

# Boilermaker Level 1

## Boilermaker

**Unit:** A1 Trade Safety Awareness

**Level:** One

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

### Overview:

Safe working procedures and conditions, injury prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers, and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to incidents or injury. It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe, and accident-free working environment. It is imperative to apply and be familiar with the Workplace Safety and Health Act and Regulations. As well, it's essential to determine workplace hazards and take measures to protect oneself, co-workers, the public, and the environment. Safety education is an integral part of Boilermaker apprenticeship training both in school and on-the-job. Unit content is supplemented throughout technical training by trade-specific information about Boilermaker safety hazards and precautions presented in the appropriate contexts of discussion and study.

**Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a 'Pass/Fail' grade will be recorded for the unit in its entirety.**

<b>Objectives and Content:</b>	<b>Percent of Unit Mark (%)</b>
<b>1. Identify safety and health requirements.</b>	<b>N/A</b>
a. Overview of the Workplace Safety and Health Act <ul style="list-style-type: none"><li>• Rights and responsibilities of employees under the Act</li><li>• Rights and responsibilities of employers under the Act</li><li>• Rights and responsibilities of supervisors under the Act</li></ul>	
b. Fourteen (14) regulations	
c. Codes of practice	
d. Guidelines	
e. Right to refuse <ul style="list-style-type: none"><li>• Explanation of right to refuse process</li><li>• Rights and responsibilities of employees</li><li>• Rights and responsibilities of employers</li><li>• Rights and responsibilities of supervisors under the Act</li></ul>	
<b>2. Identify personal protective equipment (PPE) and procedures.</b>	
a. Employer and employee responsibilities as related to PPE	
b. Standards: CSA, ANSI and guidelines	
c. Work protective clothing and danger if it fits poorly	
d. Importance of selecting and using appropriate gloves to suit task (e.g., re: chemicals, cold/hot items, slivers, etc.)	
e. Standards and requirements re: selection/use of appropriate headwear	

- f. Eye protection – Comparison/contrast eyeglasses, industrial safety glasses and safety goggles
- g. Foot protection - when required according to safety standards
- h. Hearing protection
  - hazards of various noise levels (hearing protection must be worn)
  - laws
  - types of hearing protection
- i. Respiratory protection – types; selection
- j. Fall protection - Manitoba requirements Standards Guidelines
  - ANSI (U.S.A. standards), etc.
- k. Ladders and scaffolding
- l. Safety principles for working with or around industrial trucks site specific (forklifts, pallet trucks, etc.)

**3. Identify electrical safety.**

- a. Effects of electric current on the human body
- b. Three factors that affect the severity of an electric shock
- c. The effects of electrical arcs/blasts on the human body and on equipment
- d. Hazards/precautions re: working with energized equipment

**4. Identify fire safety.**

- a. Types of fires
- b. Types of fire-fighting equipment
- c. Classifications of fire extinguishers (A, B and C)
- d. Location of fire extinguishers and fire exits
- e. Fire alarms and drills

**5. Identify ergonomics.**

- a. Definition of ergonomics and conditions that may affect the body
  - Working postures
  - Repetition
  - Force
  - Lifting
  - Special hazards and precautions re: materials handling
  - Special hazards/precautions re: lifting, carrying, and setting down a load
  - Tools
  - Identify tool and safety equipment
  - Causes of hand tool accidents
  - Equipment

**6. Describe hazard recognition and control.**

- a. Safe work practices
- b. Basic risk assessment
- c. Injury prevention and control measures
- d. Identification of hazards involved in pneumatic tool use and explanation of how to guard against them

**7. Describe the hazards of confined-space entry.**

- a. Identification of a confined space
- b. Hazards of a confined space
  - Physical
  - Biological
- c. Working in a confined space
- d. Emergency response plan
- e. Self-Contained Breathing Apparatus (SCBA)

**8. Identify First Aid/CPR.**

- a. Overview of First Aid regulation
- b. Obligations of employers regarding First Aid
  - Who is certified to provide First Aid

- What to do while waiting for help
- Location of, and access to, First Aid kit
- c. Define First Aid, and explain First Aid requirements and techniques
  - Scope and limits of First Aid intervention
  - Specific interventions (cuts, burns, abrasions, fractures, suffocation, shock, electrical shock, etc.)
  - Interface with other services and agencies (e.g., Workers Compensation claims)
- d. Describe basic CPR requirements and techniques
  - Obtaining certification
  - Scope and limits of CPR intervention (include varieties of CPR certification)

**9. Identify safety requirements as they apply to WHMIS.**

- a. WHMIS as a system
- b. Provincial Regulation under the Safety and Health Act
  - Each province has a WHMIS regulation
- c. Federal Hazardous Products Act
- d. WHMIS generic training:
  - WHMIS defined and the format used to convey information about hazardous materials in the workplace
  - Information found on supplier and workplace labeling using WHMIS
  - Hazardous materials in accordance with WHMIS
  - Compliance with government safety standards and regulations
- e. Description of WHMIS (include varieties of WHMIS Certification)
  - Typology of WHMIS labels, symbols, and classifications
  - Scope and use of Materials Safety Data Sheets (MSDS)

**10. Describe the identification and control of specified hazards.**

- a. Basic control measures (injury prevention)
- b. Safe work procedures
- c. Explanation on the importance of industrial housekeeping
- d. Employer responsibilities
- e. How and where to store materials
- f. Safety measures related to walkways, stairs and floor openings
- g. Traffic-pathway protection of workers and persons

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## Boilermaker

**Unit:** A2 Orientation I: Structure/Scope of Trade

**Level:** One

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

### Overview:

One sign that a Boilermaker has mastered a task or technique is to be asked to share this knowledge. Jobsite skills-exchange has long been fundamental to Boilermaker trade-learning. Even trade veterans rely on peers to refine their knowledge and skill.

