Apprenticeship Manitoba

Manitoba

Boilermaker
Level 2

Apprenticeship Manitoba

Boilermaker

Unit: **B4 Block and Tackle**

Level: Two

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

This unit presents information on block and tackle systems. 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.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Demonstrate or describe best work practices when reeving: a. Square. b. Skip. c. Tandem. d. Equalizer sheaves. e. Lacing. f. Reeving of simple and multi-blocks up to 24 parts.	**20%**
2. Calculate the mechanical advantage of block and tackle systems	**40%**
3. Determine the working load limits that can be lifted with a given rigging arrangement.	**40%**

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Apprenticeship Manitoba

Boilermaker

Unit: **B5 Wire Rope Drums, Aerial Access and Equipment and Scaffolds**

Level: Two

Duration: 15 hours

Theory: 7 hours

Practical: 8 hours

Overview:

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

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe the fleet angles required for grooved and smooth drums.	**10%**
2. Determine drum capacity.	**15%**
3. Describe and demonstrate spooling procedures.	**20%**
4. Describe and set-up of all temporary work platforms. a. Plank inspection. b. Plank placing and securing. c. Ladder. d. Swingstage scaffolding. e. Suspended scaffolding. f. Needle beams. g. Modular platform.	**35%**
5. Describe the safe use and pre-operational check of aerial work platforms.	**20%**

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Apprenticeship Manitoba

Boilermaker

Unit: **B6 Lifting Practices**

Level: Two

Duration: 20 hours

Theory:	20	hours
Practical:	0	hours

Overview:

This unit presents information on proper use of the ability to apply best practices for lifting. 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.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Apply the W.L.L. for various load and sling configurations.	**20%**
2. Use table and charts for rigging.	**25%**
3. Demonstrate the knowledge of signals.	**15%**
4. Basic knowledge of fork truck operations.	**10%**
5. Define the sling tension formula.	**25%**
6. Lifting devices. a. Spreader bars. b. Balance beam. c. Load levelers.	**10%**

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Apprenticeship Manitoba

Boilermaker

Unit: **C5 Drawing Interpretation One**

Level: Two

Duration: 24 hours

Theory:	24	hours
Practical:	0	hours

Overview:

This unit presents information on drawing interpretation.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Demonstrate drawing interpretation skills for vessels.	**25%**
2. Demonstrate drawing interpretation skills for tanks.	**25%**
3. Demonstrate drawing interpretation skills for boilers.	**25%**
4. Demonstrate drawing interpretation skills for trade specific components.	**25%**

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Boilermaker

Unit: **C6 Layout and Fabricating**

Level: Two

Duration: 42 hours

Theory: 42 hours

Practical: 0 hours

Overview:

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

Objectives and Content:	Percent of Unit Mark (%)
1. Ability to read a drawing and describe the component(s) used in the fabrication process.	**3%**
2. List and describe the abbreviations applicable to plate layout and development.	**3%**
3. Calculate practical problems on squares, rectangles and circles for transfer to the plate for development and fabrication.	**5%**
4. Read a drawing; determine the materials required and layout the pattern on the plate.	**3%**
5. Demonstrate the ability to utilize material through pre-planning and nesting.	**3%**
6. Demonstrate the ability to select and use tools for layout.	**3%**
7. Develop a pattern for a two and three piece 90-degree elbow using parallel line development.	**10%**
8. Demonstrate the ability to develop a template using geometric construction parallel lines and radial line development.	**10%**
9. Layout and fabricate components from drawings. a. Ladders and platforms. b. A davit for vertical and horizontal opening. c. A header. d. Pipe turns and offsets. e. Square ducts.	**45%**

f. Cylinders and cones.
g. Pressure vessel shells.

