nozzle	• Nozzle flange • Orientation • Elevation • Projection
2. Fabricate and install a nozzle	• Layout • Orientation • Elevation • Projection • Preparation • Fit • Attachment
3. Prepare and install a flush patch	• Preparation • Fit up • Welding procedures • Tack • Weld out • Specifications
4. Use stress relief techniques	• As per job requirements

Achievement Criteria 1

Performance The learner will be able to fabricate and install a nozzle in a vessel.

Conditions The learner will be given

- Material
- Equipment
- Specifications

Criteria The learner will be evaluated on

- Accuracy of nozzle fabrication
- Correct elevation and orientation
- Projection
- Flange bolt hole orientation
- Fit-up

Achievement Criteria 2

Performance The learner will be able to install a flush patch.

Conditions The learner will be given

- Materials
- Equipment
- Instructions

Criteria The learner will be evaluated on

- Accuracy of fit-up
- Distortion control
- Welding quality
- Stress relief hole

Line (GAC): F PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS

Competency: F3 Fasten components

Objectives

To be competent in this area, the individual must be able to:

- Perform hand lay-ups of fibreglass

LEARNING TASKS

1. Lay-up fibreglass

CONTENT

- Types and grades of fibreglass materials
- Mixing and curing procedures
- Tools
- PPE
- Environmental factors
  - Humidity
  - Temperature
- Accelerators, retarders and promoters
- Hazards of working with fibreglass
- Mixing resins
- Applying lay-up techniques
  - Rolling
  - Brushing
  - Spraying
- Ventilation equipment
- Storage and disposal of fibreglass materials

Achievement Criteria

Performance	The learner will be able to perform hand lay-ups of fibreglass.
Conditions	The learner will be given • Materials • Equipment • Instructions • Specifications
Criteria	The learner will be evaluated on • Strict adherence to safety protocol • Accuracy of lay out • Visual inspection

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G1 Inspect and test vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Describe codes for vessel inspection and construction
- Describe advanced testing

LEARNING TASKS	CONTENT
1. Describe codes for boiler and vessel inspection and construction	• ASME • CSA • TSBC • Other applicable codes

2. Describe hydrostatic testing	• Codes
	• Procedures
	  ○ Gauges
	  ○ Pumps
	  ○ Valves
	  ○ Fittings
	  ○ Venting point
	  ○ Attachment points

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G2 Service vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Perform isolation of a vessel
- Perform preventative maintenance on vessels and components

LEARNING TASKS	CONTENT

1. Upgrade vessels and components	• Permit requirements
	  ○ Gas tests
	  ○ Hot and cold work
	  ○ Confined space
	  ○ Verification
	• Positive identification of vessels and components to be serviced
	• Isolating
	• Blinding
	• Blanking
	• Locking and tagging
	• Fitting and fastening components to existing systems
	• Recognizing hazards of removing and adding components
	• Re-using materials and components

2. Prepare vessels and components for maintenance and repair	• Safety requirements
	  ○ Ensuring proper ventilation
	  ○ Installing bulkheads
	  ○ Performing lock out procedures
	• Connecting to service and utilities
	• Preparing parent material

3. Perform preventative maintenance on vessels and components	• Scraping and cleaning components • Performing hydro tests • Plugging tubes to isolate them from the system • Removing, maintaining and replacing components

Achievement Criteria

Performance	The learner will be able to isolate, blind and blank.
Conditions	The learner will be given • Material • Equipment • Instructions
Criteria	The learner will be evaluated on • Safety • Material handling • Installation procedures • Communication

Line (GAC): G PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS

Competency: G3 Remove and dismantle vessels and components

Objectives

To be competent in this area, the individual must be able to:

- Dismantle welded vessels and components
- Remove flange and nozzle from vessel

LEARNING TASKS	CONTENT

1. Dismantle welded vessels and components	• Dismantling methods and procedures
	  ○ Safety coordination and planning
	  ○ Planning the dismantling of components
	  ○ Tools and equipment
	  ○ Coordination with other trades
	  ○ Numbering and match marking components to organize dismantled pieces
	  ○ Salvaging materials