The opportunity to benefit from this process, however, is shaped by complex factors that include jobsite 'politics' and construction deadlines. As adult trade-learners, Boilermaker apprentices at all levels of training must use their eyes, ears, prior knowledge, and interpersonal skills to encourage journeypersons to teach as well as to supervise them. This requires understanding the trade's dynamics, as well as the roles and responsibilities which order jobsite work-life.

This unit profiles the trade's historical and modern significance, core tasks and skill requirements, as well as its job-ladders and long-term career options. It includes information about learning styles/strategies, stressing their application to apprenticeship and journey-level trade education. The unit also introduces the concept of skills stewardship, stressing the obligation that apprentices incur to help convey what their own journeypersons teach them to those who in turn follow them into the trade.

A sound grasp of the roles, workplace relationships, and possibilities introduced in this unit is part of 'learning to learn' in Manitoba's apprenticeship system. Senior apprentices are later offered information about learning to *teach* in this system – a central and time-honoured foundation of Boilermaker journeywork.

### Objectives and Content:

#### **Percent of Unit Mark (%)**

- |   |            |
|---|------------|
| <b>1. Describe structure and scope of the modern Boilermaker trade.</b> | <b>30%</b> |
| a. Historical background, incl. apprentice experience                   |            |
| b. Structure/scope of the trade   |            |
| • International and national characteristics                            |            |
| • Characteristics and practice of the trade in Manitoba                 |            |
| • Trade organizations   |            |
| c. Opportunities and career ladders                                     |            |
| • Generalists and specialists   |            |
| • 'lead hands and other immediate supervisors                           |            |
| • Geographic mobility   |            |
| • Job hierarchies and innovations                                       |            |
| <b>2. Describe the Manitoba Boilermaker Apprenticeship Program.</b>     | <b>30%</b> |
| a. Concept and significance of skills stewardship                       |            |
| • To the trade  |            |
| • To apprentices  |            |
| • To journeypersons   |            |
| • To employers  |            |

- To the community
- b. Practical training (on-the-job)
  - Roles/responsibilities of employer and journey person(s)
  - Roles/responsibilities of Apprenticeship Training Coordinator (ATC)
  - Roles/responsibilities of apprentice(s)
  - Role/responsibilities of instructors (including 'related'-area faculty)
- c. Technical training (offsite)
- d. Attendance requirements
- e. Progression requirements
- f. Reporting of grades
- g. Trade regulation and its significance
- h. Policies (e.g., re: personal conduct, "missed" units, fees, harassment, etc.)
  - Apprenticeship Manitoba
  - Training provider(s)

**3. Explain special challenges and opportunities re: apprenticeship training.**

**40%**

- a. Adapting personal learning goals to program contexts
  - Characteristics and 'domains' (types) of adult learning
  - Description/recognition of learning and teaching styles
  - Work culture (incl. work-crew hierarchy), interpersonal skills, and trade-learning
  - Integrating technical training and practical training content
  - Possibilities and perils of peer-learning
  - Budgeting and other necessary personal arrangements
  - Handling common varieties of stress at work and in school
- b. On-the-job challenges/opportunities
  - Description/recognition of jobsite teaching styles/roles
  - Communicating with journeypersons and employers
  - Coverage/documentation of formally prescribed tasks and subtasks
  - Personal record of achievements/needs: the Trade Learning Journal option
  - Getting help and fixing mistakes
- c. In-school opportunities/challenges
  - Personal arrangements that support in-school progress
  - "Baggage handling" – self-assessing potential impacts of previous school experience on current learning (favourable/unfavourable); resources
  - Techniques for note-taking, record-keeping, and review
  - Relations with instructors (including 'related'-area faculty)
  - College resources (library, support services, etc.)
  - 'Missed Units' – policies re: supplementals, re-tests, make-up assignments, etc.

**4. Accommodation for apprentices with disabilities.**

- a. Technical training.
  - Requirements.
  - Roles and responsibilities.
  - Services and information required by persons with disabilities.
- b. On-the-job.
  - Requirements.
  - Roles and responsibilities.
  - Services and information required by persons with disabilities.

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## Boilermaker

**Unit:** A3 Common Hazards

**Level:** One

**Duration:** 14 hours

Theory: 14 hours

Practical: 0 hours

### Overview:

This unit presents information on accident prevention, first aid, the operation of firefighting equipment and Workplace Hazardous Material Information System (W.H.M.I.S.). The safety subject matter taught in this section must also be stressed in the appropriate sections throughout the Boilermaker training program. Reference should be made to OH & S when applicable.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Demonstrate knowledge of workplace hazards.</b>	<b>9%</b>
a. Recognize and correct common causes of accidents in the work environment.	
b. Carry out work activities in a manner conducive to a maximum possible standard of shop safety.	
c. Recognize, report and/or eliminate fire hazards existing in the work environment.	
d. Recognize various classes of fires and be aware of the extinguishing medium for use in each case.	
e. Effectively operate fire-extinguishing equipment and be aware of the extinguishing medium for use in each case.	
f. Effectively operate fire-extinguishing equipment to extinguish various classes of fires.	
g. Demonstrate knowledge of the fall restraint, fall arrest program.	
h. Complete a Job Safety Analysis (JSA'S).	
<b>2. Identify potential fatal hazards in confined space entry.</b>	<b>10%</b>
a. Entering without testing.	
b. Lack of retesting.	
c. Not blanking or lacking out.	
d. Lack of ventilation.	
e. Inert gases.	
f. Use of oxygen.	
g. Cutting/welding hoses and valves.	
h. Welding without checking neighbouring compartments.	
i. Sludge in confined space.	
j. Lack of respiratory protection.	
k. Possible toxic or flammable material.	
l. Improper rescue procedures.	