10. Perform radial nozzle installation. 15%

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Boilermaker

Unit: **D3 Cutting, Welding and Related Processes**

Level: Two

Duration: 67 hours

Theory: 41 hours

Practical: 26 hours

Overview:

This unit presents information on the safe use of cutting, welding and related process equipment. This unit also emphasizes the application of safe work practices and procedures when cutting, welding and using related process equipment.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify and describe forces involved in material expansion and contraction.	**3%**
2. Describe cutting processes involved in cutting alloy steels and non-ferrous metals. a. Plasma-arc. b. Water jet cutting.	**3%**
3. Describe correct cutting techniques and common cutting faults.	**3%**
4. Perform flame-cutting skills involving radial cuts.	**3%**
5. Demonstrate flame-cutting skills on structural shapes.	**3%**
6. Demonstrate weld joint preparation and joint tolerances from drawings.	**3%**
7. Determine if metal conditions require specific cleaning methods.	**3%**
8. List the functions of coating for arc welding electrodes.	**3%**
9. List the functions of slag in arc welding electrodes.	**3%**
10. Explain the effects of alloy additions to the coating for arc welding electrodes.	**3%**
11. Explain static and dynamic loading for arc welding electrodes.	**3%**
12. Describe the storage requirements of low hydrogen electrodes.	**3%**

13.	**Explain the reasons for selecting a welding machine for a specific task.**	**3%**
14.	**Recognize these other welding processes, GTAW, GMAW, FCAW and SAW.**	**7%**
15.	**Demonstrate the set up and operation of (carbon arc cutting) CAC-A equipment correctly and safely.**	**5%**
16.	**Determine the correct fit up and procedure for welding operations.** a. Joint spacing. b. Holding or clamping devices. c. Number and spacing of tack welds. d. Pre-setting/distortion allowances of joint member current type, polarity and voltage.	**5%**
17.	**Interpret welding symbols as standardized by the American Welding Society specific to this trade for shop and field construction.**	**5%**
18.	**Demonstrate the ability to weld a lap joint in the 2F (horizontal) position using E4310 (E6010) and E4918 (E7018).**	**10%**
19.	**D Demonstrate the ability to weld a tee joint in the 2F (horizontal) position using E4310 (E6010) and E4918 (E7018).**	**10%**
20.	**Demonstrate the ability to weld a corner joint in the 1F (flat) position using E4310 (E6010) and E4918 (E7018).**	**10%**
21.	**Demonstrate acceptable welding procedures to prevent distortion, etc. for all the joints.**	**9%**

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Unit: **E6 Fibreglass Fitting**

Level: Two

Duration: 12 hours

Theory: 12 hours

Practical: 0 hours

Overview:

This unit presents information on best practices related to fire reinforced plastics.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Perform the skills required to safely handle and store the chemicals required to assemble fiberglass pipe.	**9%**
2. Identify skills required to install fiberglass fittings. a. Drawing interpretation. b. Drilling. c. Bolting. d. Resin production and handling. e. Cutting. f. Grinding. g. Laminating glass.	**9%**
3. Identify and describe the resins and fiberglass materials required for lay-up and repairs.	**9%**
4. Describe the uses of fiberglass in pulp mills, chemical plants and refineries.	**9%**
5. Describe where boilermakers use fiberglass in tanks, silos, stacks breeching and piping.	**9%**
6. Define the purpose of fiberglass materials. a. Polyester resins. b. Catalysts. c. Promoters. d. Surfacing veil e. Mat. f. Woven roving. g. Acetone.	**9%**

h. Methylene chloride.
i. Air dry additive.

7. Perform the skills required to facilitate repairs on round and flat surfaces. 9%

8. Describe the tools and materials used for preparation and assembly. 9%

a. Power cutter (skill saw)
b. Power disc sander.
c. Extension cords.
d. Rags.
e. Wax paper (feeler wrapper)
f. Rubber gloves.
g. Paper coveralls.
h. Face shields.
i. Safety goggles.

9. Describe measuring equipment. 9%

a. Paper or plastic mixing cups.
b. Mixing sticks.
c. Plastic bucket graduated for measuring resin.
d. Glass for measuring promoters and catalysts.
e. Mixing pails.