2. Remove flange and nozzle from vessel	• Lifting, hoisting, handling and storage methods • Safety coordination and planning • Proper disposal of waste material • Material and scrap removal procedures • Coordination with other workers • Securing the work area • Identify material for re-use or scrap

Achievement Criteria

Performance	The learner will be able to remove a nozzle from a vessel.
Conditions	The learner will be given • Equipment • Material • Instructions
Criteria	The learner will be evaluated on • Organization • Safety • Procedures • Communication

Section 4

ASSESSMENT GUIDELINES

Assessment Guidelines – Foundation

Foundation Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	BOILERMAKER FOUNDATION		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
A	PRACTICE SAFE WORK PRACTICES	4%	1%
B	USE TOOLS AND EQUIPMENT	4%	7%
C	USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS	10%	7%
D	PERFORM CUTTING AND WELDING ACTIVITIES	15%	15%
E	USE RIGGING, HOISTING AND LIFITNG EQUIPMENT	30%	25%
F	PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS	30%	40%
G	PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS	7%	5%
	Total	100%	100%
In-school theory/practical subject competency weighting		60%	40%
Final in-school percentage score		IN-SCHOOL %	

Assessment Guidelines – Level 2

Level 2 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	BOILERMAKER LEVEL 2		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
B	USE TOOLS AND EQUIPMENT	5%	5%
C	USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS	15%	0%
D	PERFORM CUTTING AND WELDING ACTIVITIES	20%	0%
E	USE RIGGING, HOISTING AND LIFITNG EQUIPMENT	30%	20%
F	PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS	25%	50%
G	PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS	5%	25%
	Total	100%	100%
In-school theory/practical subject competency weighting		50%	50%
Final in-school percentage score		IN-SCHOOL %	

In-school Percentage Score Combined theory and practical subject competency multiplied by	80%
Standardized Level Exam Percentage Score The exam score is multiplied by	20%
Final Percentage Score	FINAL%

Assessment Guidelines – Level 3

Level 3 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	BOILERMAKER LEVEL 3		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
B	USE TOOLS AND EQUIPMENT	5%	0%
C	USE DOCUMENTATION AND PRACTICE ORGANIZATIONAL SKILLS	15%	0%
D	PERFORM CUTTING AND WELDING ACTIVITIES	5%	0%
E	USE RIGGING, HOISTING AND LIFITNG EQUIPMENT	30%	40%
F	PERFORM LAY OUT, FABRICATION AND ASSEMBLY OF VESSELS AND COMPONENTS	35%	50%
G	PERFORM MAINTENANCE, UPGRADES AND REPAIR OF VESSELS AND COMPONENTS	10%	10%
	Total	100%	100%
In-school theory/practical subject competency weighting		50%	50%
Final in-school percentage score Apprentices must achieve a minimum 70% as the final in-school percentage score to be eligible to write the Interprovincial Red Seal exam.		IN-SCHOOL %	

All apprentices who complete Level 3 (Final Level) of the Boilermaker program with a FINAL level mark of 70% or greater will write the Interprovincial Red Seal examination as their final assessment.

SkilledTradesBC will enter the apprentice's Boilermaker Interprovincial Red Seal examination mark in SkilledTradesBC Portal. A minimum mark of 70% on the examination is required for a pass.

Section 5

TRAINING PROVIDER STANDARDS

Facility Requirements

Classroom Area

- Comfortable seating and tables suitable for learning
- Compliance with the local and national fire code and occupational safety requirements
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/Air conditioning for comfort all year round
- In-room temperature control to ensure comfortable room temperature
- Acoustics in the room must allow audibility of the instructor
- Computer lab complete with 16 computers and internet access
- Space for reference material for instructor use

Shop Area

- 5,000 square foot steel fabrication workshop with ceiling height sufficient to allow safe movement of materials
- Overhead hoist
- 13,600 square foot mock-up/storage area which includes:
  - Tool crib
  - Lockers
- Adequate lighting and lighting control
- Ventilation as per WorkSafeBC standards
- Refuse and recycling bins for used shop materials