- |  |           |
|--|-----------|
| <b>3. Locate and identify legislation and regulations pertinent to “confined entry”.</b>   | <b>9%</b> |
| <ul style="list-style-type: none"> <li>a. Definition of confined space.</li> <li>b. Employer’s responsibilities.</li> <li>c. Employee’s responsibilities.</li> <li>d. Code of practice for entry and work in confined spaces.</li> <li>e. Safety training.</li> </ul>  |           |
| <b>4. Describe the following hazards in confined space entry.</b>  | <b>9%</b> |
| <ul style="list-style-type: none"> <li>a. Enclosed spaces.</li> <li>b. Partially enclosed spaces.</li> <li>c. Natural ventilation.</li> <li>d. Oxygen deficiency.</li> <li>e. Explosive and toxic liquids and gases.</li> <li>f. Hydrogen sulfide.</li> <li>g. Carbon monoxide.</li> <li>h. Liquid materials.</li> <li>i. Decaying organic matter in confined space.</li> <li>j. Fire triangle.</li> <li>k. Lower and upper explosive limits.</li> </ul> |           |
| <b>5. Preplan confined space entry.</b>  | <b>9%</b> |
| <ul style="list-style-type: none"> <li>a. Atmospheric testing and monitoring.</li> <li>b. Procedures.</li> <li>c. Preparations.</li> <li>d. Safety equipment and clothing.</li> <li>e. Ground fault interrupters.</li> <li>f. Explosion proof lighting.</li> <li>g. Intrinsic safety.</li> <li>h. Rescue equipment.</li> </ul>   |           |
| <b>6. Identify and describe a permit system for confined space entry.</b>  | <b>9%</b> |
| <b>7. Define and describe what is meant by a W.H.M.I.S. label and distinguish between supplier and workplace labels and other means of identification.</b>   | <b>9%</b> |
| <b>8. Describe what is meant by the following W.H.M.I.S. classifications:</b>  | <b>9%</b> |
| <ul style="list-style-type: none"> <li>a. Prohibited product.</li> <li>b. Restricted product.</li> <li>c. Controlled product.</li> </ul>   |           |
| <b>9. Explain what a Material Safety Data Sheet (M. S.D.S.) is, its purpose and limitations.</b>   | <b>9%</b> |
| <b>10. Describe the roles and responsibilities of employer, supplier and worker of W.H.M.I.S. in the education of workers and other subject areas as deemed appropriate and deliverable by the training establishments.</b>  | <b>9%</b> |
| <b>11. Demonstrate the safe use and operation of all equipment and supplies as indicated by manufacturers’ specifications or specifications certified by an engineer.</b>  | <b>9%</b> |

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## Boilermaker

**Unit:** A4 Safety Equipment, W.C.B. and Interpersonal and Essential Skills

**Level:** One

**Duration:** 11 hours

Theory: 11 hours

Practical: 0 hours

### Overview:

This unit presents information on proper use of safety equipment, Welders' Compensation Board, and interpersonal and essential skills. The safety subject matter taught in this section must also be stressed in the appropriate sections throughout the Boilermaker training program. Reference should be made to OH & S when applicable.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Demonstrate the proper use of the following safety equipment.</b>	<b>80%</b>
a. Welding helmets.	
b. Boots.	
c. Glasses.	
d. Goggles/shields.	
e. Safety harness.	
f. Clothing.	
g. Dust filters/respirators.	
h. Fresh air breathing equipment.	
i. Air movers.	
j. Safety showers/eyewash stations.	
k. Firefighting equipment.	
l. Hearing protection equipment.	
m. Head protection.	
n. Ladders.	
<b>2. Workers' Compensation Board (W.C.B.). <i>It is understood that the W.C.B. is a generic term referring to the provincial governing authority.</i></b>	<b>5%</b>
a. Interpret and define Workers' Compensation Board regulations.	
b. Complete and remit the appropriate forms as may be required by W.C.B.	
• Form to be completed.	
• Methods of completing.	
• Where to remit.	
<b>3. Describe the ability to use interpersonal and essential skills to communicate and</b>	<b>5%</b>

**interact with others.**

- a. Apprentices.
- b. The public.
- c. Fellow workers.
- d. Supervisory personnel (supervisor and employer).
- e. Contractor and owner representatives.
- f. Other trades people.
- g. Provincial government departments.
- h. The unions.

**4. Identify and describe good public relations with other trades as well as problems and public needs. 5%**

- a. Cooperation with allied trades.
- b. Coordination with other trade functions.
- c. Recognition of problems in all phases.
- d. Consideration of public need.

**5. Describe the apprenticeship training system in Manitoba. 5%**

- a. Identify the training profile of a Boilermaker Apprentice in Manitoba.
- b. Describe the responsibilities for the Contract of Apprenticeship by the apprentice, employer and Apprenticeship Manitoba.
- c. Discuss the contents of the apprenticeship training record book.

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## Boilermaker

**Unit:** A5 Emergency First Aid and C.P.R.

**Level:** One

**Duration:** 8 hours

Theory: 8 hours

Practical: 0 hours

### Overview:

This unit presents information on Emergency First Aid and C.P.R.