10. Describe lay-up equipment: 9%

a. Surfacing veil.
b. Matting.
c. Woven roving.

11. Describe procedures and/or equipment for fiberglass lay-up. 10%

a. Tight fit-up.
b. Sanding.
c. Filler.
d. Saturate mat.
e. Stagger cut lengths.
f. Mix resin and catalyst.
g. Apply surface veil.
h. Remove air.
i. Sand entire weld.
j. Apply resin and air dry mix.
k. Heat lamps.
l. Application method.
m. Hand lay-up.
n. Spray lay-up.
o. Cutting, fitting and surface preparation.
p. Outside joint (structural).
q. Inside joint (liner).

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Apprenticeship Manitoba

Boilermaker

Unit: **E7 Trade Mathematics Two**

Level: Two

Duration: 25 hours

Theory: 25 hours

Practical: 0 hours

Overview:

This unit presents information on how to solve mathematical trade problems.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Compute squares and square roots of numbers.	**20%**
2. Apply square roots calculation in solving right angle triangle problems using Pythagorean Theorem.	**20%**
3. Compute area of flat planes: a. Squares. b. Parallelograms. c. Triangles. d. Rectangles. e. Circles. f. Sectors.	**20%**
4. Solve problems involving percentages.	**20%**
5. Solve intermediate linear measurement problems using the Imperial and Metric measurement systems: a. Calculate length. b. Calculate weights and capacities. c. Calculate area. d. Calculate volume. e. Perform combining calculation on practical applications using various units of measure. f. Calculate conversions from Imperial to Metric and visa versa.	**20%**

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Apprenticeship Manitoba

Boilermaker

Unit: **E8 Power Tools (Electric and Pneumatic)**

Level: Two

Duration: 15 hours

Theory: 8 hours

Practical: 7 hours

Overview:

This unit presents information on the safe use of Power Tools (Electric and Pneumatic).

Objectives and Content:	**Percent of Unit Mark (%)**
1. Perform all operations in accordance with the manufacturer's specifications.	**25%**
2. Demonstrate the use of the following portable power tools. a. Drills and reamers. b. Tube expanders (identification only). c. Impacts (wrenches and hammer drills). e. Pipe threading and cutting equipment.	**25%**
3. Introduce bolt control equipment.	**50%**

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Apprenticeship Manitoba

Boilermaker

Unit: **E9 Instruments and Shop Equipment**

Level: Two

Duration: 25 hours

Theory: 25 hours

Practical: 0 hours

Overview:

This unit presents information on instruments and shop equipment.

Objectives and Content:		**Percent of Unit Mark (%)**
1.	**Basic understanding and set up of transits.**	**12%**
2.	**Demonstrate and transfer elevation points using a water level.**	**8%**
3.	**Demonstrate the skills and abilities in precision measuring using a micrometer (Metric and Imperial).**	**5%**
4.	**Introduction to new technologies.**	**2%**
5.	**Perform all operations with shop equipment in accordance with the manufacturer's specifications.**	**17%**
6.	**Describe the types of drilling machines.**	**2%**
7.	**Identify and describe drills and drilling tools.**	**5%**
8.	**Describe drill bit geometry and its sharpening procedures.**	**5%**
9.	**Determine drilling speeds and feeds.**	**3%**
10.	**Set up a drill press and drill multi-diameter holes from 1/8" to 2" of accuracy of 1/32".**	**4%**
11.	**Operate and maintain reaming equipment.**	**2%**
12.	**Describe the power roll operations for forming:** a. A full cylinder. b. A partial cylinder.	**5%**

c. A cone (reducer)
d. A partial and full ring.

13. Determine roll and brake capacity and allowances and proper direction to roll or bend. **5%**

14. Calculate blank length before forming, including: **5%**

a. Bend allowance.
b. Flat sections.
c. Seam allowance, e.g. (root opening).