Student Facilities

- Adequate lunchroom as per WorkSafeBC requirements
- Adequate washroom facilities as per WorkSafeBC requirements
- Personal Storage lockers

Instructor's Office Space

- Desk and filing space
- Computer
- Photocopier

Other

- N/A

Tools and Equipment

Shop Equipment

Required

Personal Protective Equipment (PPE) and Safety Equipment

- Atmospheric testing equipment
- Breathing air respirator
- Butyl-rubber gloves (FRP)
- Coveralls (fire retardant, acid-resistant, plastic over-suit, disposable)
- Cut resistant gauntlets and gloves
- Cutting goggles
- Dust masks
- Ear plugs and earmuffs
- Explosion-proof lights
- Fall arrest equipment (lanyards, harnesses, retractable lanyards, tripods)
- Grinding shields
- Ground fault interrupter
- Hard hat
- Leather protective clothing and gloves
- Organic vapour cartridges (FRP)
- Powered Air Purifier Respirator (PAPR)
- Protective gloves
- Respirator (half mask and full face)
- Safety glasses and mono goggles
- Self contained breathing apparatus (SCBA)
- Smoke eaters and ventilation
- Supplied air breathing apparatus (SABA)
- Systems
- Tarpaulins
- Warning tape, tags, signs, barricades
- Welding glass
- Welding masks
- Welding screens
- Welding shields
- Whip checks and pins

Welding Equipment

- Automatic welding equipment
- C/W ancillary equipment for welding processes such as ESW, FCAW, GMAW, GTAW and SAW
- Chipping hammer
- Electrode holders (whips/stingers)
- Electrode ovens (stationary/portable)
- Files
- Gougers
- Ground clamps
- Hand wire brush (mild steel and stainless steel)
- Leather welding shield
- Power sources (welding machines)
- Pre-heating torch and equipment
- Purge hoses
- Regulators
- Remote amperage controls
- Stud welding equipment
- Temperature (“temp”) sticks
- TIG torch
- Welding cable
- Welding cable “y” connectors
- Welding electrodes

Cutting Tools and Equipment

Hand Type

- Bolt cutters
- Files
- Hacksaw and blades
- Handsaw
- Metal-cutting chisels
- Metal-cutting snips
- Pipe/tube cutters
- Scissors
- Tap and die sets
- Utility knife

Powered Type

- Abrasive cut-off saw
- Band saw
- Circular saw
- Grinders (air and electric)
- Nibblers
- Reciprocating saw
- Tube milling machine

Fuel Cutting Equipment

- Oxygen lance

Oxy-Fuel Cutting Equipment

- Adapters
- Burning and heating tips
- Flashback arrestors
- Friction lighters (strikers)
- Manifold systems
- Manual cutting torches
- Oxy-fuel cart c/w fire extinguishers
- Oxy-fuel couplings and wrenches
- Oxy-fuel cylinders
- Oxy-fuel hoses and repair kits
- Radiograph and related equipment
- Regulators
- Tip cleaners

Plasma-Arc Cutting Equipment

- Air line
- Compressed air source
- Power supply c/w cables and torch
- Regulators
- Replacement ceramic cups and tips

Air Carbon-Arc Cutting Equipment

- Air-arc gouger
- Air and power supply
- Air line
- Carbon-cutting electrodes (round/flat)
- Replacement electrode holder
- Replacement insulators

Pneumatic Tools and Equipment

- Air chippers
- Air compressor
- Air grinders
- Air hammers
- Air manifolds/receiver
- Air scalers
- Air supply hose
- Air utility hoist (air tugger)
- Drills
- Filters/oilers
- Hydraulic and pneumatic tensioning and torqueing equipment
- Hydrostatic test pump
- Impact wrenches/sockets
- Milling machine
- Regulator
- Rolling motor