### Objectives and Content:

### Percent of Unit Mark (%)

- |   |            |
|---|------------|
| <b>1. Emergency First Aid and C.P.R.</b>  | <b>16%</b> |
| a. Explain the responsibilities and duties of the first aid person.                     |            |
| <b>2. Explain the diagnoses for:</b>  | <b>16%</b> |
| a. Respiratory failure.   |            |
| b. Burns.   |            |
| c. Body injury.   |            |
| <b>3. Applying artificial respiration:</b>  | <b>16%</b> |
| a. Explain the process of freeing the victim of breathing restrictions.                 |            |
| b. Explain the process of applying mouth-to-mouth respiration.                          |            |
| <b>4. Describe the emergency treatment procedure for:</b>                               | <b>16%</b> |
| a. Assessing injury.  |            |
| b. Moving the patient.  |            |
| c. Arresting bleeding.  |            |
| e. Completing Workers' Compensation Board forms.  |            |
| <b>5. Explain the methods of treating various burns and quenching fire on a victim.</b> | <b>16%</b> |
| <b>6. Basic C.P.R.</b>  | <b>20%</b> |

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## Boilermaker

**Unit:** B1 Ropes

**Level:** One

**Duration:** 19 hours

Theory: 19 hours

Practical: 0 hours

### Overview:

This unit presents information on ropes. This unit also emphasizes the application of safe work practices and procedures when using ropes.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. <b>Define and describe fibre and synthetic ropes.</b>	<b>20%</b>
a. Define the construction.	
b. Describe grades and applications.	
c. Explain best practices for the care and handling of ropes.	
2. <b>Define and describe working load limits (W.L.L.) formulas factors and reductions for natural and synthetic ropes.</b>	<b>25%</b>
3. <b>Identify the purpose and demonstrate the ability to tie the following knots and hitches:</b>	<b>25%</b>
a. Bowline.	
b. Self-centering bowline.	
c. Running bowline.	
d. Clove hitch.	
e. Reef (square) knot.	
f. Timber hitch.	
g. Rolling hitch.	
4. <b>Describe splicing of fibre and nylon ropes.</b>	<b>10%</b>
5. <b>Describe applications for short and long splice.</b>	<b>5%</b>
6. <b>Identify side splice with an eye.</b>	<b>5%</b>
7. <b>Perform crown knot and back splice.</b>	<b>5%</b>
8. <b>Describe and demonstrate the testing and strength reductions of knots and splices.</b>	<b>5%</b>

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## Boilermaker

**Unit:** B2 Hoisting

**Level:** One

**Duration:** 12 hours

Theory: 12 hours

Practical: 0 hours

### Overview:

This unit presents information on hoisting devices and accessories. This unit also emphasizes the application of safe work practices and procedures when using hoisting devices and accessories.

<b>Objectives and Content:</b>	<b>Percent of Unit Mark (%)</b>
<b>1. List and describe mobile cranes.</b>	<b>20%</b>
a. Types of mobile cranes.	
b. Parts of mobile crane.	
c. Parts of a crawler.	
d. Safe working practices.	
<b>2. Demonstrate uses and safe working practices for hoisting devices.</b>	<b>15%</b>
a. Air hoists.	
b. Come along.	
c. Wire rope pullers (tirfor).	
d. Chainfalls.	
<b>3. Identify the function, advantage and limitations of various slings and sling arrangements.</b>	<b>10%</b>
<b>4. Demonstrate slings and hitches used for hoisting materials.</b>	<b>5%</b>
<b>5. Demonstrate the best practices for the use of slings and tag lines.</b>	<b>5%</b>
<b>6. Demonstrate proper use and location of sling configurations on loads for hoisting.</b>	<b>10%</b>
a. Smooth heavy loads.	
b. Long flexible loads.	
c. Off balance loads.	
e. Heavy fragile units.	

- f. Finished or coated loads.
  
- 7. **Determine the centre of gravity for different types of loads.** **10%**
  
- 8. **Perform all operations in accordance with the manufacturer's specifications or the specifications certified by a professional engineer.** **5%**
  
- 9. **List and demonstrate hand signals used for moving equipment and hoisting.** **5%**
  
- 10. **Describe methods and precautions in using hand signals.** **%**
  
- 11. **Describe and demonstrate voice communications:** **5%**
  - a. **Radio (two way and walkie-talkie).**
  - b. **Current technology.**
  
- 12. **Describe precautions used in voice communication.** **5%**

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## Boilermaker

**Unit: B3 Wire Rope and Attachments**

**Level:** One

**Duration:** 10 hours

Theory: 10 hours

Practical: 0 hours

### Overview:

This unit presents information on wire rope and attachments. This unit also emphasizes the application of safe work practices and procedures when using wire rope and attachments.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Define and describe wire ropes.</b>	<b>20%</b>
a. Types of steel used for wire rope.	
b. Lays and their advantages.	
c. Wire rope cores.	
e. Four basic classifications of wire ropes.	
f. Working load limits (W.L.L.)	
g. Wire rope faults and removal criteria.	
h. Care and handling of wire rope.	
<b>2. Define, describe and demonstrate the ability to apply material handling attachments.</b>	<b>20%</b>
a. Hooks and shackles.	
b. Wire rope clips.	
c. Eyebolts.	
d. Chain.	
e. Additional industry attachments.	
<b>3. Determine and calculate the working load limits (WLL).</b>	<b>40%</b>
<b>4. Use tables and charts for wire rope and attachments.</b>	<b>10%</b>
<b>5. Perform all operations in accordance with the manufacturer's specifications or the specifications certified by a professional engineer.</b>	<b>10%</b>