15. Describe how to perform the following operations on shearing and punching machines. **5%**

a. Set up and punch holes in plate, angles, channels and beams.
b. Shear angles at 45° and 90°.
c. Shear flat bar, rounds and square bar.
d. Notch and cope plate and structural shapes.
e. Cut to an accuracy of 1/16” for length and within 2° for angle cuts.

16. Describe power press brake operations to form: **5%**

90 degree bends.
Oblique angle bends.
A half cylinder.
A half cone (reducer).
A partial section square to rotated square.
A partial section of square to round.

17. Determine the correct methods of positioning dies for specific operations. **5%**

18. Describe the following power saws: **5%**

a. Horizontal and vertical band saws.
b. Power hack saws.
c. Cold saws.

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Apprenticeship Manitoba

Boilermaker

Unit: **E10 Metallurgy Two**

Level: Two

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

This unit presents information to be able to identify and demonstrate the basic knowledge of physical and mechanical properties of metal. The areas in this unit shall be kept at a level of reasonable understanding by the apprentice and shall be of useful knowledge readily applicable to their work. The intent is not to advance to a metallurgist status but rather acquaint the apprentice with knowledge applicable to a working understanding of metal properties.

Objectives and Content:	**Percent of Unit Mark (%)**
1. List the basic mechanical and physical properties of metals.	**10%**
2. Identify the following metals: a. White cast iron. b. Gray cast iron. c. Low carbon steel. d. High carbon steel. e. Chromium-nickel steel (stainless) f. High manganese steel. g. Copper h. Aluminum.	**10%**
3. Determine the hardness of metal by using a file and compare to the Brinnell hardness scale.	**5%**
4. Describe how welding (heating) influence the internal structure of steel.	**10%**
5. Describe how welding and heating causes distortion.	**5%**
6. Describe methods of preventing, controlling and correcting distortion including: a. Welding procedure. b. Peening. c. Grooving and re-welding. d. Straightening. e. Clamping and stress relieving.	**20%**

f. Welding on opposite side.
g. Local heating, etc.

7. Determine the effect of carbon in its relationship to the weldability and flame cutting of steel. 10%

8. Determine the effect of alloys in their relationship to the weldability and cutting action in steels. 5%

9. Describe or demonstrate heat straightening. 5%

a. Plate.
b. Pipe.
c. Distorted header.
d. Distorted structural member.

10. Explain the effects of hot and cold working metals. 5%

11. Describe the changes to mechanical and physical properties of metals after hot and cold forming. 15%

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Apprenticeship Manitoba

Boilermaker

Unit: **E11 Heat Treatment**

Level: Two

Duration: 8 hours

Theory: 8 hours

Practical: 0 hours

Overview:

This unit presents information on the knowledge of material designations and the effect of heat on metals. 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.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe the following terms. a. Hot rolled. b. Cold rolled.	**10%**
2. Describe the following designations of carbon steel materials. a. ASTM A-36 A-283 A-285 A-515 A-516 b. CSA G40.20/21M Standard	**5%**
3. Interpret the AISI system for designating stainless steels Series 200, 300 and 400.	**5%**
4. Describe and identify the heat effected zone (HAZ).	**10%**
5. List four advantages in preheating of carbon steel for metal arc welding.	**10%**
6. Identify effects and processes of the following heat treatments: a. Expanding and shrinking. b. Stress relieving. c. Annealing. d. Hardening and tempering. e. Normalizing. f. Preheating. g. Post heating.	**25%**
7. Describe post-weld heat treatments (stress relieving) as a means to: a. Relieve stresses. b. Improve toughness.	**20%**

c. Increase strength and durability.

8. Describe measures to control and check temperatures during preheating and postweld heating. 5%

9. Describe the influence of the following on the micro-structure of the weld area (HAZ): 10%

a. The rate of heating.
b. The time at temperature.
c. The rate of cooling.

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