Electric-Powered Tools and Equipment

- Circular saw
- Cut-off saw
- Die grinder
- Drills/presses
- Electric supply panel
- Exhaust fans
- Extension cords
- Floodlights
- Grinder
- Hammer drill
- Impact wrench (electric and battery)
- Jigsaw
- Nibblers/shears
- Reciprocating saw
- String/trouble light

Powered Shop Equipment

- Brake press
- Drill press
- Horizontal bandsaw
- Iron Worker
- Overhead Hoist
- Mobile crane
- Pipe threader
- Plate rolls
- Plate shear
- Radial drilling machine
- Vertical bandsaw

Rigging Equipment

- Beam clamps
- Beam trolleys
- Blocks (tackle, wire rope, snatch)
- Chain falls
- Come-along
- Crane (Mobile)
- Equalizer plates
- Equalizer sheaves
- Fibre rope
- Grip hoist (wire rope pullers)
- Headache ball
- Hooks/latches
- Jacks (hydraulic, screw, air bags, steamboat ratchet)
- Links, swivels, rings, thimbles, eye bolts
- Load binders
- Plate clamps
- Shackles
- Slings (wire rope, fibre material, chain, synthetic, wire/chain mesh)
- Softeners
- Spreader and equalizer beams
- Swivel hoist ring
- Terminal end connections for wire rope
- Tuggers
- Two-way radios
- Wire rope
- Wire rope (clips, sockets)

Tube Removal/Expansion Tools and Equipment

- Air motor c/w adapter sleeves
- Beading tool
- Collapsing tools
- Expansion accessories (e.g., driving links, universals, gear drive)
- Internal tube cutters (one revolution tube cutter, fly cutter)
- Knockout tool
- Splitting chisels
- Torque controlled rolling motor

- Expanders for boilers and heat exchangers c/w mandrels
- Flaring/belling tools
- Hydraulic tube stub puller
- Induction heat gun
- Tube drift
- Tube end facers
- Tube plugs
- Tube pulling spear
- Tube wall reducing tool

Tube Preparation/Installation Tools and Equipment

- Die grinder c/w variety of stones
- Files
- Flapper wheels/emery cloth
- Hand/power brushes (twist)
- Hydraulic expander
- Lead hammer
- Peening tool
- Serrating tool
- Tube cut-off saw
- Tube guide
- Tube hold reamer
- Tube milling machine
- Water soluble lubricant

Tools and Equipment for Fibreglass

- Aluminum-serrated rollers
- Barrel heater
- Brooms
- Carborundum grinding discs (16-36 grit)
- Catalyst dispenser
- Fibreglass material cutting tools
- Grinder c/w flexible disc back
- Heat lamps
- Kilo scale
- Masking tape
- Mohair rollers
- Paint brushes
- Plastic buckets (5 L – 20 L)
- Putty knife
- Roll of cardboard
- Roll of un-waxed paper
- Shovels
- Wooden mixing spatulas

Recommended

- Rigging belt
- Sand blasting equipment
- Track saw
- Resin spray gun/hoses

Shop (Facility) Tools

Standard Tools

Required

Measuring Tools

- Angle and radius gauges
- Calipers/dividers
- Combination square (with interchangeable heads)
- Compass
- Compound tube gauge
- Framing squares
- Laser levels
- Measuring tapes
- Micrometers
- Scale rule
- Sliding t-bevel
- Steel tapes
- String line
- Telescoping gauge
- Vernier caliper

Measuring and Layout Tools

- Ball peen hammer
- Chalk
- Chalk-line
- Contour marker
- Dividers
- Dye
- Felt pen
- Laser level
- Lumber crayon
- Paint brush
- Paint marker
- Plumb bob
- Prick/center punch
- Protractor
- Scribe and awl
- Soapstone and holder
- Spirit level
- Squares
- Steel letter/number set
- Straight edge
- Trammel points
- Transit (theodolite)
- Water level
- Wrap-around