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## Boilermaker

**Unit:** C1 Basic Materials

**Level:** One

**Duration:** 12 hours

Theory: 12 hours

Practical: 0 hours

### Overview:

This unit presents an introduction to basic materials. This unit also identifies basic material knowledge.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Identify all structural shapes and their respective designations.	25%
2. Describe the parts of structural shapes as per their designations.	5%
3. Explain actual and nominal dimensions.	5%
4. List the information required when ordering wide flange beams.	5%
5. Define the terms camber and sweep.	2%
6. Define the classification of steel plate with reference to thickness and width.	3%
7. Explain the purpose and applications of clad steel and other cladding materials.	3%
8. Identify welded bar grating types used for stairways and platforms.	2%
9. Identify expanded mesh and expanded mesh grating by its standard sizing.	2%
10. Interpret the designations for pipe and tube.	5%
11. Explain the difference between material designations for common pipe grades (such as A53, A120, A106).	2%
12. Perform pipe cutting to size using a pipe cutter and/or oxy-fuel cutting process.	2%
13. Describe cutting/threading of pipe using manual and mechanical process.	2%
14. Describe fixed and aligning threaded fasteners.	2%



- |   |            |
|---|------------|
| <b>15. Define bolts, studs and screws.</b>  | <b>5%</b>  |
| <b>16. Describe bolt grading and sizing as designated by SAE and ASTM.</b>                        | <b>5%</b>  |
| <b>17. Interpret nut and bolt markings to determine physical properties and type of material.</b> | <b>5%</b>  |
| <b>18. Determine the bolt threads length for bolts and screws up to 6 inches in length.</b>       | <b>3%</b>  |
| <b>19. Determine the wrench sizes with related reference to the bolt major diameter.</b>          | <b>5%</b>  |
| <b>20. Describe standard fittings, their sizing, designation and function:</b>                    | <b>10%</b> |
| a. Nozzles  |            |
| b. Couplings  |            |
| c. Tees   |            |
| e. Elbows   |            |
| f. Flanges (including slip-on and weld neck)  |            |
| g. Blind flange   |            |
| h. Blanking plates  |            |
| h. Plugs  |            |
| i. Valves (backflow, check)   |            |
| <b>21. List the pressure ratings used for forged steel flanges.</b>                               | <b>2%</b>  |

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## Boilermaker

**Unit:** C2 Material Preparation and Assembly

**Level:** One

**Duration:** 8 hours

Theory: 8 hours

Practical: 0 hours

### Overview:

This unit presents an introduction to basic materials. This unit also identifies basic material knowledge.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Explain and describe the layout procedure for marking-up of the following.</b>	<b>40%</b>
a. Cutting.	
b. Braking.	
c. Shearing.	
d. Rolling.	
e. Drilling.	
f. Punching.	
<b>2. Describe the purpose of templates.</b>	<b>10%</b>
a. Materials used to make templates.	
b. Types of templates.	
<b>3. Identify the following templates.</b>	<b>10%</b>
a. Materials used to make templates.	
b. Types of templates.	
<b>4. Describe methods used to identify fabricated components and assemblies.</b>	<b>40%</b>
a. Item numbers.	
b. Material identification.	
c. Job and contract numbers.	
d. Erection sequencing.	

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## Boilermaker

**Unit:** C3 Basic Drafting

**Level:** One

**Duration:** 24 hours

Theory: 24 hours

Practical: 0 hours

### Overview:

This unit presents information on basic drafting.

### Objectives and Content:

**Percent of  
Unit Mark (%)**

- |   |     |
|---|-----|
| 1. Demonstrate the ability to draw a sketch.  | 4%  |
| 2. Properly fold and protect drawings for immediate and future use.   | 4%  |
| 3. Interpret symbols and abbreviations as required.   | 4%  |
| 4. Identify line types and uses.  | 4%  |
| 5. Identify the correct placement of dimensions applying the unidirectional system.                           | 4%  |
| 6. Identify the common parts of a drawing and the information contained within them.                          | 4%  |
| 7. Define the principle of orthographic projection.   | 4%  |
| 8. Explain the principle and applications of an isometric projection.   | 4%  |
| 9. Identify section views and their application.  | 4%  |
| 10. List three types of sections.   | 4%  |
| 11. List two requirements for a multi-view projection.  | 4%  |
| 12. Give examples of parts that need one or two views only.   | 4%  |
| 13. State the difference between primary and secondary auxiliary views.                                       | 4%  |
| 14. Define the right and left hand views.   | 4%  |
| 15. Identify the advantages for using partial views.  | 4%  |
| 16. Interpret symbols and abbreviations on drawings compiled from standards used on the following components: | 20% |

- a. Materials preparation.
- b. Structural and plate.
- c. Fired and unfired pressure vessels.
- e. Tanks.
- f. Heat exchangers.
- g. Precipitators.
- h. Others used in industry.

**17. Interpret and apply welding symbols and abbreviations.**

**20%**

- a. Weld.
- b. Supplementary symbols.
- c. Specifications.
- d. Groove and weld dimensions.
- e. Contour.
- f. Method of finish.
- g. Single and double breaks in arrow line.
- h. Standard rules for reading welding symbols.
- i. Location of symbols on drawings.

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## Boilermaker

**Unit:** C4 Introduction to Layout

**Level:** One

**Duration:** 8 hours

Theory: 8 hours

Practical: 0 hours

### Overview:

This unit presents information on layout.