Hand Tools

- Adjustable wrench
- Bar clamp
- Bench vice
- Box-end wrench
- C-clamp
- Chain wrench
- Combination wrench
- End-cut pliers (nippers)
- Hammer (slug) wrench
- Hammer wrench holder
- Locking wrench pliers
- Needle-nose pliers
- Open-end wrench
- Pipe vise (portable tri-stand)
- Pipe wrench
- Pony clamp
- Ratchet and socket wrench sets
- Screwdrivers
- Side-cutter pliers
- Sliding clamp

- Hex keys
- Holding Tools
- Holding/Turning Tools
- Lineman pliers
- Lock pliers
- Slip-joint pliers
- Spud wrench
- Strap wrench
- Torque wrench
- Water-pump (utility) pliers/channel

Fitting Tools

- 4 lb. Mini-sledge hammer
- Alignment pins
- Ball peen hammer
- Bull pin
- C-clamps
- Clamping angles
- Claw hammer
- Come-alongs
- Dogs and wedges, screw dogs
- Drift pin
- Flange spreader
- Hammering Tools
- Hickey bars
- Hose clamps
- Hydraulic jack
- Hydraulic ram
- Key plates and blank nuts
- Metal-cutting chisel
- Non-sparking hammer
- Pin punch
- Pry bar
- Shims and wedges
- Sledges
- Soft-face hammer (lead-face)
- Spud wrench
- Steel, brass and wood wedges
- Strongbacks

Recommended

- Electric screwdriver
- Induction heat gun
- Tube alignment tool

Specialty Tools

Required

- n/a

Recommended

- n/a

Student Equipment (supplied by school)

Required

- n/a

Recommended

- n/a

Student Tools (supplied by student)

Required

- CSA protective footwear
- Cotton long sleeve shirts / coveralls
- Rigging knife

Recommended

- n/a

Reference Materials

Required Reference Materials

- Contact Training Facility for Required Reference Material

Recommended Resources

- SkilledTradesBC www.skilledtradesbc.ca
- Workplace Hazardous Materials Information System (WHMIS) and First Aid https://www.canada.ca
- WorkSafeBC (WCB) www.worksafebc.com
- Codes
    - Codes Canada publications - National Research Council Canada
        - Canadian National Building Code
        - Canadian National Fire Code
    - National Fire Protection Association
        - NFPA 80 – Standards for Fire Doors and Fire Windows
        - NFPA 101 – Life Safety Code
    - BC Codes - Province of British Columbia
        - BC Building Code
        - BC Fire Code
        - BC Electrical Code

Suggested Texts

- Contact Training Facility for Suggested Texts

Instructor Requirements

Occupation Qualification

The instructor must possess:

- Boilermaker - Certificate of Qualification from BC with Interprovincial Red Seal Endorsement*, or*
- Boilermaker - Certificate of Qualification from another Canadian jurisdiction with Interprovincial Red Seal endorsement

Work Experience

A minimum of 5 years of experience working in the industry as a journeyperson.

Instructional Experience and Education

It is preferred that the instructor also possesses one of the following:

- An Instructor's Diploma or equivalent
- A Bachelor's Degree in Education

Appendices

Appendix A
Acronyms and Abbreviations

AC	Alternating current
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
CofA	Certification of Apprenticeship
CofC	Certification of Completion
CofQ	Certification of Qualification
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DC	Direct current
ESW	Electroslag welding
FCAW	Flux-core arc welding
FRP	Fibre-reinforced polymer
GAC	General Area of Competency
GMAW	Gas metal arc welding
GTAW	Gas tungsten arc welding
ID	Inside diameter
OHS	Occupation Health and Safety
PAPR	Powered air purifier respirator
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RFC	Recommendation for certification
RSOS	Red Seal Occupational Standard
SABA	Supplied air breathing apparatus
SAW	Submerged arc welding
SCBA	Self-contained breathing apparatus
TIG	Tungsten inert gas
TSBC	Technical Safety BC
WBT	Work-based training
WHMIS	Workplace Hazardous Materials Information System
WLL	Working Load Limit

Appendix B
Summary of Achievement Criteria

Achievement Criteria are included for competencies that require a practical assessment. The intent of including Achievement Criteria in the Program Outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measurable and that they reflect the skills spelled out in the competency. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