### Objectives and Content:

**Percent of  
Unit Mark (%)**

- |  |                   |
|--|-------------------|
| <p><b>1. Identify, select and use measuring, checking and layout tools.</b></p> <ul style="list-style-type: none"><li>a. Various types.</li><li>b. Standard features.</li><li>c. Design characteristics.</li><li>d. Maximum obtainable accuracy.</li><li>e. Applications.</li><li>f. Correct method of use.</li><li>g. Correct handling.</li><li>h. Storage and maintenance procedures.</li><li>i. Required conditions of use.</li></ul>   | <p><b>10%</b></p> |
| <p><b>2. Perform the following geometrical constructions:</b></p> <ul style="list-style-type: none"><li>a. Construct a line segment equal to a given line segment.</li><li>b. Construct an angle to a given angle.</li><li>c. Bisect a given angle, layout 45, 60, 30-degree angles.</li><li>d. Construct a line perpendicular to a given line through a given point on the line.</li><li>e. Bisect a given line segment.</li><li>f. Construct a line perpendicular to a given line through a given point outside the line.</li><li>g. Construct a line parallel to a given line through a given point on the circle.</li><li>h. Construct a tangent to a given circle through a given point on the circle.</li><li>i. Divide a line segment into any number of equal parts.</li><li>j. Circumscribe a circle outside a triangle.</li><li>k. Locate the centre of a given circle.</li><li>l. Inscribe a circle in a given triangle.</li><li>m. Construct regular polygons with any number of flats.</li><li>n. Inscribe a given radius into right angle, acute angle and obtuse angle turns.</li><li>o. Layout an angle.</li><li>p. Inscribe a given radius into right angle, acute angle and obtuse angle turns.</li><li>q. Bisect a given arc.</li></ul> | <p><b>40%</b></p> |

r. Construct an ellipse using the trammel method.

3. **Describe the pattern for a rectangular piece of ducting cut at an angle using parallel line development.** 20%
4. **Develop a pattern for a two-piece 90-degree elbow using parallel line development.** 20%
5. **Develop a layout for the geometric construction of bolt circles, manholes, flanges and ellipses.** 10%

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## Boilermaker

**Unit:** D1 Electric Arc Welding

**Level:** One

**Duration:** 35 hours

Theory: 9 hours

Practical: 26 hours

### Overview:

This unit presents an introduction to welding to train apprentices to a level where they may operate required equipment in a safe manner and perform such operations of metal cutting and welding as to make temporary attachment of component parts, prior to the finish welding required by a certified Welder.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Describe and demonstrate the use of safety equipment and follow manufacturer's specifications.</b>	<b>4%</b>
a. Welding apparel.	
b. Protective screens.	
c. Welding helmet and illustrate the proper placement of lenses.	
d. Harmful rays and fumes and their effects.	
e. Grounding of electrical equipment.	
<b>2. Maintain safe work environment.</b>	<b>4%</b>
<b>3. Define electricity as it relates to welding.</b>	<b>4%</b>
a. Open circuit voltage.	
b. Arc voltage	
c. Alternating current and direct current	
d. Resistance.	
e. Duty cycle.	
f. Reverse and straight polarity.	
g. Heat distribution using reverse or straight polarity.	
h. Voltage loss.	
<b>4. Describe basic arc welding machines:</b>	<b>4%</b>
a. Components and operation of an alternating current transformer.	
b. Components and operation of AC-DC rectifier.	
c. Components and operation of an AC and DC generator.	
d. Multi-process inverter welding power source.	
e. Advantages and disadvantages of the various types of welding machines.	
<b>5. Explain maintenance required for welding machines.</b>	<b>3%</b>

- |    |  |     |
|----|--|-----|
| 6. | Describe welding machines accessories.   | 2%  |
| 7. | Explain the numerical definitions of electrodes and heat settings.   | 2%  |
| 8. | Demonstrate the ability to weld stringer beads on available mild steel in the flat position using E4310 (E6010) and E4918 (E7018). | 75% |
| 9. | Identify common weld faults.   | 2%  |

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## Boilermaker

**Unit:** D2 Oxy-fuel Cutting

**Level:** One

**Duration:** 30 hours

Theory: 15 hours

Practical: 15 hours

### Overview:

This unit presents information on proper use of safety equipment, and interpersonal and oxy-fuel cutting. The safety subject matter taught in this section must also be stressed in the appropriate sections throughout the Boilermaker training program. Reference should be made to OH & S when applicable.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Describe and demonstrate the use of safety equipment and follow manufacturer's specifications.</b>	<b>2%</b>
a. Apparel.	
b. Protective screens.	
c. Goggles, face shield, filter lenses.	
d. Harmful rays and fumes and their effects.	
<b>2. Maintain a safe work environment.</b>	<b>2%</b>
<b>3. Identify and describe oxy-fuel cutting equipment.</b>	<b>2%</b>
<b>4. Identify the characteristics of oxygen and fuel gas cylinders.</b>	<b>2%</b>
<b>5. Describe the different sizes of cylinders.</b>	<b>2%</b>
<b>6. Explain the procedure for handling, transporting and storing cylinders.</b>	<b>2%</b>
<b>7. State the procedure for handling faulty cylinders.</b>	<b>2%</b>
<b>8. Explain the construction and purpose of a manifold system.</b>	<b>2%</b>
<b>9. Identify and select correct fuel gases for manual and automatic flame cutting carbon steel.</b>	<b>2%</b>
<b>10. Identify and describe regulator types and purposes.</b>	<b>2%</b>