The following tables summarize the practical assessments for each level. **For details, please refer to the Achievement Criteria following the competency in the Program Content section.**

BOILERMAKER – FOUNDATION SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
A1 Use personal protective equipment	The learner will be able to perform a respirator fit check.
A2 Use fall protection systems	The learner will be able to perform a safety harness fit test.
B2 Use power tools and shop fabrication tools	The learner will be able to demonstrate the proper selection, set-up and use of shop equipment for shaping and forming.
B3 Use cutting tools and equipment	The learner will be able to set-up an oxy-acetylene burning outfit.
C2 Use drawings and specifications	The learner will be able to produce a sketch.
D1 Cut material	The learner will be able to layout and cut carbon steel.
D2 Perform welding	1. The learner will be able to prepare joints for fitting. 2. The learner will be able to fit joints. 3. The learner will be able to perform tack welds. 4. The learner will be able to perform basic welding.
E1 Plan lifts	1. The learner will be able to inspect rigging gear prior to use. 2. The learner will be able to write a lift plan. 3. The learner will be able to make a lift using a spreader bar.
E2 Rig loads	1. The learner will be able to tie a prescribed set of knots in a working manner. 2. The learner will be able to construct a Flemish eye to a specified size. 3. The learner will be able to apply minimum size choker(s) required for a given task. 4. The learner will be able to perform a multi-part reeve-up.
E3 Hoist loads	The learner will be able to lift a given object.
F1 Perform fabrication	1. The learner will be able to demonstrate the proper set up, use, care and handling of a Builder's Level. 2. The learner will be able to develop layout patterns for assembly.
F2 Align and fit vessels and components	1. The learner will be able to erect annular ring floor and tank. 2. The learner will be able to dismantle a mock-up boiler.
F3 Fasten components	The learner will be able to expand water wall tubes.
G3 Remove and dismantle vessels and components	1. The learner will be able to remove and replace a tube bundle in a heat exchanger. 2. The learner will be able to open towers and replace defective components.

BOILERMAKER – LEVEL 2 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
B2 Use power tools and shop fabrication tools	1. The learner will be able to demonstrate the proper set up and use of given tools. 2. The learner will be able to demonstrate the proper set-up and use of shop equipment.
B3 Use cutting tools and equipment	The learner will be able to perform cutting and basic welding.
E1 Plan lifts	The learner will be able to plan and perform a lift.
E2 Rig loads	1. The learner will be able to determine sling stress at a given angle. 2. The learner will be able to apply slings to exercise maximum load control. 3. The learner will be able to choose and tie appropriate knots for given applications.
E3 Hoist loads	The learner will be able to attach and stow a jib.
F1 Perform fabrication	1. The learner will be able to lay out and construct a cardboard hopper. 2. The learner will be able to layout, fabricate and construct a metal hopper.
F3 Fasten components	1. The learner will be able to bolt components. 2. The learner will be able to remove and install fire and exchanger tubes.
G1 Inspect and test vessels and components	The learner will be able to replace tube in tube sheet of vessel.
G3 Remove and dismantle vessels and components	The learner will be able to dismantle a bolted up joint.

BOILERMAKER – LEVEL 3 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
E2 Rig loads	The learner will be able to lift and transfer loads through the rigging structure.
E3 Hoist loads	The learner will be able to plan and execute a multiple-component lift.
F1 Perform fabrication	The learner will be able to lay out and fabricate various pipe configurations: • 2 piece 90° from 6-inch pipe • 3 piece 90° from 3-inch pipe • 6-inch pipe tee • Reducing lateral from 4-inch pipe • True wye from 6-inch pipe
F2 Align and fit vessels and components	1. The learner will be able to fabricate and install a nozzle in a vessel. 2. The learner will be able to install a flush patch.
F3 Fasten components	The learner will be able to perform hand lay-ups of fibreglass
G2 Service vessels and components	The learner will be able to perform isolate, blind and blank.
G3 Remove and dismantle vessels and components	The learner will be able to remove a nozzle from a vessel.