- |   |            |
|---|------------|
| <b>11. Demonstrate the correct adjustments and care of regulators.</b>                                      | <b>2%</b>  |
| <b>12. Describe the construction and maintenance of hoses and fittings.</b>                                 | <b>2%</b>  |
| <b>13. Describe the design, maintenance, selection and operation of oxy-fuel tips.</b>                      | <b>2%</b>  |
| <b>14. Explain and demonstrate the set-up of oxy-fuel equipment.</b>  | <b>2%</b>  |
| <b>15. Explain the correct procedure in checking for leaks.</b>   | <b>2%</b>  |
| <b>16. Define the principle of the oxy-fuel gas cutting process.</b>  | <b>2%</b>  |
| <b>17. Explain and demonstrate the setting of oxy-fuel pressures, balancing and flame adjustments.</b>      | <b>2%</b>  |
| <b>18. List the causes of backfires and flashbacks.</b>   | <b>2%</b>  |
| <b>19. Define flame propagation.</b>  | <b>2%</b>  |
| <b>20. Demonstrate the ability to light a torch using the recommended striker.</b>                          | <b>2%</b>  |
| <b>21. Explain and demonstrate the different types of flames and uses.</b>                                  | <b>2%</b>  |
| <b>22. List and demonstrate the acceptable shutting down procedure.</b>                                     | <b>2%</b>  |
| <b>23. Explain and demonstrate fire prevention and controls.</b>  | <b>2%</b>  |
| <b>24. Identify the types of fire extinguishers available and where used.</b>                               | <b>2%</b>  |
| <b>25. Define hazardous areas in construction.</b>  | <b>2%</b>  |
| <b>26. Perform manual cutting on material of various thickness.</b>   | <b>46%</b> |
| a. Straight line and bevel cutting on plate steel.  |            |
| b. Cuts on various structural steel shapes.   |            |
| c. Circle cutting.  |            |
| d. Hole piercing.   |            |
| e. Radial cutting.  |            |
| <b>27. Describe expansion and contraction.</b>  | <b>2%</b>  |
| <b>28. Describe how to control expansion contraction and distortion resulting from welding and cutting.</b> | <b>2%</b>  |

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## Boilermaker

**Unit:** E1 Trade Mathematics One

**Level:** One

**Duration:** 25 hours

Theory: 25 hours

Practical: 0 hours

### Overview:

This unit presents information on trade mathematics.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Fractions.</b>	<b>15%</b>
a. Identify key terms and concepts used in working with fractions.	
b. Change fractions to a common denominator.	
c. Solve problems using whole numbers and fractions.	
d. Solve problems using whole numbers and fractions in practical applications.	
e. Solve squares and square roots.	
<b>2. Decimals.</b>	<b>15%</b>
a. Read and write decimal fractions.	
b. Round decimal fractions to specified place values.	
c. Convert decimal inches to a fraction with a practical denominator.	
d. Convert fractions to decimals.	
e. Add and subtract decimal fractions.	
f. Multiply and divide decimal fractions.	
<b>3. Metric and Imperial Measurement.</b>	<b>15%</b>
a. Identify commonly used metric units of measurement.	
b. Convert between units of measurement.	
c. Convert imperial units: feet to inches, square inches to square feet, and cubic measures to gallons.	
<b>4. Solve simple arithmetic problems by applying the principles of:</b>	<b>15%</b>
a. Whole numbers.	
b. Decimal numbers.	
c. Fractional numbers.	
d. Mixed numbers.	
<b>5. Using linear measurements compute perimeters of the following shapes:</b>	<b>15%</b>

- a. Rectangles.
- b. Squares.
- c. Triangles.
- d. Circles.

**6. Solve Basic linear measurement problems using the Imperial and Metric measurement systems.**

**25%**

- a. Calculate length.
- b. Calculate weights and capabilities.
- c. Calculate area.
- d. Calculate volume.
- e. Express units of area measure.
- f. Express units of volume measure.
- g. Perform combining calculation on practical applications using various units of measure.
- h. Calculate conversions from Imperial to Metric and visa versa.

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## Boilermaker

**Unit:** E2 Hand and Power Tools

**Level:** One

**Duration:** 15 hours

Theory: 7 hours

Practical: 8 hours

### Overview:

This unit presents information on hand and power tools.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Recognize safety hazards related to general safety.</b>	<b>5%</b>
<b>2. Perform all operations in a safe manner in accordance with the health and Safety Ac, manufacturer's specifications and the rules and regulations of specific facilities.</b>	<b>5%</b>
<b>3. Identify, illustrate and describe the safe operation and maintenance of hand tools.</b>	<b>20%</b>
a. Spirit level.	
b. Plumb bob.	
c. Hammers.	
d. Chisels.	
e. Drill bits.	
f. Pliers.	
g. Clamps.	
h. Bolt cutters.	
i. Hacksaws.	
j. Files.	
k. Punches and pins.	
l. Connecting bars.	
m. Bull pins.	
n. Line up bars (drift pins).	
o. Punches.	
p. Sliding t bevels.	
q. Various types of squares.	
r. Scribers.	
s. Dividers.	
t. Chalk lines.	

- u. Vises.
  - v. Trammel points.
  - w. Measuring tools.
  - x. Removal of mushroomed or fractured heads on chisels, punches and stamps.
- 4. Identify, illustrate and describe the uses of wrenches. 5%**
- a. Structural offset (spud wrench).
  - b. Sockets, ratchets and drives.
  - c. Adjustable.
  - d. Combination.
  - e. Open end.
  - f. Box end.
  - g. Set screws.
  - h. Torque.
  - i. Pipe.
- 5. Describe and demonstrate the safe operation and maintenance of power and pneumatic tools: 20%**
- a. Hand drills.
  - b. Grinders.
  - c. Pedestal grinders.
  - d. Chipping hammers.
- 6. Describe mounting procedures for grinding wheels on a pedestal and portable grinder. 5%**
- 7. Demonstrate the safe use of a disc grinder. 25%**
- a. Disc selection.
  - b. Clean torch-cut edges.
  - c. Remove tacks/scabs.
  - d. Cut material.
  - e. Wire brush (remove layers of paint, rust, etc.)
  - f. Regrind chisels, punches, screwdrivers and drifts to the correct size and geometry.
  - g. Buff surfaces.
- 8. Safely and efficiently operate pneumatic and/or electrically powered portable and stationary drilling equipment. 5%**
- 9. Identify and use twist drills. 5%**
- 10. Use and maintain threading equipment for the production of internal and external threads. 5%**

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## Boilermaker

**Unit:** E3 Metallurgy One

**Level:** One

**Duration:** 15 hours

Theory: 15 hours

Practical: 0 hours

### Overview:

This unit presents information on metallurgy. This unit also presents basic knowledge of physical and mechanical properties of metal.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. List and describe the six elements that are always present in steel.</b>	<b>5%</b>
a. Carbon.	
b. Manganese.	
c. Sulphur.	
d. Iron.	
e. Phosphorus.	
<b>2. Describe the effects of carbon and the other elements in steel.</b>	<b>5%</b>
a. Physical properties.	
b. Weld ability.	
<b>3. Differentiate between ferrous and non-ferrous metals.</b>	<b>5%</b>
<b>4. Describe the production of cast iron, carbon steel, alloy steel and stainless steel.</b>	<b>5%</b>
<b>5. Describe the killed steel.</b>	<b>5%</b>
<b>6. Describe the forming of steel from the ingot stage to the finished product for:</b>	<b>15%</b>
a. Plate.	
b. Sheet.	
c. Bar.	
d. Rod.	
e. Tube.	
f. Rail.	
g. Pipe.	
h. Structural shape.	
i. Forging.	

- 7. Define the mechanical properties of plain carbon steel. 20%**
- a. Stress.
  - b. Strain.
  - c. Elasticity.
  - d. Ductility.
  - e. Toughness.
  - f. Yield point.
  - g. Yield strength.
  - h. Tensile strength.
  - i. Compression strength.
  - j. Elastic limit.
  - k. Brittleness.
  - l. Malleability.
  - m. Impact strength.
  - n. Elongation.
  - o. Torsion strength.
- 8. Define the physical properties of plain carbon steel: 5%**
- a. Colour.
  - b. Melting point.
  - c. Density.
  - d. Heat and electrical conductivity.
  - e. Corrosion resistance.
- 9. Name the four basic types of carbon steel. 5%**
- 10. Name the five groups of steel. 5%**
- 11. Explain how the amount of carbon in ferrous material determines whether a material is steel or cast iron. 5%**
- 12. Explain how low-alloy, high-tensile steels differ from low carbon steels. 5%**
- 13. Determine the main advantage of low-alloy steel. 5%**
- 14. Describe the significance of AISI steel numbers. 5%**
- 15. Describe the application of different types of steel for a specific use. 5%**

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## Boilermaker

**Unit:** E4 Trade Related Components

**Level:** One

**Duration:** 10 hours

Theory: 10 hours

Practical: 0 hours

### Overview:

This unit presents information on trade related components. This unit also presents basic knowledge of pressure vessel components and their functions.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Identify and describe pressure vessel components and their functions.</b>	<b>20%</b>
a. Heads (elliptical, dished and hemispherical).	
b. Course shells and baffles.	
c. Manways.	
d. Davits.	
e. Trays, downcomers.	
f. Weirs.	
g. Hand holes.	
h. Repads.	
i. Skirts and saddles.	
j. Demisters.	
k. Vortex breakers.	
l. Catwalks and ladders.	
m. Plug.	
<b>2. Define mounting of a Davit for both vertical and horizontal openings.</b>	<b>20%</b>
<b>3. Describe the shapes and minimum standard dimensions of hand hole openings.</b>	<b>20%</b>
<b>4. Determine the minimum diameter used for a circular manway opening as per CSA.</b>	<b>20%</b>
<b>5. Explain the use of bubble caps and tray fittings.</b>	<b>20%</b>

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## Boilermaker

**Unit:** E5 Identification of Pressure Vessels

**Level:** One

**Duration:** 10 hours

Theory: 10 hours

Practical: 0 hours

**Overview:**

This unit presents information on pressure vessels, tanks and boilers.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<p><b>1. Identify the boilermaker’s involvement in the following heavy industrial sectors.</b></p> <ul style="list-style-type: none"> <li>a. Nuclear generating stations.</li> <li>b. Hydro generating stations.</li> <li>c. Fossil fuel generating stations.</li> <li>d. Oil refineries.</li> <li>e. Pulp and paper mills.</li> <li>f. Steel plants.</li> </ul>	<b>16%</b>
<p><b>2. Identify types and explain the working principles of watertube boilers and firetube boilers.</b></p> <ul style="list-style-type: none"> <li>a. Describe shell and tube sheet construction.</li> <li>b. Identify boiler tubes.</li> <li>c. Describe the function of a firebox.</li> </ul>	<b>14%</b>
<p><b>3. Describe the working principle of heat exchanger and their components.</b></p>	<b>14%</b>
<p><b>4. Explain heat exchanger sizing and type designation.</b></p>	<b>14%</b>
<p><b>5. Describe the working principle of distillation towers and their components.</b></p>	<b>14%</b>
<p><b>6. Describe the working principle and types of storage tanks and their components.</b></p>	<b>14%</b>
<p><b>7. Identify procedures, safe work practices and equipment used in basic tank erection.</b></p>	<b>14%</b>

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